CLEAN DEVELOPMENT MECHANISM
PROJECT DESIGN DOCUMENT FORM (CDM-SSC-PDD)
Version 03 - in effect as of: 22 December 2006

CONTENTS

Annexes

Revision history of this document

Version Number	Date	Description and reason of revision
01	21 January 2003	Initial adoption
02	8 July 2005	• The Board agreed to revise the CDM SSC PDD to reflect guidance and clarifications provided by the Board since version 01 of this document. • As a consequence, the guidelines for completing CDM SSC PDD have been revised accordingly to version 2. The latest version can be found at <http://cdm.unfccc.int/Reference/Documents>.
03	22 December 2006	• The Board agreed to revise the CDM project design document for small-scale activities (CDM-SSC-PDD), taking into account CDM-PDD and CDM-NM.

SECTION A. General description of small-scale project activity

A.1 Title of the small-scale project activity:

UTE São Borja 12.3 MW Rice Husk Project
Version VII
February 23th, 2012
First Versions of this PDD were prepared by Mr. Ricardo Audi Filho
Final version was prepared by GES Biogas GmbH

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

Objective of the Project Activity

The main objective of the project activity is to reduce GHG emissions through the production of energy using rice husks as fuel. Rice husks are a leftover from the rice milling process and are usually dumped and left to decay in stockpiles. The planned plant will shift grid electricity and avoid CH_4 emissions related to the rice husk disposal. In the baseline scenario, the rice husks would be dumped in landfills or stock-piled and the energy would be produced according to the mix of sources that feed the Brazilian interconnected grid.
The project will be installed in the Southern Brazil State of Rio Grande do Sul and will make use of the residual rice husks as a fuel. It will be located in the municipality of Sao Borja, close to Argentinean border. It involves the construction of a thermo power plant that will utilize the rice husks to produce renewable electric energy.

UTE São Borja Geradora de Energia Eléctrica S.A("UTE São Borja") will have a gross capacity of 12.33 MW according to the supply contract.

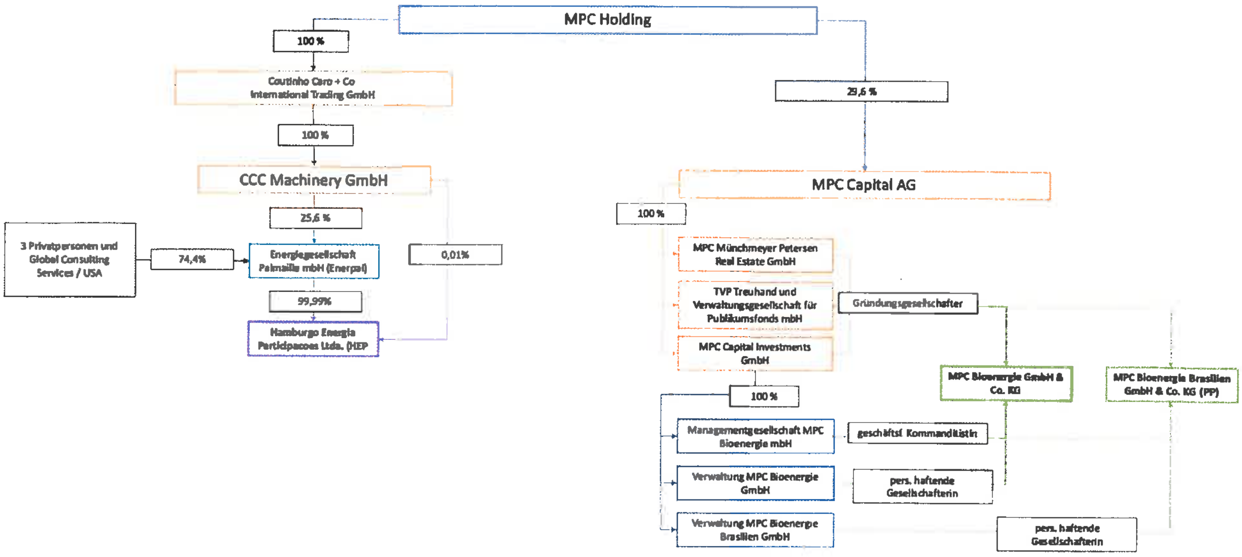
Brief History of the project activity

The project activity has a history since it was initiated by a different company and as taken over by the PP in 2008 after suspension by the former owner. The present project started in July 2008 with the takeover of a former renewable energy project under development in Brazil at a very initial stage by the MPC Bioenergie GmbH. Later they transferred the assets to their newly founded project company UTE São BorjaGeradora de Energia Eléctrica S.A. UTE São Borja

The project activity was planned to be implemented as a CDM project since 2005 by the former owner, Energiegesellschaft Palmaille GmbH (ENERPAL). The former owner designed this project to be eligible under the CDM and already achieved a positive validation from DOE TÜV Süd Industrie Services GmbH. Due to the loss of financing ENERPAL had no other possibility as to sell the project.

One of the parties that was interested in buying the project was MPC Bioenergie GmbH & Co KG which has been founded for the purpose to take over the project by its mother company MPC Capital AG.

The following figure shows the relationship between the old and the new project companies at the moment of the transfer. In essence the ownership changed from ENERPAL to MPC Bioenergie GmbH & Co KG which is owned by MPC Capital AG.



MPC Capital AG structures closed-ends-funds to grant investment possibilities to German individual investors. But apart from the fund development they were able to provide the financing of the project on their own and do not depend on the return of equity by the fund investors. MPC Capital AG decided to buy the assets of the existing project but to develop a new business. They bought the liabilities and the assets and transferred them to their newly founded Brazilian project company. The Brazilian project company was later taken over by the MPC Bioenergie Brasilien GmbH & Co KG, the PP.

The project activity of this PDD: *UTE São Borja Geradora de Energia Elétrica S.A.*, is a Thermal Electric Power Plant, with an installed capacity of 12.3 MW[1].

Financial Structure

The total project investment at the time of investment decision was estimated at BRL 55.9 millions. This included the costs related to:

- Capex on a turn-key basis,
- Contingencies
- Interim financing expenditures

The project has not been granted any subsidy of any type. After an interim period for developing the fund concept the project will be 100% equity financed. The equity stakeholders will be German investors having bought the fund shares.

[1] According to the sales contract between the equipment supplier CCC Machinery GmbH and UTE São Borja Geradora de Energia Elétrica S.A was established in 17.07.09

Contribution to the sustainable development of the host country and region

The south of Santa Catarina and Rio Grande do Sul state have the biggest coal reserves[2] in Brazil and the largest production of rice[3]. The attractiveness of the coal reserves are pushing for the development of large coal based energy plants in the state[4]. Most of the rice production is far from the planned coal reserves and future plants[5], making it economically unattractive to co-fire rice husk with coal in the future.

According to information from ANEEL[6], Rio Grande do Sul energy generation capacity is 2,053. MW in 50 plants. Only 8 are based on biomass, including UTE São Borja Project, representing 86,72 MW or about 4,2 % of the State installed capacity.

Rice husk represent more than 20%[7] in weight of the rice and has very low density compared to rice, so represents an important mass and extra logistics costs for the rice producer.

The rice husks based energy plants will significantly contribute to the development of the rice regions by making use of this residue that today causes environmental problems and extra costs to the producers.

According to the BEN 2007[8], the biomass based energy generation represented less than 2% of the total energy produced in Brazil. The rice husks based energy production is negligible since there is only one plant producing energy from rice husks in Brazil mainly for internal consumption, a CDM project named CAMIL Itaqui Biomass Electricity Generation Project[9].

Biomass fuels, especially sugar cane bagasse represent a strong opportunity for Brazil since the potential of energy production could reach 15% of the total energy production in Brazil[10]. The importance of biomass residues based energy is noted on the Brazilian National Climate Change Plan[11], promoted by the Minister of Science and Technology. One of the top priorities of the plan is to maintain renewable energy levels on the global national energy matrix, increasing mainly biomass, solar and wind based energy production. This is due to constrain expected on the hydro energy production in the long-term.

This project activity also contributes to social development of the region by creating new jobs in a region where these jobs didn't exist before the project activity.

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[2] http://www.cprm.gov.br/opor/pdf/carvaorssc.pdf

[3] http://www.arroz.agr.br/site/estatisticas/html/tab103.htm

[4] http://www.ecodebate.com.br/2008/08/20/rs-fepam-pressiona-para-liberar-usinas-de-carvao-diz-ong/

[5] The largest rice producing regions are more than 500 km from the State Capital Porto Alegre, in the region where the coal based energy plants are located. http://www.irga.rs.gov.br/arquivos/ranking.pdf

[6] http://www.aneel.gov.br/aplicacoes/ResumoEstadual/GeracaoTipoFase.asp?tipo=2&fase=3&UF=RS:RIO%20GRANDE%20DO%20SUL

[7] According to the rice husk analysis conducted by project participants

[8] *BEN – Balanco Energetico Nacional 2007.*

[9] http://cdm.unfccc.int/UserManagement/FileStorage/7Q7IH03DPAA2EL4SA8AM4I5CKQ7502

[10] *União das indústrias Sucro Alcooleiras de São Paulo - UNICA*

[11] http://www.mma.gov.br/estruturas/imprensa/_arquivos/96_11122008040728.pdf

A.3. Project participants:

Name of Party involved ((host) indicates a host Party)	Private and/or public entity(ies) project participants (as applicable)	Kindly indicate if the Party involved wishes to be considered as project participant (Yes/No)
Brazil (host)	UTE São Borja Geradora de Energia S.A.	No
Germany	MPC Bioenergie Brasilien GmbH & Co. KG	No

UTE São Borja Geradora de Energia Elétrica S.A. (“UTE São Borja”)

UTE São Borja is the Project activity plant. It is registered under the CNPJ: 10.420.690/0001-91

MPC Bioenergie Brasilien GmbH & Co. KG (“MPC Bioenergie Brasilien”)

MPC Bioenergie Brasilien GmbH & Co. KG is the company which will invest in the development of the bioenergy opportunities in Brazil.
MPC Bioenergie Brasilien GmbH & Co KG will own UTE São Borja, which contracts a service partner with a fully dedicated team on several different areas of expertise and has been supporting the development of the energy project opportunities especially in Southern States of Brazil.
Today several highly qualified professionals covering different areas of expertise are working for this service company in its office in Porto Alegre.

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

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

A.4.1.1. Host Party(ies):

Brazil

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

Rio Grande do Sul

A.4.1.3. City/Town/Community etc:

São Borja

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

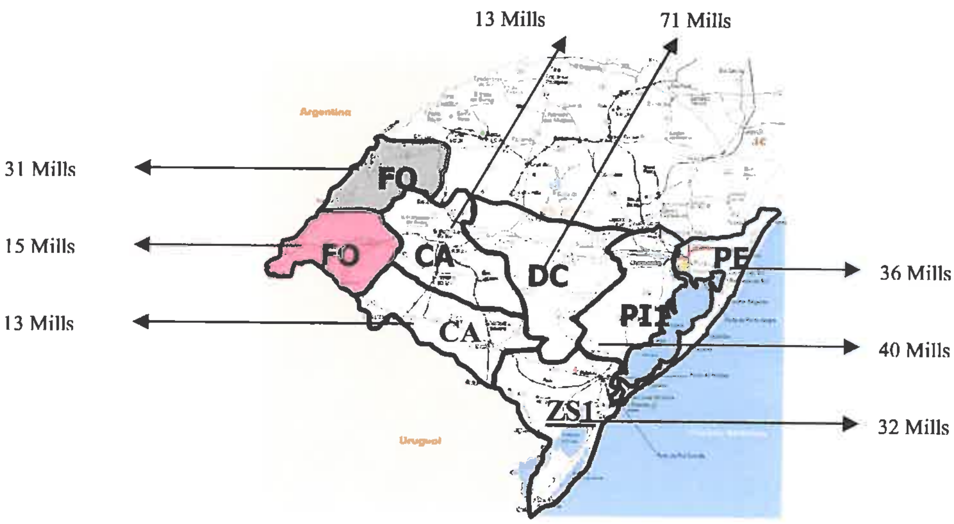
The project site is located in São Bento, Rincão da Cria e Chácara da Conceição , Distrito 1° - São Borja, Rio Grande do Sul, Brasil, S 28°41'09.88" W 55°55'22.75". The region is located at about 600 km from

the State Capital Porto Alegre and is the 6th largest rice producing region in the State, accounting for more than 7,535,219 tons of rice in crop 2007/2008 according to the study presented in the Annex 3 of the PDD.
The plant is located on a proprietary terrain of about 6 hectares and is close to the biggest rice mill of the region. Considering the influence region of the project there is a potential of more than 245,000 tonnes of rice husk, considering the installed capacity of the existing mills. Details are presented in the tables from the study in Annex 3.

Figure 1- Location

According to the study presented on Annex 3, the West frontier of Rio Grande do Sul is the main rice-producing region in the south of Brazil, it is represented by West Frontier 1(FO1) and West Frontier 2 (FO2) to the north, where UTE São Borja will be located.
The region is characterized by farms averaging 250ha, with 51% of rice crops in farms larger than 500ha. The other rice producing regions (CA, DC, PE, PI1, ZS1) are explained in Annex 3 of the PDD and in the research supported by the project proponents.

Figure 2- Number of Rice Mills in RS state according to study presented on Annex 3



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

Type and categories

According to Appendix B to the Simplified Modalities and Procedures for Small-Scale CDM Project Activities, the project type and categories are defined as follows:

Type I. – Renewable energy projects
Category I.D. – Grid connected renewable electricity generation

Type III. – Other project activities
Category III.E. – Avoidance of methane production from biomass decay through controlled combustion, gasification or mechanical/thermal treatment

The project activity is a Greenfield power plant where in the project site no generation of energy occurs.

Technology

The process to obtain the complete combustion of rice husk is more difficult to occur (compared with other types of biomass). The erosivity of rice husk is high enough to “sand blast” to some extent the boiler when co-fired with for example wood bark that have ash with fouling propensity[12].
The best combustion process of rice husk is to burn it when it is crushed (lowering the percentage of non-combusted husks) and the best technology for its combustion is obtained in bubbling fluidized bed boilers, but this is the most expensive and energy consuming equipment[13]. The manufacturers of the boilers have been developing improvements in order to increase combustion performance and overall efficiency for different types of fuels.
Among the various forms of burning rice husks, 4 are listed below:

1. In boiler with inclined oscillating grid (70% in the grid and 30% in suspension) for husks "in natura"
2. In boilers with horizontal scale tilting (almost 100% in suspension) - husks crushed
3. In boilers with fluidized bubbling (100% suspension) – rice husks "in natura"
4. In boilers with horizontal vibrating grid (70% matter and 30% in the grid) – rice husks "in natura".

The fourth form is the technology used in this project activity. It consists of a boiler generating steam, with two tubes with a large diameter, suspended by a steel structure; auto circulated with vibrating grid and balanced movement.
According to the equipment supply contract, the boiler production capacity is 53,000 kg of steam/h, with a working pressure of 44 kgf/cm² and the vapor temperature of 430 ° C, using rice husk "in natura" as fuel.
The furnace is made of carbon steel tangents tubes, hermetic, suitable for complete combustion, allowing greater residence time of the gases and, therefore, lowering losses of the unburned solid fuel.

[12] http://www.fwc.com/publications/tech_papers/files/TP_CFB_08_05.pdf

[13] www.fwc.com/publications/tech_papers/files/TP_**CFB**_08_05.pdf

The cross-flow tubular beam of gas allows better heat exchange and thermal efficiency.
The solid fuel is introduced into the furnace by a screw extractor fitted under the lung-supplying silo and fuel distributors. The turbulence that is created (vortex) allows the start of the burning of the thin fuel in suspension.
Pipelines and secondary air nozzles will be installed to provide turbulence and complete combustion.
The furnace is equipped with insulation panels and grid filled up, to keep the necessary heat to keep the fuel ignited.
The air needed to burn the fuel is heated on high temperature on the pre-heater and evenly distributed on the grid. This air is blown directly by a centrifugal industrial fan in distribution channels designed for this purpose.

Technology transfer and personnel training

The project uses the environmentally safe and sound technology described above. The commissioning and training is already part of the scope of supply of the technology provider.
Most of the unique equipments will be produced locally in order to transfer technology to the host country.
Under the EPC agreement, the 25 employees of the plant will be firstly trained by the EPC contractor Areva Koblitz. The O&M contractor – to be defined- will be responsible for the personnel involved on the plant operations and under the UTE São Borja guidance they will places particular emphasis on staff training consisting of:

- safety,
- plant knowledge,
- rice husk fuel firing technology,
- environmental management and awareness, and
- supervisory training.

The most training will be on-the job, since the O&M contractor will be responsible for the plant performance, plant availability and equipment integrity.
After the successful installation and commissioning of the project plant, the technology is considered transferred to the host country and will be available for other similar projects.

The main technical data of the project activity are described on the table 1 below[14].

Table 1 - Main technical data

General Data	Gross electrical output at generator at substation	12.33 11.097 Net Output	MW
	Power Generation Level	13.8	kV
	Grid Level	13.8/ 69	kV
	Auxiliary Power Level	480	V
Fuel – Rice Husk[15]	Design Fuel	Rice husk, natural	
	Fuel LHV (basis for efficiency)	13,188	MJ/kg
	Fuel Density	0.115	t/m³
	Humidity	12	%
	Fixed Carbon	33.12	%
	Ashes	20.4	%
	Fuel Consumption +- 2% (at 12% humidity)[16]	12,995	kg/ h
Boiler	Manufacturer	Equipalcool	
	Device Name	53-V-2-S	
	Boiler Type	Spreader stoker with Vibrating Grate	
	Boiler Efficiency	86.11%	%
	Steam Capacity	53	t / h
	Superheater outlet Pressure	44	bar (a)
	Superheater outlet Temperature	430	°C
Dust	Dust Collection Equipment	Multicyclone and Bagfilter	
	Dust Outlet concentration	<150	mg/Nm³

[14] According to the sales contract between the equipment supplier CCC Machinery GmbH and UTE São Borja Geradora de Energia Elétrica S.A was established in 17.07.09

[15] According to tests conducted by the lab: Relatório de Ensáio no 995 126-203

[16] According to the sales contract between the equipment supplier CCC Machinery GmbH and UTE São Borja Geradora de Energia Elétrica S.A was established in 17.07.09

Turbine	Manufacturer	Dresser Rand	
	Device Name	RD9MOQ	
	Capacity	12,995	kW
	Efficiency (Yield)	82.32	%
	Efficiency (Rankine Cycle)	23.2	%
	Steam inlet pressure	43	bar(a)
	Steam inlet temperature	420	°C
Generator	Manufacturer	INDAR	
	Device Name	,LSA-900-XIA4	
	Generator capacity	12.429	MW
	Generator Efficiency	97.1	%
	Generator Speed	1800	rpm
	Generator Power	15.6	MVA
	Generator voltage	13.8	kV, 3 phase
Other Data	Auxiliary transformer rating	2	MVA
	Capacity of Turbine crane	10	t
	Capacity of clarification plant	1 x 80	m³/hr
	Capacity of demineralization plant	1 x 8	m³/hr
	Ambient Temperature range (min/max)	-3/37	°C
	Relative Humidity	70-77	%
	Altitude above see level	<100	m
	Wind speed max	<130	km/h
Cooling Tower	Total Heat load capacity	25,900	Mcal/h
	Total water rate	3,700	m³/h
	Water inlet temperature	37	°C
	Water outlet temperature	30	°C
	Wet bulb temperature	24	°C
	Sound pressure level at 1 m	<90	dB (A)
	Evaporation and drift losses	1.1	%

Energy balance

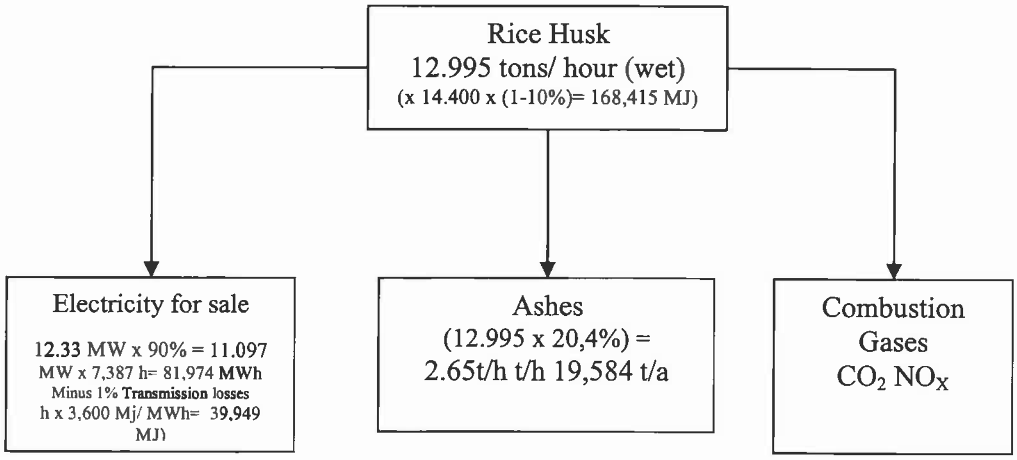
The assigned analysis by the project participants[17] shows the following characteristics of the rice husk in the region:

Table 2 – <u>Fuel Specs</u>[18]

Rice Husk Specs	• LHV: 14.400 MJ/ kg (dry basis) • Density: 0.115 ton/m³ • Misture: 12% • Carbon: 38.9% • Hidrogen: 4.84% • Nitrogen: 0.3% • Sulphur: 0.04% • Ashes: 20,4%.

According to the supply contract[19], the plant total gross energy output is 12.33 MW, consuming 12.995 tonnes/ hour of rice husk with 12% moisture. The self-consumption is expected in 10%, resulting in a energy export capacity of 11.097 MWh. The average ash generation is in the calculation estimated in 20,4% (average of plant specification 18.2% and IRGA research 22.6%), resulting in a total ash production of 2.65 t/ h.

Figure 3- Energy balance[20]



[17] The analysis report is available to the DOE. Please see "Relatório de ensaio no 995 126-203

[18] The analysis report is available to the DOE. Please see "Relatório de ensaio no 995 126-203

[19] According to the sales contract between the equipment supplier CCC Machinery GmbH and UTE São Borja Geradora de Energia Elétrica S.A was established in 17.07.09

[20] According to equipment data from the sales agreement. The sales agreement is available to the DOE

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

Table 4 shows the estimated emission reduction over the crediting period of 21 years.

Table 3: Estimated emission reductions[21]

Years	Annual estimation of emission reductions in tons of CO2e
1	26.290
2	28.467
3	30.569
4	32.598
5	34.558
6	36.450
7	38.277
8	40.041
9	41.745
10	43.390
11	44.978
12	46.512
13	47.993
14	49.423
15	50.804
16	52.137
17	53.425
18	54.668
19	55.869
20	57.028
21	58.147
Total estimated reductions (tons of CO2e)	**923,369**
Total number of crediting years	21
Annual average over the crediting period of estimated reductions (tons of CO2e)	43,970

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

There is no public funding for the proposed project activity.

[21] In case the total ER for the year exceeds 60,000t CO2/y the ER will be caped to not more than 60,000 t CO2/y as per the applicability criteria for small-scale project activities

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

Based on the criteria set to determine the occurrence of debundling, described in Appendix C of the Simplified Modalities & Procedures for Small-Scale CDM project activities, it is confirmed that the project activity is not a debundled component of a large project activity as the project participants did not register or applied for another small-scale CDM project activity:

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

According to the information in the CDM web site[22], after a search on the project search tool screening the results by sectoral scopes (1:Energy industries and 13:Waste handling and disposal), AMS I. D methodology, AMS III.E Methodology and Brazil as host country 42 projects were found, but no one related to the project participants of UTE São Borja, that were using the same technology measure, registered in the previous 2 years and with boundary within 1km at the closest point.

Thus the project is not a debundled component of a large project activity.

[22] http://cdm.unfccc.int/Projects/projsearch.html

SECTION B. Application of a baseline and monitoring methodology

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

Type I – AMS I.D. Grid connected renewable electricity generation (version 17)

Type III – AMS III.E. Avoidance of methane production from decay of biomass through controlled combustion, gasification or mechanical/thermal treatment (version 16)

"Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site" (Version 04).

"Tool to calculate project or leakage CO2 emissions from fossil fuel combustion" (Version 02).

"Tool to calculate the emission factor for an electricity system" (Version 2).

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

The project activity is a stand-alone energy plant supplied by biomass residues coming from its surrounding areas and is applicable to the project categories I.D and III.E.

The energy generation component meets the following applicability conditions according to the methodology AMS I.D.:

1. This category comprises renewable energy generation units, such as photovoltaics, hydro, tidal/wave, wind, geothermal and renewable biomass:

(A) Supplying electricity to a national or regional grid: or

(B) Supplying electricity to an identified consumer facility via national/regional grid through a contractual arrangement such as wheeling.

Project activity is the construction of a renewable energy generation unit that supplies electricity to the grid.

3. This methodology is applicable to project activities that (a) install a new power plant at a site where there was no renewable energy power plant operating prior to the implementation of the project activity (Greenfield plant); (b) involve a capacity addition; (c) involve a retrofit of (an) existing plant(s); or (d) involve a replacement of (an) existing plant(s).

Project activity is the construction of a Greenfield power plant. There was no renewable energy power plant operating prior to the implementation of project activity.

4. Hydro power plants with reservoirs that satisfy at least one of the following conditions are eligible to apply this methodology:

The project activity is a renewable energy generation unit that uses renewable biomass (rice husks) as fuel and will supply electricity to the Brazilian interconnected grid. UTE São Borja is a thermal power plant.

5. If the new unit has both renewable and non-renewable components (e.g.,. a wind/diesel unit), the eligibility limit of 15 MW for a small-scale CDM project activity applies only to the renewable component. If the new unit co-fires fossil fuel1, the capacity of the entire unit shall not exceed the limit of 15 MW.

The project activity will use rice husk as its only fuel and fossil fuel will be used just to start-up the plant. Furthermore there isn't a non-renewable component and the maximum output of the project will not exceed 15 MW, being 12.3 MW.

6. Combined heat and power (co-generation) systems are not eligible under this category.

The project activity is a power generation system and will not generate heat.

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

Project activity is a Greenfield plant and is not connected to an existing renewable power generation facility.

8. In the case of retrofit or replacement, to qualify as a small-scale project, the total output of theretrofitted or replacement unit shall not exceed the limit of 15 MW.

Project activity is a Greenfield plant and does not include retrofit or replacement.

The avoidance methane production component of the project meets the following applicability conditions according to the methodology AMS III.E.:

1. This project category comprises measures that avoid the production of methane from biomass or other organic matter that:

(a) Would have otherwise been left to decay under clearly anaerobic conditions throughout the crediting period in a solid waste disposal site without methane recovery.

2. Due to the project activity, decay of the wastes of type referred to in paragraph 1(a) above is prevented through one of the following measures:

(a) Controlled combustion.

The project activity includes a boiler for steam generation using the rice husk as part of an energy generation plant. Thus it is considered a controlled combustion.

3. The produced RDF/SB shall be used for combustion either on site or off-site.

The project is not producing or using RDF/ SB, but rice husk directly as a fuel.

4.In the case of stockpiles of wastes baseline emissions calculations as described in the "Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site" shall be adjusted. Stockpiles can be characterized as waste disposal sites that consist of wastes of a homogenous nature with similar origin (e.g, rice husk, empty fruit bunches of oil palm, sawmill waste, etc..).

The project activity is using rice husk, as its only fuel. The common practice for the residual rice husk is disposing it on stockpiles until its decay. The project proponents adjusted the calculation for the methane emissions according to the guidance provided in AMS III.E paragraph 22.

5. Measures are limited to those that result in emission reductions of less than or equal to 60 kt CO2 equivalent annually

As showed in the section A.4.3, the emission reductions of the project activity will be less than 60 ktCO2e in any year of the crediting period[23].

6. Where in the baseline usually there is a reduction in the amount of waste through regular open burning or removal for other applications, the use of the "Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site" shall be adjusted to take account of this burning or removal in order to estimate correctly the baseline emission.

The baseline emissions calculation is based on the amount of rice husk that would be stockpiled and land filled. The study assigned by the project participants and available in the Annex 3 shows the availability, excluding other possible uses of rice husk.

7. The project activity does not recover or combust methane unlike AMS-III.G. Nevertheless, the location and characteristics of the disposal site in the baseline condition shall be known, in such a way as to allow the estimation of its methane emissions.

The project activity is based on the controlled combustion of rice husk. The characteristics of the disposal sites in the baseline are known and open for visit. Without the project activity, the disposal sites would continue to exist as it is operated for several years already.

8.If the project activity involves combustion, gasification or mechanical/thermal treatment of partially decayed waste mined (i.e., removed) from a solid waste disposal site in addition to freshly generated waste the project participants shall demonstrate that there is adequate capacity of the combustion, gasification or mechanical/thermal treatment facility to treat the newly generated wastes in addition to the partially decayed wastes removed from the disposal site. Alternately justifications for combusting, gasifying or mechanically/thermally treating the partially decayed wastes instead of the newly generated wastes shall be provided.

The project activity will combust newly generated rice husk based on the supply contracts to avoid technical problems.

[23] In case the total ER for the year exceeds 60,000t CO2/y the ER will be caped to not more than 60,000 t CO2/y as per the applicability criteria for small-scale project activities

9.If the combustion facility, the produced syngas, producer gas or RDF/SB is used for heat and electricity generation within the project boundary, that component of the project activity shall use a corresponding methodology under Type I project activities.

The project activity is not producing syngas, producer gas or RDF/SB. The electricity production is exported to the grid based on AMS I.D methodology.

10.In case of RDF/SB production, project proponents shall provide evidence that no GHG emissions occur, other than biogenic CO2, due to chemical reactions during the thermal treatment process for example limiting the temperature of thermal treatment to prevent the occurrence of pyrolysis and/or the stack gas analysis.

The project is not producing RDF/SB, but electricity from rice husk.

11.In case of gasification, the process shall ensure that all the syngas produced, which may contain non-CO2 GHG, will be combusted and not released unburned to the atmosphere. Measures to avoid physical leakage of the syngas between the gasification and combustion sites shall also be adopted.

The project is not producing syngas, but electricity from rice husk.

12. In case of RDF/SB processing, the produced RDF/SB should not be stored in such a manner as resulting in high moisture and low aeration favoring anaerobic decay. Project participants shall provide documentation showing that further handling and storage of the produced RDF/SB does not result in anaerobic conditions and do not lead to further absorption of moisture.

The project is not producing RDF/SB, but electricity from rice husk.

13. In case of RDF/SB processing, local regulations do not constrain the establishment of RDF/SB production plants/thermal treatment plants nor the use of RDF/SB as fuel or raw material.

The project is not producing RDF/SB, but electricity from rice husk.

14. During the mechanical/thermal treatment to produce RDF/SB no chemical or other additives shall be used.

The project is not producing RDF/SB, but electricity from rice husk.

15.In case residual waste from controlled combustion, gasification or mechanical/thermal is stored under anaerobic conditions and/or delivered to a landfill emissions from the residual waste shall to be taken into account using the first order decay model (FOD) described in AMS-III.G.

The project activity is not producing a residual waste containing biodegradable organic matter. The only residue is rice husk ash. According to the Ash specification, it's inorganic[24].

Therefore, the project activity meets all the applicability criteria of the methodologies AMS I.D. and AMS III.E.

[24] http://congress.cimne.upc.es/rilem04/admin/Files/FilePaper/p282.pdf

B.3. Description of the project boundary:

As described in AMS I.D and AMS III.E, the boundary for this project activity encompasses the physical, geographical site:

- Where the renewable energy is generated, represented by the site where the electricity generation occurs or where UTE São Borja is installed;
- Where the solid waste would have been disposed or is already deposited and the avoided methane emissions occurs in absence of the proposed project activity, represented by the rice husk disposal sites from the rice mills in the region;
- Where the treatment of biomass through controlled combustion takes place, represented by the site where the electricity generation occurs or where the plant is installed;
- Where the final residues (ashes) of the combustion process will be deposited, represented by the ash disposal site from UTE São Borja;
- And the itineraries between them, where the transportation of wastes and combustion residues occurs. Represented by the distances between the project site and where the generation of rice husks occurs.

The emissions sources proposed by the methodologies are related in table 3.

Table 4: Emission sources

	source	gas	included/ excluded	Justification/explanation
baseline	electricity generation	CO_2	included	Main emission source.
		CH_4	excluded	Excluded for simplification. This is conservative.
		N_2O	excluded	Excluded for simplification. This is conservative.
	emissions from biomass residues stockpiles that decay at solid waste disposal site	CO_2	excluded	It is assumed that CO_2 emissions form surplus biomass residues do not lead to changes of carbon pools in the LULUCF sector.
		CH_4	included	Project participants decided to include this emission source.
		N_2O	excluded	Excluded for simplification. This is conservative.
Project Activity	CO_2 emissions related to the combustion of the non-biomass carbon content of the waste (plastics, rubber and fossil derived carbon) and auxiliary fossil fuels used in the combustion facility	CO_2	excluded	This source is not applicable because there isn't non-biomass carbon content in the waste as well as no auxiliary fossil fuel is used in the combustion facility.
		CH_4	excluded	
		N_2O	excluded	
	Incremental distances between the collection points of biomass to the project site as compared to the baseline disposal site.	CO_2	included	May be an important emission source.
		CH_4	excluded	Excluded for simplification. This emission source is assumed to be very small.
		N_2O	excluded	Excluded for simplification. This emission source is assumed to be very small.
	Transportation of combustion residues and final waste from controlled burning to disposal site.	CO_2	included	May be an important emission source.
		CH_4	excluded	
		N_2O	excluded	

	Transportation of RDF/SB from the mechanical/thermal treatment facility to the storage site within the project boundary	CO_2	excluded	These sources are not applicable because there isn't mechanical/thermal treatment facility in the project activity.
		CH_4	Excluded	
		N_2O	Excluded	
	Transportation of RDF/SB to the sites of the end users	CO_2	Excluded	
		CH_4	Excluded	
		N_2O	Excluded	
	CO_2 emissions related to the fossil fuel and/or electricity consumed by the project activity facilities	CO_2	included	May be an important emission source.
		CH_4	excluded	Excluded for simplification. This emission source is assumed to be very small.
		N_2O	excluded	Excluded for simplification. This emission source is assumed to be very small.
	Waste water from the treatment of biomass residues	CO_2	excluded	There is no waste water in the project activity.
		CH_4	excluded	There is no waste water in the project activity.
		N_2O	excluded	There is no waste water in the project activity.

B.4. Description of baseline and its development:

Project activity will reduce the emissions of greenhouse gases in two aspects: the substitution of electric energy produced by non-renewable sources and the avoidance of anaerobic decay of biomass at disposal.

Component 1: Grid connected renewable electricity generation
To estimate the baseline emissions related to grid connected renewable electricity generation, the baseline defined under category I.D of Appendix B is applied. According to small scale Methodology AMS I.D (Version 17) for the installation of a new grid-connected renewable power plant…

"...the baseline scenario is the electricity delivered to the grid by the project activity that otherwise would have been generated by the operation of grid-connected power plants and by the addition of new generation sources."

For calculating the baseline emissions the produced renewable power in kWh is multiplied by a grid emission factor representing the power production mix in the grid area as an average of the approximate operating margin and build margin.

Component 2: Avoidance of methane production from biomass decay through controlled combustion
Approved small scale Methodology AMS III.E (Version 16) sets the baseline as the

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

To calculate the baseline emissions the First order Decay Model is used referring to the AMS III.E and the *"Tool to determined methane emissions avoided from disposal of waste at a solid waste disposal site."*

The following table 4 shows the project specific baseline assumptions

Table 5: Project specific baseline assumptions

Variable	Description	Data source	Value
$EF_{grid,CM,y}$	Combined margin CO2 emission factor of the grid in year y	Calculated, see Annex 3	0.3112 (t CO2/MWh)
EGBL,y	Electricity generation/export to the grid	Installation planning and design	81,154 MWh
Qy,biomass	Amount of biomass utilized for combustion	Biomass used in project activity	96,000
Qy, non-biomass	Amount of non-biomass utilized for combustion	Project design	0
$W_{j,x}$	Amount of organic waste prevented from disposal	Biomass used in project activity	96,000
Φ	Model correction factor	TME	0.9
F	Fraction of methane captured at the SWDS and flared, combusted or used in another manner	Project design	0
Ox	Oxidation factor	Project design	0.1
F	Fraction of CH_4 in landfill gas	TME/IPCC2006	0.5
J	Percent of rice husk in the deposited waste	Project Design	100%
DOCj	Fraction of degradable organic carbon (by weight) in the waste type j	IPCC, Biomass classified as "wood and wood waste"	0.43
DOCf	Fraction of degradable organic carbon (DOC) that can decompose	IPCC	0.5
Kj	Decay rate for the waste type j	TME, classification as wood, wood waste	0.035
MCF	Methane correction factor	Adapted from IPCC, also see B6.2.	0.28
X	Year since the landfill started receiving waste	Project design	2012
Y	Years for which Emission reductions are calculated	Project design	2013-2034
GWPCH4	Global Warming Potential of methane	IPCC	21
CTy	average truck capacity for waste transportation (tonnes/truck)	Project design	6
DAFw	average incremental distance for	Project design, see also B7.1.	11

	waste transportation (km/truck)		
EFCO2	CO2 emission factor from fuel use due to transportation	IPCC	0.00077
Qy,ash	quantity of combustion and gasification residues and residues	20.4% of rice husk weight, dry matter content	19.584
DAFash	average distance for residues transportation (km/truck)	Adjacent Disposal site	5
CTy,ash	average truck capacity for residues transportation (tonnes/truck)	Project design	6
FCi,j,y	quantity of fuel type i combusted in process j during the year y	Project design	340
COEFi,y	CO2 emission coefficient of fuel type i in year y	Calculated	
NCVi,y	Net calorific value of the fossil fuel type *i* in year *y*	IPCC, diesel	0.043
EFCO2,i,y	weighted average CO2 emission factor of fuel type i in year y (tCO2/TJ)	IPCC	74.1

Annex 3 gives further explanations about the baseline assumptions

Determination of "eligible biomass"
The biomass is renewable as per definition of EB 23, Annex 18. It can be addressed as biomass residue which is defined as "*biomass by-products, residues and waste streams from agriculture, forestry, and related industries.*" (EB 20, Annex 8)
The project proponent assigned a biomass study from which extracts can be found in Annex 3 of this document. The study shows that there is a surplus of biomass in the region where project activity takes place and that there is no competition for the biomass that could lead to leakage.

B.5. Description of how the anthropogenic emissions of GHG by sources are reduced below those that would have occurred in the absence of the registered small-scale CDM project activity:

According to Attachment A to Appendix B of the simplified modalities and procedures for small scale CDM project activities the project participants should provide an explanation that the project activity would not have not have occurred anyway due to at least one of the following barriers:

(a) Investment barrier
(b) Technological barrier
(c) Barrier due to prevailing practice
(d) Other barriers

As a first step in this process realistic and credible alternatives to the project activity shall be listed. The following scenarios can be seen as plausible alternative scenarios:

Scenario 1 - Electricity supply by the grid and disposal of rice husks (Continuation of current situation)
This scenario represents the situation before the implementation of the project activity as well as would represent also the continuation of current emission levels in the absence of the project activity. Instead of building new renewable grid connected capacity for power production the existing conventional power production already connected or in future added to the grid will be used to satisfy consumption of electricity in the region. The electricity delivered through the grid is defined by the average mix of the national respective regional power production. There are no regulations to fully or partially buy electricity from renewable sources. Moreover, in this scenario rice husks will be disposed as it is usual practice in large landfills that can be found near rice processing sites and related methane production from decay would continue would not be utilized for renewable electricity generation. It is not legally required to gainfully use the rice husk residues or to mitigate the methane emissions from disposal.

Scenario 2 - Power Supply by a thermal biomass power generation unit undertaken as CDM activity (the proposed project)

In this scenario it is assumed that a thermal power plant uses biomass, such as rice husk, for the production of renewable electricity and displaces the higher carbon intensive electricity prevailing in the baseline scenario. In addition, in this scenario generation of methane from the disposal of biomass residues would be avoided. The equipment for biomass power production requires a significant amount of capital to be realized which is significantly higher than that for conventional power plants in the Southern region of Brazil, i.e. the state of Rio Grande do Sul and there are no other subsidies or incentives for the building of a biomass fired power plant. By implementing such project greenhouse gas emission reduction may be claimed for displacing grid electricity and for the avoidance of methane from decaying renewable biomass through controlled combustion and supply of electricity through the utilization of biomass. The scenario 2 may be therefore only a plausible scenario as the investments and operation of such a plant is economically not feasible without the additional income from the CDM, however this is subject to the additionality assessment as set forth below.

Based on the above analyses both scenarios can be regarded as plausible alternative scenarios.

Check of consistency with mandatory laws and regulations: The identified alternatives have to meet Brazil's applicable mandatory and legal and regulatory requirements. According to the environmental regulations, the rice husk produced has to be used on the field or deposited and stockpiled. There is currently a regulation dictating the disposal method of agricultural waste[25]. FEPAM which is an acronym for *Fundação Estadual de Proteção Ambiental*, the environmental agency of Rio Grande do Sul state, is responsible for the regulations related to waste solids disposal on the rice production. The regulation is stated on the operating licence[26] conceived to each rice producers. The regulation states:

- The ashes, biomass residues and other impurities generated on the rice processing can be deposited or used on own or third parties agricultural areas and deposits. The residue can be used as soil cover, organic fertilizer or cattle breeding.

[25] http://www.sema.rs.gov.br/sema/html/doc/gestaoAmbiental/palestrasPassoFundo/LO_BENEFICIAMENTO_GRAOS.pdf

[26] http://www.sema.rs.gov.br/sema/html/doc/gestaoAmbiental/palestrasPassoFundo/LO_BENEFICIAMENTO_GRAOS.pdf

- The ashes, biomass residues and other impurities generated on the rice processing can be stored on the production area for a short-term period until its disposal or use. The biomass residues cannot suffer runoff or be dragged by environmental factors (wind, rain etc.).
- The biomass residues cannot be deposited on an open air deposit, close to living areas (800 meters), close to rivers and lakes.
- Any different proposition on the destination on the residue should be approved by FEPAM.
- It is prohibited the open air burning of the biomass residue, according to ordinance 03/88 – SSMA.
- The rice producer has to fill on a quarter bases a spreadsheet on the residues produced and send it to FEPAM signed by its legal representative.

There is no other regulation and law that prohibits the installation of the stand-alone biomass power plant. Based on the assessment provided above the scenarios are consistent with applicable laws and regulations and comply with all regulations imposed by FEPAM in order to get its installation license approved and all other licenses required by ANEEL.

In the subsequent section the additionality of the project activity will be shown by taking into account investment barriers as the relevant barrier faced at the time the decision of implementing the project was taken.

The continuation of the current practice (Scenario 1) does not impose any investment barrier to the project developer as it requires no further financing.
The construction of a biomass power plant and the utilization of rice husks as a fuel for the production of renewable energy (Scenario 2) faces specific financial / economic barriers as it requires a significant investment and capital costs to construct such project are very high. Especially the expected return on capital of such an investment must be attractive enough to investors and has to reflect the investment risks.

For the evaluation of the attractiveness of such investment option or the determination of the investment barrier the return of the specific investment can be compared to a benchmark. A benchmark analysis as applicable type of an investment analyses was applied to further demonstrate the investment barrier. Within the benchmark analysis the main principles of step 2 of the *"Tool for the demonstration and assessment of additionality"* were used. The benchmark analysis applied uses default financial indicators published by the UNFCCC in EB 62 Report Annex 5 *"Guidelines on the assessment of investment analyses"*. These default values are reflecting the cost of equity considering the respective country risk based on ratings by Moody's. These values are based on long-term average returns of US treasury bonds and as such are expressed in US$ terms. This would require to evaluate the project in US$ terms. As the project evaluation is expressed in Brazilian Real the cost of equity have to be adjusted in order to reflect future differences in the valuation of the US$ and the Brazilian Real, expressed by the exchange rate.[27] As a proxy for future exchange rate development the expected inflation rates are used. Furthermore the rating of Brazil has improved in between the investment decision and the publication of the default values from Ba1 to Baa3.[28] Therefore the basic default value has been increased from 11.75% to 12% to reflect the

[27] See A. Damadoran, Applied Corporate Finance: A User's Manual, Chap. 5 – Measuring Return on Investment, pp.5.55 http://people.stern.nyu.edu/adamodar/pdfiles/acf3E/book/ch5.pdf

[28] Moody, Rating Action: Moody's upgrades Brazil to Baa3 and assigns a positive outlook, 22. September 2009, http://www.moodys.com/credit-ratings/Brazil-Government-of-credit-rating-114650#

perceived higher country risk at the time of the investment decision. Finally the forecast is made in nominal terms. The default value has been adjusted as proposed by the UNFCCC in EB 62 Report Annex 5 by adding the inflation rate. Overall these adjustments lead to costs of equity of 18.9%[29]. As the project is 100% equity financed the costs of equity equal the weighted average cost of capital (WACC). The detailed calculations and references to the assumptions can be found in the excel file *UTESB_20120222.xls* which is handed out to the DOE.

Table 6: Key Financial Parameters of Cash Flow Model

Project Assumptions	Value	Source
Base Year of Calculation	2009	
Project Start	07/14/2008	Purchase of Kfw Loan
Exchange rate (BRL / EUR) for 2008 (estimate)	2.60	EIU, Country Report Brazil, June 2008
Exchange rate (BRL / EUR) for 2009 (estimate)	2.63	EIU, Country Report Brazil, June 2008
Exchange rate (BRL / USD) for 2009 (estimate)	1.74	EIU, Country Report Brazil, June 2008
Inflation, average consumer prices (annual percentage change)	4.50%	IMF, World Economic Outlook April 2008
Installed Capacity (MW)	12.33	According to plant specification, Selling Memorandum 2007
Net Generation Capacity (MW)	11.097	Self Consumption 10% - According to plant specification, Selling Memorandum 2007
Operating Hours	7,387	Supply contracts June 2008. There are two months when the rice husk suppliers are exempted from their delivery obligation, restricting the maximum operating hours
Annual Electricity Generation for Sale (MWh)	81,154	Calculated Cable Loss of 1%
Annual Sale of MWh contracted by PPA (MWh)	96,390	The ANEEL license allows to sell the maximum amount of electricity which could be generated by the power plant, i.e. 11.097 MW x 24 hrs x 365 days minus cable loss of the power plant.
Annual Supply Need of Biomass (tons)	96,000	Supply Contracts June 2008
Price of biomass (rice husk + transport)	19.78 BRL	Supply Contracts June 2008
Investment Expenditures Plant	52,985,708 BRL	Selling Memorandum 2007
Investment Expenditures Interim Financing	2,885,555 BRL	Loan Agreement May 2008
Sales price per MWh (auction, long term)	158.00 BRL	CCEE - The average price for long-term PPA between 2005 and 2007 has been 133 BRL/MWh.

[29] The calculations are detailed with references in the excel sheet "WACC" in file "UTESB_20120208.xls" provided to the DOE

Purchase price per MWh on spot market for covering the difference between own generation and contracted MWh by PPA	96.00 BRL	CCEE - Considering the continous increase over the past years the calculation of an average has been based the last three years only. The 3.5-year average (2005-6/2008) was 109.65 BRL/MWh.
Operating & Maintenance	4,560,598 BRL	Selling Memorandum and Proposal by Service Provider
Other Annual Fixed Costs Electricity Generation	1,379,874 BRL	Selling Memorandum, ANEEL, estimates
Annual Net Revenues from Rice Husk Ash Sales from 2015	1,031,292.00 BRL	Estimates. Additional business to power generation, accounting for about 10% of EBIT.

The investment analysis made available to the DOE shows that project activity without the CDM fails to reach the benchmark. The conducted sensitivity analysis shows that even under favorable circumstances like an increase of the sales price for electricity or a decrease of the operating or biomass costs the benchmark is not passed without the CDM. The following table shows the influence on the return of the project. In this table only favorable changes are documented because they lead to an increased performance of the investment that could question the necessity of CDM if they alone can bring the interest above the benchmark.

Table 7: Sensivity Analysis

		IRR without CER	IRR with CER
Benchmark		18.9%	
Base Case		12.9%	15.2%
Electricity Price	+10%	15.9%	18.0%
Operating Costs	-10%	13.9%	16.1%
Biomass Costs	-10%	13.3%	15.6%

Based on the investment barriers outlined above it has been shown that the expected result of reduction in anthropogenic emissions by sources of greenhouse gases through the implementation of the proposed project activity is additional to any that would occur in the absence of the proposed project activity. Thus the project activity is environmentally additional in comparison to the baseline scenario and therefore eligible to receive Certified Emission Reductions (CERs) under the CDM.

Prior Consideration of the CDM

It has to be justified that the project participant's prior awareness of CDM benefits were considered necessary in the decision to undertake the project as a CDM project activity. The necessity of being eligible for carbon financing under the CDM has been an integral part of the project history as well as of the financing structure of the project. This evidence can be obtained from the documents provided by the former owner to the potential buyers during the sales process whereas for the purpose of selling the project ENERPAL assigned a selling memorandum for potential buyers of the projects (document from 6.9.2007) based on aa technical, legal and financial due diligence made in summer 2007. In all of these reports it is clearly stated that the revenues from carbon credits are an integral part of project activity.
MPC CAPITAL critically reviewed the selling memorandum and other available information. After own research and assumptions based on their experience MPC CAPITAL made an internal calculation that was meant to determine the attractiveness of an investment in this project. The results have been discussed above (see Investment barrier). In furtherance it should be noted that after the investment decision from July 2008 additional actions to continue the activity as CDM Show the consideration of CDM prior to global stakeholder process. The following timeline set out in tables 8 to 11 demonstrates in detail the project history and awareness of the CDM by the project participants prior to implementation of the project activity and thereafter. Evidence is provided to the DOE by the cited documents.

Table 8: History of the project activity before the project start

06/02/2006	Former project company Sao Borja Bioenergetica S.A. is incorporated (source: selling memorandum, file: *ELEKTRA Selling_Memorandum.pdf)*
18/09/2006	Turn key contract with EPC is signed (source: Technical DD, file: *01[1].01.01.01 Technical Due Diligence Report of BC Projetos.pdf)* Scheduled completion 30.05.2008 (source: Technical Due Dilligence, page 18)
13/03/2007	Last achieved milestone of construction (source: Technical Due Dilligence, page 18)
15/05/2007	ANEEL license has been granted (source: selling memorandum)
06/2007	Guarantees needed for the financing by the KfW ceased. The construction is suspended (source: selling memorandum, page 54*)* ENERPAL decided to sell the plant in order to minimize losses.
09/2007/- 07/2008	To initiate the sales process ENERPAL assigned a due diligence process (and file: *01.01.02.01 Financial Due Diligence Report*) and a selling memorandum was handed it out to potential buyers of the project.

Table 9: History of the project activity after the project start

14/07/2008 (Investment decision and project start date)	Based on the result of the review of the due diligence MPC Bioenergie GmbH & Co KG, an affiliate of MPC Capital AG founded for the purpose of acquisition and development of the project, buys the loans from KfW in exchange of the ownership of the assets with the intention to later transfer the assets to newly founded project companies. This activity is the time of investment decision where MPC Bioenergie GmbH & Co KG ultimately decided to invest in the project. Because with this contract substantial expenditures were made by MPC Bioenergie GmbH & Co KG, this is also regarded the project start date. (source: Purchase and Participation agreement between KfW and MPC Bioenergie Brasilien GmbH, file:*kfw_agreement.pdf*; selling memorandum)

22/12/2008	The Ancillary Asset Purchase Agreement is closed to transfer the assets to the newly founded project company (source: Ancillary Asset purchase Agreement between new and old project companies, file: *Asset_purchase_agreement_20081222.pdf*)
17/07/2009	Turn key contract with equipment supplier CCC Machinery was closed
05/2011	First trial operation with 7,8 MW capacity
05/2012	Plant is fully operational

Table 10: Consideration of CDM before the project start

Date	Description and evidence of prior consideration of CDM
2005	Project is initiated by old project owner and Perspectives GmbH is assigned for development of the PDD and TÜV Süd is assigned as DOE (source: old PDD by Perspectives GmbH, file:*PDD_GSP_SaoBorja_060330*,dated 2nd April 2006)
25/06/2006	The old project received positive validation by TÜV Süd (source: validation report, file:*(6a) 1_VR_CCC-SaoBorja_260606_1_compl.pdf*)
28/06/2006	TÜV Süd signed a request for registration to the UNFCCC (source: request for registration, file: *F_CDM_REG_Sa Borja_280606.pdf*)
2007, June	The necessary guarantees for the KfW loan cannot be fulfilled and the payment of loans was ceased (source: technical DD, file: 01[1].01.01.01 Technical Due Diligence Report of BC Projetos.pdf, page 4, selling memorandum page 54)
14/06/2007/	Due to the collapse of the financing structure of the project the agreements for the construction and financing of the biomass power plant Sao Borja Bioenergetica S.A. were suspended (source: Technical DD, file*: 01[1].01.01.01 Technical Due Diligence Report of BC Projetos.pdf*). ENERPAL as owner of the assets of the former project power plant UTE São Borja decided to to sell the project and for the purpose thereof ENERPAL initiated a comprehensive due diligence process, including financial and technical due diligence.
06/09/2007-07/2008	To initiate the sales process ENERPAL assigned a due diligence process and a selling memorandum was handed it out to potential buyers of the project. Among the investment highlights the selling memorandum stated that the project is an emission reduction project due to generation of CO2 neutral electricity using biomass and that the project is expected to fulfill the requirements of a CDM project, e.g. the CDM status will be granted in due course. This can be also evidenced by the previous efforts to document the project under the CDM (see old PDD developed by Perspectives GmbH) and the engagement of TÜV SÜD as DOE and its request for registration of the project after positive validation (source: request for registration). The income from Certified Emission Reductions has been an integral part of the revenue perspective provided in the selling memorandum and therefore should be an important part in the acquisition decision by any new project owner. (source: selling memorandum, file: *ELEKTRA_Selling_Memorandum.pdf*).. The technical due diligence sustained that the project has been eligible for carbon credits. MPC Capital AG was one of the interested buyers for the project. An internal review process of the due diligence documents was conducted by MPC Capital AG in respect to the project including the review of the CDM component.

Table 11:- Consideration of CDM after the project start

14/07/2008 (Investment decision and project start date)	Based on the result of the review of the due diligence (see Table *** above) MPC Bioenergie GmbH & Co KG, an affiliate of MPC Capital AG founded for the purpose of acquisition and development of the project, buys the loans from KfW in exchange of the ownership of the assets with the intention to later transfer the assets to newly founded project companies. This activity is the time of investment decision where MPC Bioenergie GmbH & Co KG ultimately decided to invest in the project. Because with this contract substantial expenditures were made by MPC Bioenergie GmbH & Co KG, this is also regarded the project start date. (source: Purchase and Participation agreement between KfW and MPC Bioenergie Brasilien GmbH, file:*kfw_agreement.pdf*; selling memorandum)
02/10/2008	Ativos Técnicos e Ambientais was assigend to develop a the PDD for the project. (source: Contract with ATA for CDM services file: *Contract with ATA, signed 02.10.2008.pdf*). This shows that actions to apply for the CDM have been taken immediately after investment decision.
22/12/2008	The Ancillary Asset Purchase Agreement is closed to transfer the assets to the newly founded project company (source: Ancillary Asset purchase Agreement between new and old project companies, file: *Asset_purchase_agreement_20081222.pdf*)
12/07/2009	Bureau Veritas (BV) has been assigned as DOE. But later on it has become clear that BV wasn't able to validate the scope of project activity due to a missing accreditation of scope 13. (source: Mail from Bureau Veritas, File: *BV_Notice_of_project_status_2008_10_08.pdf*)
10/01/2010	The contract with BV was cancelled (source: Cancellation of the contract with BV, file:*Project Cancellation 10.01.10.pdf*)
06/01/2010	TÜV NORD CERT GmbH was assigned as new DOE. (source: Assignment of TÜV Nord, file:*CDM_Validation_Proposal_BRS-92106_01_2010.pdf*)

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

As mentioned above, the project activity uses the following approved baseline and monitoring methodologies for small scale CDM project activity:

- AMS I.D. – Grid connected renewable electricity generation (version 17)
- AMS III.E. – Avoidance of methane production from decay of biomass through controlled combustion, gasification or mechanical/thermal treatment (version 16)

The UTE São Borja main objective is to reduce GHG emissions through the production of energy using rice husks as fuel. According to the methodologies and to the project participant decision, only the following emissions will be considered in the calculations of emission reductions:

Table 12: Main emission sources

	Methodology	Emissions source
Baseline emissions	AMS I.D.	CO_2 emissions from electricity generation in the Brazilian connected grid that is displaced through the project activity
	AMS III.E.	CH_4 emissions from anaerobic decay of the biomass residues in the absence of the project activity
Project emissions	AMS III.E.	CO_2 emissions from the incremental distances between the collection points of the rice husk to the project site as compared to the baseline disposal site
	AMS III.E.	CO_2 emissions related to the fossil fuel and/or electricity consumed by the project activity facilities
	AMS III.E.	CO_2 emissions from the transportation of combustion residues and final waste from controlled burning to disposal site.

<u>**Baseline Emissions – AMS I.D.**</u>

According to AMS I.D., baseline emissions due to the displacement of electricity are calculated by multiplying the net quantity of increased electricity generated with biomass residues as a result of the project activity ($EG_{BL,y}$) with the CO_2 baseline emission factor for the electricity displaced due to the project ($EF_{grid,CO2}$), as follows:

Where:
$BE_{AMS.I.D,y}$ = AMS I.D. baseline emissions in year y (tCO_2)
$EG_{BL,y}$ = Quantity of net electricity supplied to the grid as a result of the implementation of the CDM project activity in year *y* (MWh)
$EF_{grid,CO2}$ = CO2 emission factor for the electricity displaced due to the project activity during the year *y* (tCO_2e/MWh)

The CO2 emission factor for the electricity displaced from the grid was calculated by SIN – Sistema Interligado Nacional (national operator of the electric energy production and transmission system) using the "Tool to calculate the emission factor for an electricity system" and will be used in this calculation.
To this project activity, $EG_{BL,y}$ correspond to the net quantity of electricity generation in the project plant.

According to the "**Tool to calculate the emission factor for an electricity system**"[30], the following steps shall be applied to calculate the $EF_{grid,CO2}$.

Step 1. Identify the relevant electricity systems.

The relevant electricity system in the SIN[31], or the Brazilian interconnect national grid. According to the national operator (ONS), the system cover all but 3.4% of the country. The resolution 8 from 26th May, 2008[32] refers to the SIN as the only system in Brazil.
The license from ANEEL to the project activity also demonstrates that the project is in the national grid.

Step 2: Choose whether to include off-grid power plants in the project electricity system (optional)

No off-grid plants are included, so this step is not considered. As presented by ONS, Brazil has a vast connected electricity system.

Step 3: Select a method to determine the operating margin (OM)

According to the Brazilian DNA, the method used to estimate the OM is the dispatch data analysis OM[33]. This approach is not applicable to historical data and, thus, requires annual monitoring of $EF_{grid,OM-DD,y}$.

Step 4: Calculate the operating margin emission factor according to the selected method

The selected method is the dispatch data analysis. The calculation is made by the Brazilian DNA and available to the public[34].

Step 5: Identify the group of power units to be included in the build margin

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[30] http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-07-v2.pdf

[31] http://www.ons.org.br/conheca_sistema/o_que_e_sin.aspx

[32] http://homologa.ambiente.sp.gov.br/biogas/docs/resolucoes_comissao/resolucao_8.pdf

[33] http://www.mct.gov.br/index.php/content/view/74689.html

[34] http://www.mct.gov.br/index.php/content/view/303077.html#ancora

Brazilian DNA calculates the build margin based on the last capacity additions, following the Tool[35].

Step 6: Calculate the build margin emission factor

Brazilian DNA calculates the build margin based on the last capacity additions, following the Tool[36].

Step 7: Calculate the combined margin emissions factor
The combined margin emissions factor is calculated as follows:

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

Where:
$EF_{grid,BM,y}$= Build margin CO_2 emission factor in year *y* (tCO_2/MWh)
$EF_{grid,OM,y}$= Operating margin CO_2 emission factor in year *y* (tCO_2/MWh)

w_{OM} = Weighting of operating margin emissions factor(%)
w_{BM} =Weighting of build margin emissions factor(%)

According to the "tool" and since the project is not Wind and solar power based, for the first crediting period w_{OM} =w_{BM} = 0.5.

The latest available data from the DNA[37] from 2008 shows the value of 0.1458 for the $EF_{grid,BM,y}$ and average of 0.476575 for the $EF_{grid,OM,y}$..

Then, the combined margin emissions factor ($EF_{grid,CM,y}$) is = 0.3112.

This value has to be monitored during the crediting periods of the project activity.

<u>Baseline Emissions – AMS III.E.</u>

According to AMS III.E., the baseline emissions are the amount of methane that would have been emitted from the decay of the cumulative quantity of rice husk diverted from the disposal site by the project activity, calculated as the methane generation potential using the formula in the "Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site".
All biomass residues (Rice Husk) used in the project activity are stockpiled and, according to the methodology, the baseline calculation shall be adjusted using MCF value of 0.28 and the lower value of k. According to the tool, the amount of methane produced in the year y ($BE_{CH4,SWDS,y}$) is calculated as follows:

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

[35] http://www.mct.gov.br/index.php/content/view/74689.html

[36] http://www.mct.gov.br/index.php/content/view/74689.html

[37] http://www.mct.gov.br/index.php/content/view/303077.html#ancora

Where:
$BE_{CH4,SWDS,y}$ = Methane emissions avoided during the year *y* from preventing waste disposal at the solid waste disposal site (SWDS) during the period from the start of the project activity to the end of the year y (tCO_2e)
φ = Model correction factor to account for model uncertainties (0.9)
f = Fraction of methane captured at the SWDS and flared, combusted or used in another manner
GWP_{CH4} = Global Warming Potential (GWP) of methane, valid for the relevant commitment period
OX = Oxidation factor (reflecting the amount of methane from SWDS that is oxidized in the soil or other material covering the waste)
F = Fraction of methane in the SWDS gas (volume fraction) (0.5)
DOC_f = Fraction of degradable organic carbon (DOC) that can decompose
MCF = Methane correction factor
$W_{j,x}$ = Amount of organic waste type *j* prevented from disposal in the SWDS in the year *x* (tons)
DOC_j = Fraction of degradable organic carbon (by weight) in the waste type *j*
kj = Decay rate for the waste type *j*
j = Waste type category (index)
x = Year during the crediting period: x runs from the first year of the first crediting period (x = 1) to the year y for which avoided emissions are calculated (x = y)
y = Year for which methane emissions are calculated

The variables (DOC_j) and (kj) should be chosen from the tool[38] and according to the information available, rice husk is considered similar to waste wood and wood products and straw, other biomass residues types thus the value of 43% is considered as in other approved CDM project activities[39].

According to the guidance provided in the paragraph 22 of AMS III.E, a quantitative analysis shall be carried out using the following options (in order of priorities):

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

Since the project proponents are not rice producers and thus not in control of the rice husks disposal sites, receiving data from the disposal in the past is quite difficult.
Considering this, the project proponent assigned a study presented in Annex 3 about the rice husk industry in the state and the region of the project activity.
The study is based on official data sources from IRGA (Instituto Rio Grandense do Arroz) and was developed by industry experts. It covers the several possible uses of the biomass and disposal practices. According to the study, a significant part of the residual biomass is land filled and the rest is stockpiled.

[38] According to the options available in the "**Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site v.04**", *If a waste type, prevented from disposal by the proposed CDM project activity, can not clearly be attributed to one of the waste types in the table above, project participants should choose among the waste types that have similar characteristics that waste type where the values of* DOC_j *and* k_j *result in a conservative estimate (lowest emissions), or request a revision of / deviation from this methodology.*

[39] http://cdm.unfccc.int/UserManagement/FileStorage/457GSXGVWU0OFOSH7MDML51UZJK0R1

The project proponents considered that the common practice is stockpiling, leading to a more conservative baseline emissions.
Although the access to the disposal site data is quite difficult, the project proponents have access to a major disposal site that have a controlled group and were established in more than 3 years from the start of the project activity.
Part of the biomass at this disposal site is stockpiled for more than 8 years according to the responsible for the site. Thus, there are no restrictions for leaving the biomass in a stockpile indefinitely.
Visit to this disposal sites are available to the DOE. Figure 5 presents the two major disposal sites that will disappear due to the project activity.

The rice husk consumed by the project activity ($W_{j,x}$) match the quantity that would be stockpiled in the absence of the project activity because, to be used as a fuel in the power plant, the rice husk need to be fresh and so on can't be the rice husk already stockpiled. The project activity meets the situation described in the item 23 of the AMS III.E. and will used the following equation to calculate the baseline emissions.

$$BE_{AMSIII.E,y} = BE_{CH4,SWDS,y}$$

Where:
$BE_{AMSIII.E,y}$ = AMS III.E baseline emissions at year y during crediting period (tCO2e)

$BE_{CH4,SWDS,y}$ = yearly Methane Generation Potential of the wastes diverted to be disposed in the landfill from the beginning of the project (x=1) up to the year y, calculated according to the "Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site" (tCO2e)

Project Emissions – AMS I.D.

According to the methodology, for renewable energy project like the proposed activity, $PE_{AMSI.D.,y} = 0$.

Project Emissions – AMS III.E.

As described above, the project emissions sources of this component are:

a. CO2 emissions related to the gasification and combustion of the non-biomass carbon content of the waste (plastics, rubber and fossil derived carbon) or RDF/SB and auxiliary fossil fuels used in the combustion, gasification or mechanical/thermal treatment facility;
b. CO_2 emissions from the incremental distances between the collection points of the rice husk to the project site as compared to the baseline disposal site and CO_2 emissions from the transportation of combustion residues and final waste from controlled burning to disposal site ($PE_{y,transp}$),
c. CO2 emissions related to the fossil fuel and/or electricity consumed by the project activity facilities ($PE_{y,power}$).

a. CO2 emissions related to the gasification and combustion of the non-biomass carbon content of the waste (plastics, rubber and fossil derived carbon) or RDF/SB and auxiliary fossil fuels used in the combustion, gasification or mechanical/thermal treatment facility

This source is excluded since the project activity is combusting rice husk only. The auxiliary fossil fuel that could be used in the project is included in item (c) below.

b. CO2 emissions from the incremental distances between the collection points of the rice husk to the project site as compared to the baseline disposal site

I. Incremental distances between the collection points to the project site as compared to the baseline disposal site;

This is the major source and is considered below as a source of emissions.

II. Transportation of combustion residues and final waste from controlled burning to disposal site;

III. The planned disposal site is adjacent from where the controlled burning occurs so this source is not considered.Transportation of RDF/SB from the mechanical/thermal treatment facility to the storage site within the project boundary;

This source of emissions is not applicable to the project activity since the project is not producing RDF/ SB.

IV. Transportation of RDF/SB to the sites of the end users (if some of the sites are unknown a conservative approach assuming transport emissions for a specific distance, for example a default of 250 km, shall be used).

This source of emissions is not applicable to the project activity since the project is not producing RDF/ SB.

The biomass residues are not generated directly at the project site, so it will require the use of trucks to transport the biomass residues from suppliers to the project plant.
According to the methodology, the following equation is used to calculate:

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

Where:
Qy = quantity of waste combusted, gasified or mechanically/thermally treated in the year y (tonnes)
CTy = average truck capacity for waste transportation (tonnes/truck)
DAFw = average incremental distance for waste transportation (km/truck)
EFCO2 = CO2 emission factor from fuel use due to transportation (tCO2/km, IPCC default values or local values)
Qy,ash = quantity of combustion and gasification residues and residues from mechanical/thermal treatment produced in the year y (tonnes)
CTy,ash = average truck capacity for residues transportation (tonnes/truck)
DAFash = average distance for residues transportation (km/truck)
Qy,RDF/SB = quantity of RDF/SB produced in the year y (tonnes)
CTy,RDF/SB = average truck capacity for RDF/SB transportation (tonnes/truck)
DAFRDF/SB = aggregate average distance for RDF/SB transportation to the storage in the production site as well as to the end user sites (km/truck)

In the beginning of the project, the emissions from the transportation of the ashes is considered zero because the ashes will be disposed at the project activity site. With the first samples of ashes, the project participants will start a market research to look for clients to buy the ashes. Gradually, ashes will be commercialized and this emission source calculated.

As described above, the emissions from the transportation of the RDF/SB are considered zero.

c. CO2 emissions related to the fossil fuel and/or electricity consumed by the project activity facilities

The biomass residue fired power plant requires the use of some fossil fuel to acquire proper and efficient operation. This source of emissions will consider the fossil fuels combusted in the project plant during year y and the fossil fuels combusted at the project site for other purposes that are attributable to the project activity during year y. The following activities will be considered to the calculation:

- plant start-up,
- on-site transportation of the biomass residues,
- mechanical preparation of the biomass residues.

The CO_2 emissions from on-site combustion of fossil fuel will be calculated using the latest approved version of the "Tool to calculate project or leakage CO2 emissions from fossil fuel combustion" (Version 02). The equation below will be used in the calculations.

$$PE_{FC,j,y} = \sum_{i} FC_{i,j,y} * COEF_{i,y}$$

Where:
$PE_{FC,j,y}$ = Are the CO2 emissions from fossil fuel combustion in process j during the year y (tCO2/yr) = $PE_{y,power}$;
$FC_{i,j,y}$ = Q, $_{fuel}$ = Is the quantity of fuel type i combusted in process j during the year y (mass or volume unit/yr);
$COEF_{i,y}$ = Is the CO2 emission coefficient of fuel type i in year y (tCO2/mass or volume unit)
i = Are the fuel types combusted in process j during the year y

The CO2 emission coefficient COEFi,y can be calculated using two different options: based on the chemical composition of the fossil fuel type i (option A) or based on net calorific value and CO2 emission factor of the fuel type i. As the chemical composition of fossil fuels in Brazil is different from supplier to supplier, option B will be used for calculations.

Option B:

The CO2 emission coefficient COEFi,y is calculated as follows:

$$COEF_{i,y} = NCV_{i,y} \times EF_{CO2,i,y}$$

Where:
$COEF_{i,y}$ = Is the CO2 emission coefficient of fuel type i in year y (tCO2/mass or volume unit)
$NCV_{i,y}$ = Is the weighted average net calorific value of the fuel type i in year y (GJ/mass or volume unit)
$EF_{CO2,i,y}$ = Is the weighted average CO2 emission factor of fuel type i in year y (tCO2/GJ)
i = Are the fuel types combusted in process j during the year y

The CO2 emissions from electricity consumption is not applicable because all the electricity consumption will be supplied by the captive renewable power plant (project activity) and the emissions from this power plant are not considered in this PDD.

Finally, according to the AMS III.E., the project activity emissions are calculated as follows:

$$PE_{AMSIII.E.,y} = PE_{y,comb} + PE_{y,transp} + PE_{y,power}$$

Where:
$PE_{AMSIII.E,y}$ = project activity direct emissions in the year y (tCO2e)
$PE_{y,comb}$ = emissions through combustion and gasification of non-biomass carbon of waste and RDF/SB in the year y (tCO2e) = 0
$PE_{y,transp}$ = emissions through incremental transportation in the year y (tCO2e)
$PE_{y,power}$ = emissions through electricity or diesel consumption in the year y (tCO2e)

Leakage

The methodologies exposed the leakage emissions as follow:

AMS I.D.
If the energy generating equipment is transferred from another activity, leakage is to be considered.

AMS III.E.
If the controlled combustion technology is equipment transferred from another activity or if the existing equipment is transferred to another activity, leakage effects at the site of the other activity are to be considered.

According to the sales contract, the equipment that will be installed in the project activity will be new and no other equipment from another activity will be transferred to the project site. No leakage will be resulted by the project activity.

Leakage in biomass project activity

According to the "General guidance on leakage in biomass project activity"[40], for small-scale energy CDM project activity involving biomass residues or wastes, project participant shall demonstrate that the use of the residue or waste is unlikely to affect the generation of the biomass and could not be used for other purposes in the absence of the project activity.

Since the project is using biomass residues, it has to follow the guidance on competing use of biomass. Where the biomass may in the absence of the project activity be used elsewhere, for the same or a different purpose.

C. Competing uses for the biomass[41]

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[40] http://cdm.unfccc.int/Reference/Guidclarif/ssc/methSSC_guid04.pdf

[41] http://cdm.unfccc.int/Reference/Guidclarif/ssc/methSSC_guid04.pdf page 4

17. In some cases, the biomass used in the project activity could be used for other purposes in the absence of the project. For example, biomass residues from existing forests could have been used as fuel wood or agricultural biomass residues could have been used as fertilizers or for energy generation. Competing uses for biomass are not relevant, where the biomass is generated as part of the project activity (new forests or cultivations).

The biomass is not generated as part of the project activity, so the competing uses for biomass are relevant.

18. The project participant shall evaluate ex ante if there is a surplus of the biomass in the region of the project activity, which is not utilized. If it is demonstrated (e.g., using published literature, official reports, surveys etc.) at the beginning of each crediting period that the quantity of available biomass in the region (e.g., 50 km radius), is at least 25% larger than the quantity of biomass that is utilized including the project activity, then this source of leakage can be neglected otherwise this leakage shall be estimated and deducted from the emission reductions.

For the purpose of evaluating ex ante if there is a surplus of biomass in the region, the project participants assigned a study called "Study about the availability of rice husk for energy production in the region of São Borja - western border of Rio Grande do Sul – Brazil" to demonstrate the evidences about the existence of surplus of the biomass residues also considering the transport feasibility range of the rice husk (see Annex 3 for a summary of the study). The study identifies a average feasible distance of transport for the rice husk of up to 237,7 km, depending on the exchange rate of Brazilian Real and US Dollars and Oil Price (in USD/barrel). However referring to AMS0042 and recommendations of the EB: *"...the region should cover a radius around the project activity of at least 20 km but not more than 200 km"* (AM0042/ Version 01, page 17)

The study divides the areas where project activity could have influence on the biomass availability in three parts: the central area of up to15 km, the primary area of up to 150,7km and the secondary area of up to 237,5km. The primary area is defined as the most feasible range for biomass supply and lies within the above defined boundary. The surplus of available biomass in this region accounts for 33% (page 89). Hence this source of leakage can be neglected.

Emission Reductions – AMS I.D.

$$ER_{AMSID,y} = BE_y - PE_y - LE_y$$

$ER_{AMSID,y}$ = emission reductions in year y (tCO2e/y)
BE_y = baseline emissions in year y (tCO2e/y)
PE_y = project emissions in year y (tCO2e/y)
LE_y = leakage emissions in year y (tCO2e/y)

Emission Reductions – AMS III.E.

$$ER_{AMSIIIE,y} = BE_y - \left(PE_y + Leakage_y\right)$$

$ER_{AMSIIIEy}$ = emission reductions in the year y (tCO2e)
BE_y = baseline emissions at year y during crediting period (tCO2e)

PE_y = project activity direct emissions in the year y (tCO2e)
$Leakage_y$ = leakage in year y

Total Emission Reductions

$$ER_{total,y} = ER_{AMSI.D.,y} + ER_{AMSIII.E.,y}$$

The project activity mainly reduces CO2 emissions through substitution of power generation with fossil fuel by generation with biomass residues. The Emission Reduction *ERtotal,y* by the project activity during a given year y is the summation of the emission reduction resulted from the two different methodologies utilised in this PDD. Is calculated as follows:

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

Data / Parameter:	φ
Data unit:	N/A
Description:	Model correction factor according to the " tool to determine methane emissions avoided from dumping waste at a solid waste disposal site"
Source of data used:	Tool to determine methane emissions avoided from dumping waste at a solid waste disposal site v.04
Value applied:	0.9
Justification of the choice of data or description of measurement methods and procedures actually applied :	Default Factor
Any comment:	N/A

Data / Parameter:	**OX**
Data unit:	
Description:	Oxidation factor (reflecting the amount of methane from SWDS that is oxidized in the soil or under material covering the waste)
Source of data used:	Site visit and research realized by project proponent
Value applied:	0
Justification of the choice of data or description of measurement methods and procedures actually applied :	The solid waste disposal sites are not covered with oxidizing material such as soil and or compost.
Any comment:	N/A

Data / Parameter:	**F**
Data unit:	%
Description:	Fraction of methane in the landfill gas

Source of data used:	Tool to determine methane emissions avoided from dumping waste at a solid waste disposal site v.04
Value applied:	0.5
Justification of the choice of data or description of measurement methods and procedures actually applied :	Default Value
Any comment:	N/A

Data / Parameter:	**DOC_f**
Data unit:	%
Description:	Fraction of degradable organic carbon (DOC) that can decompose
Source of data used:	IPCC 2006 Guidelines for National Greenhouse Gas Inventories
Value applied:	0.5
Justification of the choice of data or description of measurement methods and procedures actually applied :	Default Factor
Any comment:	N/A

Data / Parameter:	**DOC_j**
Data unit:	%
Description:	Fraction of degradable organic carbon (by weight) in the waste type j
Source of data used:	Tool to determine methane emissions avoided from dumping waste at a solid waste disposal site v.04 and IPCC 2006 Guidelines for National Greenhouse Gas Inventories.
Value applied:	43
Justification of the choice of data or description of measurement methods and procedures actually applied :	Biomass classified as "wood and wood waste", wet basis. Default factor
Any comment:	N/A

Data / Parameter:	**Kj**
Data unit:	-
Description:	Decay rate for the waste type j
Source of data used:	Tool to determine methane emissions avoided from dumping waste at a solid

	waste disposal site v.04 and IPCC 2006 Guidelines for National Greenhouse Gas Inventories
Value applied:	0.035
Justification of the choice of data or description of measurement methods and procedures actually applied :	Classification as "wood, wood products and straw", tropical (MAT > 20oC), Wet (MAP>1000mm).
Any comment:	N/A

Data / Parameter:	**Specific fuel consumption**
Data unit:	ton rice husk/MWh
Description:	Quantity of fuel used per MWh produced
Source of data used:	Sales contract between UTE São Borja and equipment supplier
Value applied:	1.056[42]
Justification of the choice of data or description of measurement methods and procedures actually applied :	Based on supply contract.
Any comment:	N/A

Data / Parameter:	**MCF**
Data unit:	-
Description:	Methane correction factor
Source of data used:	AMS III.E and IPCC 2006 Guidelines for National Greenhouse Gas Inventories
Value of data:	0.28
Description of measurement methods and procedures to be applied:	This is the MCF value for an unmanaged shallow SWDS (0,4) minus 30% uncertainty range as specified in 2006 IPCC Guidelines for National Greenhouse Gas Inventories and described in the AMS III.E paragraph 22. The applied uncertainty range is a conservative assumption for the estimation of methane emissions from stockpiles.
QA/QC procedures to be applied:	The disposal conditions of the rice husks will be checked according to national or state rules defined by FEPAM, and by the project participant.
Any comment:	N/A

Data / Parameter:	**w_{OM}, w_{BM}**
Data unit:	%
Description:	w_{OM}= Weighting of operating margin emissions factor w_{BM}=Weighting of build margin emissions factor

[42] (12.995 t/hr / 12,3 MW)

Source of data used:	"Tool to calculate emission factor from an electricity system
Value applied:	0.5
Justification of the choice of data or description of measurement methods and procedures actually applied :	Parameter from the tool, considering the type of project (Thermal).
Any comment:	N/A

B.6.3 Ex-ante calculation of emission reductions:

Baseline Emissions

The results obtained by the equations and variables explained in the sections B6.1 and B6.2 are shown in the tables below.

Variable $EG_{BL,y}$ represents the "Quantity of net electricity supplied to the grid as a result of the implementation of the CDM project activity in year y (MWh)"

After Subtraction of own consumption (10%) the remaining electric capacity is 11.097 MW. Assuming 7,387 operational hours (the total amount of tons supplied (96,000 t) divided by the amount of rice husk needed per operating hour (12.995 t /hr), also see sheet "assumptions" in file *UTESB_20120222.xls*) and a grid loss of 1% the quantity of electricity deliverable to the grid is 81,154.

Table 13: baseline emissions AMS I.D.

Year	$EG_{BL,y}$	EF_{CO2} [43]	$BE_{AMS\,I.D,y}$
1	81.154	0.3112	25.255
2	81.154	0.3112	25.255
3	81.154	0.3112	25.255
4	81.154	0.3112	25.255
5	81.154	0.3112	25.255
6	81.154	0.3112	25.255
7	81.154	0.3112	25.255
8	81.154	0.3112	25.255
9	81.154	0.3112	25.255
10	81.154	0.3112	25.255
11	81.154	0.3112	25.255
12	81.154	0.3112	25.255
13	81.154	0.3112	25.255
14	81.154	0.3112	25.255
15	81.154	0.3112	25.255
16	81.154	0.3112	25.255
17	81.154	0.3112	25.255
18	81.154	0.3112	25.255
19	81.154	0.3112	25.255
20	81.154	0.3112	25.255
21	81.154	0.3112	25.255
Total	1,704,230	0.3112	530,356

Table 14: baseline emissions AMS III.E.

[43] http://www.mct.gov.br/index.php/content/view/74689.html

φ	(1-f)	GWP_{CH4}	(1-OX)	.16/12.	F	DOCf	MCF	$W_{j,x}$	DOCj	e	Kj
0.9	1	21	0.9	1.33	0.5	0.5	0.28	96,000	0.43	2.718	0.035

Year	$BE_{AMSIII.E,y}$
1	2,254
2	4,431
3	6,532
4	8,562
5	10,521
6	12,414
7	14,241
8	16,005
9	17,709
10	19,354
11	20,942
12	22,476
13	23,957
14	25,387
15	26,768
16	28,101
17	29,389
18	30,632
19	31,833
20	32,992
21	34,111
Total	418,609

Table 15: Baseline Emissions Total

Year	AMS I.D. $BE_{AMS.I.D,y}$	AMS III.E. $BE_{AMSIII.E,y}$	Baseline Emissions
1	25.255	2,254	27.509
2	25.255	4,431	29.686
3	25.255	6,532	31.787
4	25.255	8,562	33.817
5	25.255	10,521	35.776
6	25.255	12,414	37.669
7	25.255	14,241	39.496
8	25.255	16,005	41.260
9	25.255	17,709	42.964
10	25.255	19,354	44.609
11	25.255	20,942	46.197
12	25.255	22,476	47.731
13	25.255	23,957	49.212
14	25.255	25,387	50.642

15	25.255	26,768	52.023
16	25.255	28,101	53.356
17	25.255	29,389	54.644
18	25.255	30,632	55.887
19	25.255	31,833	57.088
20	25.255	32,992	58.247
21	25.255	34,111	59.366
Total	**530,356**	**418,609**	948,965

Project Emissions

The ex-ante project emissions are determined by the equations and variables shown above and using the values of the estimated variables described in the section B7.1. The project emissions are presented in the table below.

Table 16: Calculation of project emissions – $PE_{y,transp}$

year	Q_y	CT_y	DAF_w	EF_{CO2}	$Q_{y,ash}$	$CT_{y,ash}$	DAF_{ash}	$Q_{y,RDF/SB}$	$CT_{y,RDF/SB}$	$DAF_{RDF/SB}$	$PE_{y,transp}$
1	96,000	6	11	0.00077	19,584	6	0	0	6	0	136
2	96,000	6	11	0.00077	19,584	6	0	0	6	0	136
3	96,000	6	11	0.00077	19,584	6	0	0	6	0	136
4	96,000	6	11	0.00077	19,584	6	0	0	6	0	136
5	96,000	6	11	0.00077	19,584	6	0	0	6	0	136
6	96,000	6	11	0.00077	19,584	6	0	0	6	0	136
7	96,000	6	11	0.00077	19,584	6	0	0	6	0	136
8	96,000	6	11	0.00077	19,584	6	0	0	6	0	136
9	96,000	6	11	0.00077	19,584	6	0	0	6	0	136
10	96,000	6	11	0.00077	19,584	6	0	0	6	0	136
11	96,000	6	11	0.00077	19,584	6	0	0	6	0	136
12	96,000	6	11	0.00077	19,584	6	0	0	6	0	136
13	96,000	6	11	0.00077	19,584	6	0	0	6	0	136
14	96,000	6	11	0.00077	19,584	6	0	0	6	0	136
15	96,000	6	11	0.00077	19,584	6	0	0	6	0	136
16	96,000	6	11	0.00077	19,584	6	0	0	6	0	136
17	96,000	6	11	0.00077	19,584	6	0	0	6	0	136
18	96,000	6	11	0.00077	19,584	6	0	0	6	0	136
19	96,000	6	11	0.00077	19,584	6	0	0	6	0	136
20	96,000	6	11	0.00077	19,584	6	0	0	6	0	136
21	96,000	6	11	0.00077	19,584	6	0	0	6	0	136

Table 17: project emissions – $PE_{y,power}$

Year	NCVi,y	EFCO2,i,y	COEFi,y	□FCi,j,y	PEFC,j,y = $PE_{y,power}$
1	0.043	74.1	3.1863	340	1,083
2	0.043	74.1	3.1863	340	1,083

3	0.043	74.1	3.1863	340	1,083
4	0.043	74.1	3.1863	340	1,083
5	0.043	74.1	3.1863	340	1,083
6	0.043	74.1	3.1863	340	1,083
7	0.043	74.1	3.1863	340	1,083
8	0.043	74.1	3.1863	340	1,083
9	0.043	74.1	3.1863	340	1,083
10	0.043	74.1	3.1863	340	1,083
11	0.043	74.1	3.1863	340	1,083
12	0.043	74.1	3.1863	340	1,083
13	0.043	74.1	3.1863	340	1,083
14	0.043	74.1	3.1863	340	1,083
15	0.043	74.1	3.1863	340	1,083
16	0.043	74.1	3.1863	340	1,083
17	0.043	74.1	3.1863	340	1,083
18	0.043	74.1	3.1863	340	1,083
19	0.043	74.1	3.1863	340	1,083
20	0.043	74.1	3.1863	340	1,083
21	0.043	74.1	3.1863	340	1,083

Table 18: Project Emissions

Year	$PE_{y,transp}$	$PE_{y,power}$	$PE_{y,total}$
1	136	1,083	1,219
2	136	1,083	1,219
3	136	1,083	1,219
4	136	1,083	1,219
5	136	1,083	1,219
6	136	1,083	1,219
7	136	1,083	1,219
8	136	1,083	1,219
9	136	1,083	1,219
10	136	1,083	1,219
11	136	1,083	1,219
12	136	1,083	1,219
13	136	1,083	1,219
14	136	1,083	1,219
15	136	1,083	1,219
16	136	1,083	1,219
17	136	1,083	1,219
18	136	1,083	1,219
19	136	1,083	1,219
20	136	1,083	1,219
21	136	1,083	1,219
Total	**2,846**	**22,750**	**25,596**

Table 19: Project Emissions

Year	$PE_{AMS.I.D}$	$PE_{AMS.III.F}$	$PE_{y,total}$
1	0	1,219	1,219
2	0	1,219	1,219
3	0	1,219	1,219
4	0	1,219	1,219
5	0	1,219	1,219
6	0	1,219	1,219
7	0	1,219	1,219
8	0	1,219	1,219
9	0	1,219	1,219
10	0	1,219	1,219
11	0	1,219	1,219
12	0	1,219	1,219
13	0	1,219	1,219
14	0	1,219	1,219
15	0	1,219	1,219
16	0	1,219	1,219
17	0	1,219	1,219
18	0	1,219	1,219
19	0	1,219	1,219
20	0	1,219	1,219
21	0	1,219	1,219
Total	**0**	**25,596**	**25,596**

Emissions Reductions

The results obtained by the equations and variables explained in the sections B6.1 and B6.2 are show in the table below.

Table 20: Emissions Reductions

year	$ER_{AMSID,y}$	$ER_{AMSIIIF,y}$	$ER_{total,y}$
1	25.255	1,035	26.290
2	25.255	3,212	28.467
3	25.255	5,313	30.569
4	25.255	7,343	32.598
5	25.255	9,303	34.558
6	25.255	11,195	36.450
7	25.255	13,022	38.277
8	25.255	14,786	40.041
9	25.255	16,490	41.745
10	25.255	18,135	43.390
11	25.255	19,723	44.978
12	25.255	21,257	46.512
13	25.255	22,738	47.993

14	25.255	24,168	49.423
15	25.255	25,549	50.804
16	25.255	26,882	52.137
17	25.255	28,170	53.425
18	25.255	29,413	54.668
19	25.255	30,614	55.869
20	25.255	31,773	57.028
21	25.255	32,892	58.147
Total	**530,356**	**393,013**	**923,369**

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

Table 21: Ex-ante Estimation of Emission reductions

Year	Estimation of Project activity emissions (tCO2e)	Estimation of baseline emissions (tCO2e)	Estimation of leakage (tCO2e)	Estimation of overall emission reductions (tCO2e)
1	1,219	27.509	0	26.290
2	1,219	29.686	0	28.467
3	1,219	31.787	0	30.569
4	1,219	33.817	0	32.598
5	1,219	35.776	0	34.558
6	1,219	37.669	0	36.450
7	1,219	39.496	0	38.277
8	1,219	41.260	0	40.041
9	1,219	42.964	0	41.745
10	1,219	44.609	0	43.390
11	1,219	46.197	0	44.978
12	1,219	47.731	0	46.512
13	1,219	49.212	0	47.993
14	1,219	50.642	0	49.423
15	1,219	52.023	0	50.804
16	1,219	53.356	0	52.137
17	1,219	54.644	0	53.425
18	1,219	55.887	0	54.668
19	1,219	57.088	0	55.869
20	1,219	58.247	0	57.028
21	1,219	59.366	0	58.147
Total (tCO_2e)	**25,596**	**948,965**	**0**	**923,369**

For further details on the emission reductions calculation see spreadsheet: 2012_02_17_UTE_Emission_reductions.xls

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

B.7.1 Data and parameters monitored:

Data / Parameter:	$EG_{BL,y}$
Data unit:	MWh/yr
Description:	Net quantity of electricity generated in the project plant during the year y and sold to the grid
Source of data to be used:	On-site measurements. Hourly and monthly
Value of data	81,154 MWh/year Calculated by 7,387 operational hours with a electric capacity of 11.097 MW (after subtraction of own consumption) and subtraction of 1% grid loss. (also see sheet "assumptions" in file *UTESB_20120222.xls*)
Description of measurement methods and procedures to be applied:	Continuously recording, monthly reporting. Standard electricity metering procedures in accordance with the requirements defined by the Câmara de Comercialização de Energia Elétrica (CCEE) and/ or ANEEL.
QA/QC procedures to be applied:	Electricity metering will be conducted with standard metering devices, which are characterized by a high accuracy due to their relevance for invoicing and financial accounting. Only measurement devices accepted by CCEE/ ONS will be used (currently: the Standards for Electricity NBR 5410, grid proceedings from ONS). Standards for connection are established by grid companies during licensing. According to the Brazilian regulations on electrical grid, at least two supplementary conventional electronic measurers are to be installed at the outlet cabin: one primary meter, and a backup meter. These metering devices have to comply with the standards of CCEE/ ONS. Meters will be subject to regular maintenance and testing regime to ensure accuracy. The meter must meet the relevant calibration standards of ONS/ANEEL/CCEE (whichever is relevant at the time of calibration). Calibration records will be kept to show auditors in the verification process, if requested. The consistency of metered electricity will be crosschecked with the metering device installed in the grid and also the quantity of biomass fired (e.g. estimation of efficiency = electricity generation divided by the quantity of utilized biomass). The cross-check with records for sold electricity also.
Any comment:	Information on the two metering devices (major and back-up): • Socket base type • Location: Sub-station of São Borja at CEEE-GT – approx 9km from the plant • Nature: Bi-directional (energy exported and imported) • Precision: class 0,2 • Location: Sub-station of CEEE-GT, approx 9km from UTE São Borja

Data / Parameter:	$EF_{grid, OM-DD,y}$
Data unit:	tCO2/MWh
Description:	Operating margin CO_2 emission factor in year *y*
Source of data to be used:	MCT (Ministério da Ciência e Tecnologia) used the latest approved version of the "Tool to calculate the emission factor for an electricity system" to calculate the grid emission factor.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	0.476575
Description of measurement methods and procedures to be applied:	Updated annually.
QA/QC procedures to be applied:	Annually check in the MCT site. The QA/QC procedures will be applied annually by MCT according to the latest approved version of the tool described above.
Any comment:	

Data / Parameter:	$EF_{grid,BM,y}$
Data unit:	tCO_2/MWh
Description:	Build margin CO_2 emission factor in year *y*
Source of data to be used:	MCT (Ministério da Ciência e Tecnologia) used the latest approved version of the "Tool to calculate the emission factor for an electricity system" to calculate the grid emission factor.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	0.1458
Description of measurement methods and procedures to be applied:	Updated annually.
QA/QC procedures to be applied:	Annually check in the MCT site. The QA/QC procedures will be applied annually by MCT according to the latest approved version of the tool described above.
Any comment:	

Data / Parameter:	$W_{j,x} = Q_y$
Data unit:	tons of dry matter or liter
Description:	The only biomass used in the project activity is rice husk. Quantity of biomass residue type *k* combusted in the project plant during the year *y*

Source of data to be used:	On-site measurements
Value of data applied for the purpose of calculating expected emission reductions in section B.5	96,000 tons. This parameter is calculated based on the hourly consumption of the plant according to the supply contract (12,995 kg/hr) x 7,387 hrs per year.
Description of measurement methods and procedures to be applied:	The trucks will be weighted at the entrance of UTE São Borja by the balance. The quantity shall be crosschecked with the quantity of electricity generated. Continuously, prepare annually an energy balance.
QA/QC procedures to be applied:	Crosscheck the measurements with an annual energy balance that is based on purchased quantities and stock changes
Any comment:	Information on the balance: • Model: 820 MTX with 80 ton capacity • Size: 21 x 3 m • Controlling software: Guardian • Location: entrance of UTE São Borja

Data / Parameter:	Q_{ash}
Data unit:	tons
Description:	Quantity of rice husk ash produced in the project plant during the year *y*
Source of data to be used:	On-site measurements
Value of data applied for the purpose of calculating expected emission reductions in section B.5	19,584 tons This parameter is calculated based on the hourly consumption of the plant according to the supply contract (12,995 kg/hr) x 7,387 hrs per year x 20,4% (amount of ashes in the husk).
Description of measurement methods and procedures to be applied:	The trucks will be weighted at the exit of UTE São Borja by the balance. The quantity shall be crosschecked with the quantity of electricity generated and biomass combusted.
QA/QC procedures to be applied:	Crosscheck the measurements with an annual energy balance that is based on purchased quantities and stock changes
Any comment:	

Data / Parameter:	Rice husk specification
Data unit:	
Description:	Biomass specification on year *y*
Source of data to be used:	Analysis to be conducted by a lab
Value of data applied for the purpose of	N/A

calculating expected emission reductions in section B.5	
Description of measurement methods and procedures to be applied:	A specialized lab on a yearly basis will analyze a representative sample of biomass based on the required test methods. This is critical to define the quality of fuel and thus the plant performance and contract with O&M partner.
QA/QC procedures to be applied:	Crosscheck the analysis with data from literature.
Any comment:	

Data / Parameter:	Biomass supply demand balance
Data unit:	
Description:	Biomass supply and demand balance
Source of data to be used:	Official information from the Rice institute, ANEEL and primary data collected by the Project participants to update the research conducted
Value of data applied for the purpose of calculating expected emission reductions in section B.5	N/A
Description of measurement methods and procedures to be applied:	As required by AMS III.E, project the project participants shall demonstrate annually, through the assessment of common practices at proximate waste disposal sites, what percentage of the amount of waste combusted, gasified or mechanically/thermally treated in the project activity facilities would have been disposed in a solid waste disposal site without methane recovery in the absence of the project activity and would decay anaerobically in the disposal site throughout the crediting period. Project participants will use the latest available data on local industry capacity or gather primary data from the local mills, energy plants based on rice husk in the region and other potencial users on rice husk. Also, project participants will monitor the existence of rice husk disposal sites in the region.
QA/QC procedures to be applied:	Crosscheck the analysis with data from literature.
Any comment:	

Data / Parameter:	CTy , CT_{ash}
Data unit:	tonnes/truck
Description:	average truck capacity for waste and ash transportation
Source of data to be used:	On-site measurements
Value of data applied for the purpose of	6

calculating expected emission reductions in section B.5	
Description of measurement methods and procedures to be applied:	According to national standards or project needs or every new crediting period. The calculation will be made based on the data of the amount of biomass reaching ash leaving UTE São Borja (measured by the balance in the plant entrance/ exit) and divided by the number of trucks that delivers the biomass and ash.
QA/QC procedures to be applied:	Check consistency of the average truck capacity with the quantity of biomass combusted, e.g. by the relation with previous years.
Any comment:	

Data / Parameter:	DAF_w , DAF_{ash}
Data unit:	Km/truck
Description:	average incremental distance for waste and rice husk ash transportation
Source of data to be used:	Records by project participants on the origin of the biomass and destination of ash. Source: transport logistics.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	11 km (from and to). The table below is only an indicative example. In this case ash transportation is considered zero due to the disposal site location adjacent to the plant.
Description of measurement methods and procedures to be applied:	Measurement of transport distance between each fuel supplier and project site (once) and UTE São Borja and Rice husk ash destination. A spreadsheet will be prepared to receive as input the information related to: • supplier; • invoice number (value and volume) Based on the information from each truck reaching and leaving UTE SB, the spreadsheet will result the distance (based on supplier info and ash destination), volume for each truck. Multiplying each distance and the volume and then dividing it by the total biomass purchased and ash delivered results the averaged incremental distance for waste and ash transportation.
QA/QC procedures to be applied:	Check consistency of distance records provided by the truckers by comparing recorded distances with other information from other sources (e.g. maps).
Any comment:	The biomass residue is supplied from different sites, the destination of ash could be the deposit or client and parameter will correspond to the mean value of km traveled by trucks that supply the biomass plant and ash clients.

Data / Parameter:	EFCO2
Data unit:	tCO2/km
Description:	CO2 emission factor from fuel use due to transportation using diesel fuel
Source of data to be used:	Companhia de Tecnologia de Saneamento Ambiental do Estado de São Paulo – CETESB. http://homologa.ambiente.sp.gov.br/proclima/PDF/inventario_efeitoestufa.pdf
Value of data applied	0.00077

for the purpose of calculating expected emission reductions in section B.5	
Description of measurement methods and procedures to be applied:	Every new crediting period the value will be checked from CETESB
QA/QC procedures to be applied:	Cross-check measurement results with emission factors referred to in the literature.
Any comment:	Applicable because option 1 was chosen to estimate CO2 emissions from transportation.

Data / Parameter:	NCVi,y
Data unit:	TJ/ton
Description:	Net calorific value of the fossil fuel type *i* in year *y*
Source of data to be used:	2006 IPCC Guidelines for National Greenhouse Gas Inventories Volume 2 Energy. The fossil fuel used in the project activity is diesel oil.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	0.043
Description of measurement methods and procedures to be applied:	Every new crediting period the value will be checked from IPCC Guidelines
QA/QC procedures to be applied:	Check consistency of measurements and local / national data with default values by the IPCC.
Any comment:	

Data / Parameter:	$EF_{CO2,i,y}$
Data unit:	tCO2/TJ
Description:	Weighted average CO2 emission factor of fuel type *i* in year *y*
Source of data to be used:	2006 IPCC Guidelines for National Greenhouse Gas Inventories Volume 2 Energy. The fossil fuel used in the project activity is diesel oil.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	74.1
Description of measurement methods and procedures to be applied:	Every new crediting period the value will be checked from IPCC Guidelines
QA/QC procedures to be applied:	Check consistency of measurements and local / national data with default values by the IPCC.
Any comment:	

Data / Parameter:	$FC_{i,j,y}$ = Q, fuel
Data unit:	Mass per year (ton/yr)
Description:	Fossil fuel used to start-up in case it is needed. There is no fossil fuel used to produce electricity in the project activity. Quantity of fuel type *i* combusted in process *j* during the year *y* (diesel). The usage of Diesel is one of the responsibilities of the O&M operator, or Dalkia. The Diesel is used in the generator at the plant for electricity demand of the plant (office and other minor uses) when UTE is not producing electricity or the grid cannot supply electricity.
Source of data to be used:	Onsite measurements by inventory of fuel stock and cross check with fuel bills.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	340 400 lts per year is an estimative in case it is needed x 0.85[44] (diesel density in kg/lt) = 340 This value is an assumption for the diesel generator.
Description of measurement methods and procedures to be applied:	Diesel is stored in a tank that is equipped with an oil-level display. Shortly before the display shows minimum fuel level, the O&M contractor Dalkia is responsible in the case a new order of diesel fuel is need and to store information related to this item. Immediately before the tank is re-filled, staff records the amount of utilized fuel in liter/ m3. This data is entered into the power plant's fuel control system. Volume units are transformed into mass units with a diesel density of 0.85
QA/QC procedures to be applied:	Measurements of annual fuel consumption will be cross-checked with cumulative fuel bills. In case of discrepancies, the higher value will be applied to calculate project emissions.
Any comment:	

Data / Parameter:	Wj,x
Data unit:	tons
Description:	Total amount of organic waste prevented from disposal in year x (tons)
Source of data to be used:	Measurements by project participants. Source: plant operator, biomass residues bills and contracts.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	96,000
Description of measurement methods	Fuel consumption will be double-checked. Firstly, at the entry of the project site, trucks will be weighted with standardized

[44] http://www.sincopetro.org.br/conteudo.asp?xmenu=121

and procedures to be applied:	and calibrated truck weights (INMETRO). According to decision 23 6/96, the maximum tolerable deviation of such is +- 20 kg. Before the biomass is stored on-site, non-biomass components of the delivered fuel will be separated and weighted (parameter Qy, non-biomass). A second weighting process takes place shortly before utilization. As pointed out above, there will be in interim-storage for biomass in a silo immediately before entering the power plant. The quantity of biomass will be determined via a flow-meter at the transport belt to the silo (continuous measuring during operation of weight belt). Calibration will take place in line with INMETRO-provisions; the standard deviation is less than 0.02% of the nominal capacity (decision 23 6/96). This data will be recorded and entered into the power plant's fuel control system
QA/QC procedures to be applied:	The power control center will control the fuel feed to the burning chamber. This will be managed electronically.
Any comment:	

Data / Parameter:	**GWPCH4**
Data unit:	tCO2e/tCH4
Description:	Global Warming Potential for CH4
Source of data used:	IPCC 2006
Value applied:	21
Justification of the choice of data or description of measurement methods and procedures actually applied :	Default factor.
Any comment:	This value is updated every time IPCC provides a new data.

Data / Parameter:	**f**
Data unit:	%
Description:	Fraction of methane captured at the SWDS and flared, combusted or used in another manner
Source of data used:	Tool to determine methane emissions avoided from dumping waste at a solid waste disposal site v.04
Value applied:	0
Measurement procedure (if any) :	N/A
Monitoring frequency	Annually
QA/QC procedures:	N/A
Any comment:	N/A

Data / Parameter:	$COEF_{i,y}$
Data unit:	tCO2

Description:	Is the CO2 emission coefficient of fuel type *i* in year *y* (tCO2/mass or volume unit)
Source of data used:	The CO2 emission coefficient COEFi,y can be calculated using two the formula below: $$COEF_{i,y} = NCV_{i,y} \times EF_{CO2,i,y}$$
Value applied:	3.1863
Measurement procedure (if any) :	N/A
Monitoring frequency	Every new crediting period the value will be checked from IPCC Guidelines
QA/QC procedures:	Check consistency of measurements and local / national data with default values by the IPCC.
Any comment:	N/A

B.7.2 Description of the monitoring plan:

According to the monitoring plan, the project participant will implement a set of procedures for the ex-post calculation of emission. The monitored variables are described at B7.1 section. The implementation of the Monitoring plan will ensure accuracy, objectivity, credibility and clarity of data.

The monitoring plan

The monitoring system of the variables will be online during the operation through a supervisory system, which the control design is based on the configuration of the control according to the control system diagram. The complete control system consists of individual PLC units in connection with the supervisory system with two terminals that are redundant. If a computer fails the system can operate with the remaining computer.

Electricity metering will be conducted with standard metering devices, which are characterized by a high accuracy due to their relevance for invoicing and financial accounting. Only measurement devices accepted by CCEE/ ONS will be used (currently: the Standards for Electricity NBR 5410, grid proceedings from ONS). Standards for connection are established by grid companies during licensing. According to the Brazilian regulations on electrical grid, at least two supplementary conventional electronic measurers are to be installed at the outlet cabin: one primary meter, and a backup meter. These metering devices have to comply with the standards of CCEE/ ONS.
Meters will be subject to regular maintenance and testing regime to ensure accuracy. The meter must meet the relevant calibration standards of ONS/ANEEL/CCEE (whichever is relevant at the time of calibration). Calibration records will be kept to show auditors in the verification process, if requested.
The consistency of metered electricity will be crosschecked with the metering device installed in the grid and also the quantity of biomass fired (e.g. estimation of efficiency = electricity generation divided by the quantity of utilized biomass).
The cross-check with records for sold electricity also.

UTE São Borja hired an O&M company that will be responsible for the plant operations and data substitution procedure and recording in the log book[45], as showed in the contract between Dalkia and UTE São Borja.

The O&M agreement clause 5.1 provides all the instruction on service data and records. Appendix B provides a list of the minimum data to be gathered by the operator.

In case of an ERP break-up, the management will restore the data from its primary sources, as the operator is responsible for the data and reporting.

The monitoring methodology includes:

- Supply situation for types of biomass residues used in the project plant. The balance 820 MTX with capacity of 80 tons (size 21 x 3 mts) is located at the plant entrance. The Guardian software is used in a DELL computer to gather the data and control de balance.
- System to monitor the amount of all types of biomass combusted (if the amount of biomass combusted is estimated from the amount of biomass delivered to the project site, a procedure should be established to undertake an energy balance for the verification period, considering the stocks of biomass at the beginning and end of each verification period)
- On-site fossil fuel consumption (mass or volume flow meters, or an energy balance over the verification period, considering stocks at the beginning and at the end of each verification period)
- Type of measurement instrumentation used
- Responsibilities for monitoring
- QA/QC procedures
- Calibration procedures of all meters and instruments used in the project and industry practice.

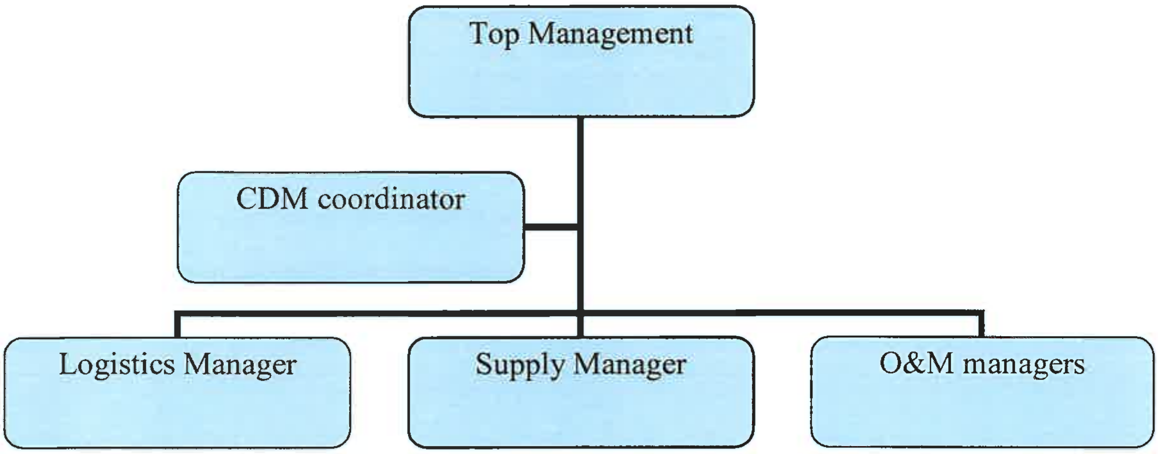
All data collected as part of monitoring should be archived electronically and be kept at least for 2 years after the end of the last crediting period. 100% of the data should be monitored if not indicated differently in the comments in the tables bellow.
In accordance with the monitoring methodology AMS III.E, the amount of biomass combusted as well as its composition (representative sampling) will be monitored. The monitoring plan takes into account that biomass will be delivered by different suppliers. Hence, the monitoring concept is designed in a way to explicitly differentiate the different sources of biomass.

Management structure regarding monitoring

Due to the importance of the CERs revenues for the project feasibility, the accurate monitoring is one of the top priorities of the management team and the plant operators.
The ERP system will gather and store all information in order to provide monthly reports on the CO_2 emissions reduction of the proposed project activity and a coordinator will be nominated especially to this purpose.
The CER coordinator will respond directly to the top management of the company and will be responsible for the interface between all relevant areas in order to monitor the emissions reductions and the well functioning of the energy plant.

[45] Appendix E of the O&M agreement with Dalkia, available to the DOE.

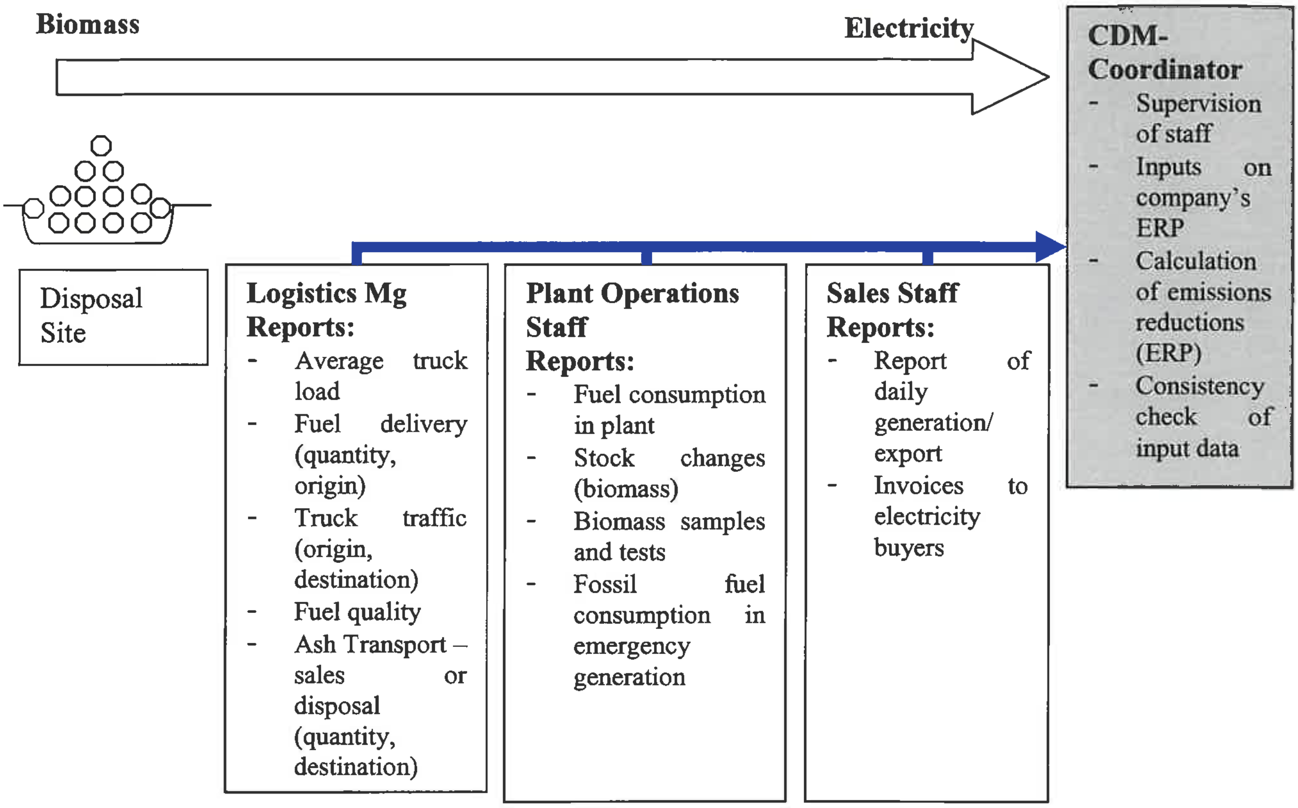
Figure 4: Management Structure



The CDM coordinator will supervise all monitoring activities and will be responsible for the inputs on the ERP system of the company with all relevant data to calculate and monitor emissions reductions.
One of his major task will be the consistency check (i.e fuel cross-check based on fuel invoices, biomass consumption versus energy production, cross-check of biomass received and invoices paid.) before the data is inputted in the ERP.
The CDM coordinator will be responsible for the data archiving and monthly reporting to the top management and solve all problems if any inconsistency is found, being it technical or related to suppliers.
Finally, the CDM coordinator will be in charge of making sure that all tools needed to monitor the emissions reductions, including equipment calibration, maintenance of metering devices are in accordance with the rules.

The procedure is summarized in Figure below:

Figure 5: Management



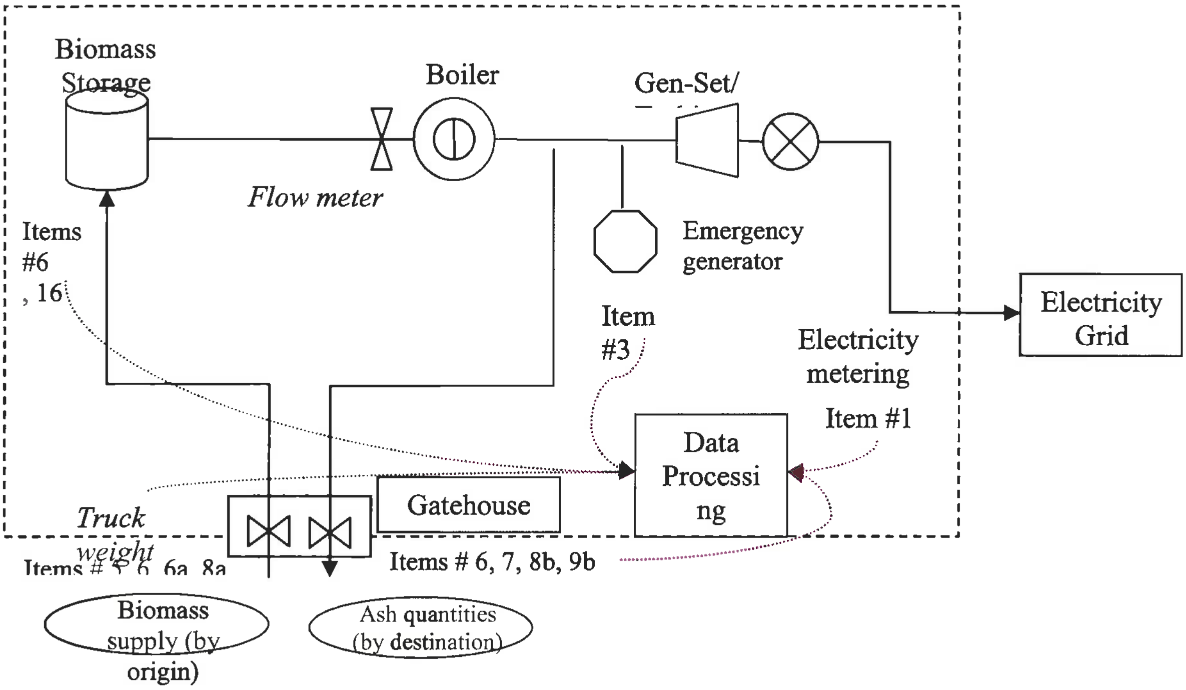
The project activity includes an extensive human resources program. The technology is new and the region lacks of qualified personnel to operate the plant due to non-existence of a similar project and the uniqueness of the technology in this region.

After finalization of construction, the plant will be managed and operated by the Brazil company staff. They will participate in the supervision of the construction and will receive an extensive introduction to the functioning and technical details by the EPC Company. This will be done on a 1-month program, including daily workshops on different topics during the plant-commissioning phase.

This procedure will lead to the transfer both of installation-specific knowledge and an in-depth understanding of Brazil employers regarding the applied technologies.

This training will not only include information on functioning and technical details of the plant, but also inform about monitoring procedures and requirements. All staff involved in the monitoring will receive a to-do-list (checklist including timetable) and templates for data entry.

The monitoring procedure is summarized below:
Figure 6: Monitoring procedure



B.8 Date of completion of the application of the baseline and monitoring methodology and the name of the responsible person(s)/entity(ies)

The date of the completion of the monitoring methodologyis 28/05/2009 by ATA – Ativos Técnicos e Ambientais. ATA contact information:

Ricardo Audi Filho
ATA – Ativos Técnicos e Ambientais
São Paulo – Brazil
Phone number: 55 (11) 5505-9676
e-mail: raf@atapart.com.br

The date of completion of the baseline study is 14/02/2012 by GES Biogas GmbH.
Marius Bossen
GES Biogas GmbH
Hamburg – Germany
Phone number: +49 (0) 40 8090 63 109
e-mail: m.bossen@greenstream-biogas.net

SECTION C. Duration of the project activity / crediting period

C.1 Duration of the project activity:

C.1.1. Starting date of the project activity:

The starting data of the project activity is related with the signing of a contract to transfer the loans from the former project owner on 14th July 2008.

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

25 years, according to equipment lifetime.[46]

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

C.2.1. Renewable crediting period

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

The first crediting period starts in 01/01/2013.

C.2.1.2. Length of the first crediting period:

The first crediting period is 7 years, 0 month, twice renewable.

After the first and the second crediting period, the baseline will be reviewed and the project participants will conduct a new biomass residue availability study.

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

NA

C.2.2.2. Length:

NA

[46] http://www.mte.gov.br/legislacao/normas_regulamentadoras/nr_13.pdf paragraph 13.5.6

SECTION D. Environmental impacts

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

State governmental environmental law, enforced through FEPAM, environmental agency of Rio Grande do Sul state, obliges operators of rice mills to deposit rice husks on licensed disposal site. The disposal site has to be approved by FEPAM. However, no national, state or national safety requirements or legal regulation exist that require the capture, removal or combustion of methane from disposed rice husks.
The UTE São Borja is in complying with all environmental licences needed for the plant construction and operations, including:

- Installation License (LI n. 445/2009-DL) – approval of the construction and operations plan
- Operations License (LO) – approval of the operations according to plant described in the (LI)

The project is designed to comply with the relevant Brazilian and State environmental standards, mainly regarding the control of flue gas emissions and wastes. Combustion residues (ashes) will not be deposited but re-used in other industrial processes. In the beginning of the plant operation, the ashes will be dumped in a landfill licensed by FEPAM. With the first samples of ashes, the project participants will start a market research to look for clients to buy the ashes. Gradually, ashes will be storage in a warehouse licensed by FEPAM to be commercialized. Hence, environmental problems regarding waste disposal will not occur.
All emission standards of the state Rio Grande do Sul will be met by the biomass power plant. It may be noted that the fuel itself is not dangerous and is not expected to emit pollutant on its combustions.
For example, emissions of sulphur based gases, dioxins and PAK are not expected because this biomass do not contain any substance that will lead to the formation of this gases (i.e plastics).
The combustion gases will be post-combusted and filtered by a multi-cyclone filter before releasing them to the atmosphere. Carbon monoxide concentration on the flue gas will be minimized through the controlled combustion process. In the case of NOx emissions, a low-NOx-burner will be used.
An electronic control panel allows automatic and full control of the biomass power plant and supervises fuel input, temperature and pressure within the process and electricity exports to the grid.
Related to the rice husk handling, a closed system is used in order to avoid the thin dust inherent to this fuel:

- Trailers will be uploaded in a closed cabin additionally filtered by a cyclone filter,
- Further transportation is assured by elevators and conveyors to the storage and boiler feed silo,
- Silos are preferred to fuel houses.

Trans-boundary environmental impacts are not to be expected in a significant scale. The project is expected to reduce the biomass environmental impact caused by biomass disposed in the region not according to legislation.

D.2. If environmental impacts are considered significant by the project participants or the host Party, please provide conclusions and all references to support documentation of an environmental impact assessment undertaken in accordance with the procedures as required by the host Party:

No negative environmental impact is expected from project activity and no study of environmental impact was required by Brazilian authorities.

SECTION E. Stakeholders' comments

>>

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

The tasks needed to the approval of CDM project activities by the Brazilian DNA are:

- Translation of the PDD into Portuguese
- Invitation of local and global stakeholders
- Submission of a validation report of an accredited DOE to obtain the letter of approval

With regard to Sao Borja Rice husks power plant, a letter of invitation of comments has been prepared in May 2009 and has been sent to the stakeholders in June 2009. The letter includes inter alia:

- a detailed description of the project activity (in technical and financial terms) and
- the background of the CDM.

According the procedures defined by *Comissão Interministerial de Mudança Global do Clima*, the Brazilian DNA, as per the resolution no. 7 of march 05, 2008 Art 3[47] § II, calls for comments should be addressed by the project proponent to the players involved and affected by the project activity, according to paragraph b of Annex 37 I of the "Modalities and Procedures for the CDM." The designated players are:

- City Hall,
- City Councillor´s chamber,
- State Environmental Agency (FEPAM),
- Municipal Environmental Agency,
- Brazilian Forum of NGO's and Social Movements for the Environment and Development,
- Community Associations,
- Federal and State Public prosecutors.

Private local stakeholders have also been informed on the planned project activity and have been invited to raise questions and provide comments on the project.
Besides the stakeholders that received the letter to provide the comments, the project proponent organized a one day meeting to present the project to the local community, opening a straight communication channel between the local community by e-mail, phone and fax within 30 days.
The event was conducted as an open meeting, lead by the managing director of the power plant. The project was presented to the audience and questions of individuals were answered. Those were primarily technical nature.
Invitation letters, newsletter advertisements, the full documentation of the meeting including a participants list and the hand-outs have been provided to the DOE.
According to that, the following stakeholders were designed:

[47] http://homologa.ambiente.sp.gov.br/biogas/docs/resolucoes_comissao/resolucao_7.pdf

Table 22:
: Stakeholders

Institution	Representative	Position
Rio Grande do Sul State Government	Yeda Crusius	State Governor
São Borja City Hall	Mariovane G. Weis	City Mayer
City Councilor's Chamber	Antônio Carlos Rocha Almeida	President
State Environment Foundation	Marilene Alves da Cruz	
Municipal Environment Foundation	José Ênio Abreu de Jesus	
State Public Prosecutors	Erico Fernando Barin	São Borja Public Prosecutor
Federal Public Prosecutors	Roberto Monteiro Gurgel Santos	Federal Public Prosecutor
Várzea Neighborhood Association	Luiz Carlos Silva Lescano	
Vila Goulart Neighborhood Association	Jorge Sidnei Guimarães	
Vila São Francisco Neighborhood Association	José Nenê da Cruz	
Brazilian Forum of NGO´s and Social Movements for the Environmental and Development	Esther Neuhaus	Executive Manager

E.2. Summary of the comments received:

No comments have been received so far.

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

>>

Annex 1

Organization:	UTE São Borja Geradora de Energia S.A.
Street/P.O.Box:	Rua Félix da Cunha, n.109, floor n.9
Building:	
City:	Porto Alegre
State/Region:	RS
Postcode/ZIP:	90570-000
Country:	Brazil
Telephone:	
FAX:	
E-Mail:	a.ramcke@mpcbioenergia.com.br
URL:	
Represented by:	
Title:	
Salutation:	Mr.
Last name:	Ramcke
Middle name:	
First name:	Albert
Department:	CEO
Mobile:	
Direct FAX:	
Direct tel:	
Personal e-mail:	

Organization:	MPC Bioenergie Brasilien GmbH & Co. KG
Street/P.O.Box:	Palmaille 67
Building:	
City:	Hamburg
State/Region:	
Postcode/ZIP:	22767
Country:	Germany
Telephone:	+49 40 3802 4283
FAX:	+49 40 3802 4139
E-Mail:	
URL:	
Represented by:	
Title:	
Salutation:	
Last name:	Storbeck
Middle name:	
First name:	Markus

Department:	
Mobile:	+40 40 3802 7424
Direct FAX:	
Direct tel:	
Personal e-mail:	

Annex 2

INFORMATION REGARDING PUBLIC FUNDING

There is no public funding for the proposed project activity.

Annex 3

BASELINE INFORMATION

Emissions Factor of the Grid

The emission factor of the grid is calculated by SIN – *Sistema Interligado Nacional* (national operator of the electric energy production and transmission system), according to "Tool to calculate the emission factor for an electricity system" adopted by the CDM Executive Board. Briefly, the emission factor of the grid for CDM projects is a combination of operating margin CO2 emission factor, which reflects the intensity of CO2 emissions from energy dispatched at the margin, with the emission factor of the build margin, which is the intensity of CO2 emissions from new power plants. This factor can be used to quantify the contribution of a future power plant that will generate electricity for the grid in terms of reducing CO2 emissions, i.e. to quantify the emissions that are being displaced at the margin.

Rice Husk Availability

The proposed project activity will use only residual biomass that would in the absence of the project activity been dumped on deposits or left to decay. The disposal of rice husks is regulated by the local environmental agency, FEPAM. FEPAM also controls the amount of residues produced and deposited and the control is made on a 3 months base.

Also the off-take agreements with each of the 16 rice mills will be capped by a maximum of 75% below their historical production level. Their production level is also controlled by FEPAM.

To assess the supply situation for the type of biomass residue used in the project activity, the project participants assigned an in depth study about the rice industry in Brazil and in the project influence area, rice husks generation and rice husks destination. Part of this work is cited on this PDD and the complete study will be available as an attachment of this PDD. The next items of this section shows parts of the study that are important to demonstrate that the biomass residue used in the plant did not increase fossil fuel consumption elsewhere.

"Study about the availability of rice husk for energy production in the region of São Borja - western border of Rio Grande do Sul – Brazil"

Rice Industry in the State of Rio Grande do Sul

The availability of raw material (rice in husk) is the primary factor of the industrialization of rice and has undergone profound changes in Brazil. Advances in technology, competition with other cultures and globalization, among other factors, led to a concentration in the production of the cereal in the Southern American region.

The availability of rice in Brazil has suffered, in recent years, a process of change in geographical distribution. At the end of the 90s, the market and technological conditions imposed to regions that produced non irrigated rice (tropical) a fierce competition with other crops, especially soybeans. In contrast, the irrigated rice-producing regions have started a process of intense technological development, increasing considerably the rates of productivity, thereby increasing the competitiveness of irrigated crop. Thus, the production migration is resulting in the concentration of the area sown with rice to Southern Brazil, mainly in the states of Rio Grande do Sul and Santa Catarina (figure 1).

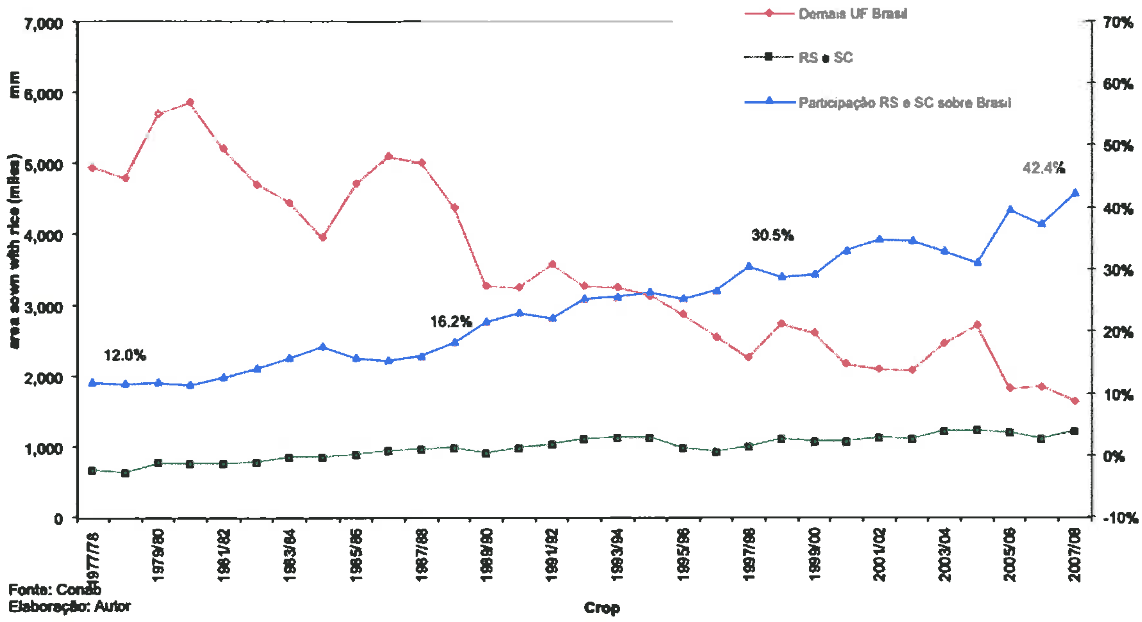


Figure 1: Comparative evolution in the area sown with rice in Brazil, million hectares, between RS and SC and other states in Brazil.

The change in the profile of the geographic distribution of the area resulted in the reduction of the sown area, but in increased production. Three decades ago in the 1977/78 harvest, Brazil sown 5.6 million hectares and harvested 7.3 million tons, in the last crop (2007/08), the area sown was 2.9 million ha for a production of 12.1 million t. In summary, RS and SC increased 81.5% the area sown with rice in the period with the production increasing 265%, while the other Brazilian states decreased 66.4% and 23.3% in the production during the period. Therefore, RS and SC are responsible for 69.5% of the national production of rice.

Besides the geographical shift in the domestic availability of rice in husk, the deepening of trade relations between Brazil and the other members of Mercosur (Argentina, Uruguay and Paraguay) has enabled these to specialize in the production of rice, resulting in opening a market with more than 170 million inhabitants, with high levels of per capita consumption of rice, as the Brazilian market.

Thus, encouraged by a market with growing demand and low barriers to start plantation, Uruguay and Argentina, and more recently Paraguay, increased the production of rice to fulfil the gap between production and consumption of grain in Brazil. Besides these factors, structural differences allowed the Mercosur countries produce and industrialize rice aiming more economically and efficiently exports to Brazil.

Questions related to the purchase of feedstock's and machinery, and tax incentives offered by the Brazilian states in the form of "fiscal war", led the advance of production in these countries because the guarantee of entry into the Brazilian market. This process brought, as a result, a significant increase in production of rice in Mercosur. Uruguay, in the crop 1990/91, produced 522.1 thousand tons of rice and in the 2007/08 crop the production reached 1,330 thousand tons, a positive variation of 155%. In turn, Argentina produced in the beginning of Mercosur 347.6 thousand tons and the production actually rose to 1.275 million tons, a 267% increase. Even Paraguay increased its production of rice, from 87 thousand tons in 1990/91 to 210 thousand tons in 2007/08, an increase of 141%.

Evolution of the planted area, production and productivity in the State of Rio Grande do Sul

Rio Grande do Sul (RS) and Santa Catarina (SC), while concentrating the production of rice in Brazil, show significant differences in relation to the area and volume of rice produced. While the area sown with rice in SC has hardly changed in the last 30 years, Rio Grande do Sul doubled the area sown in the same period (Figure 2).

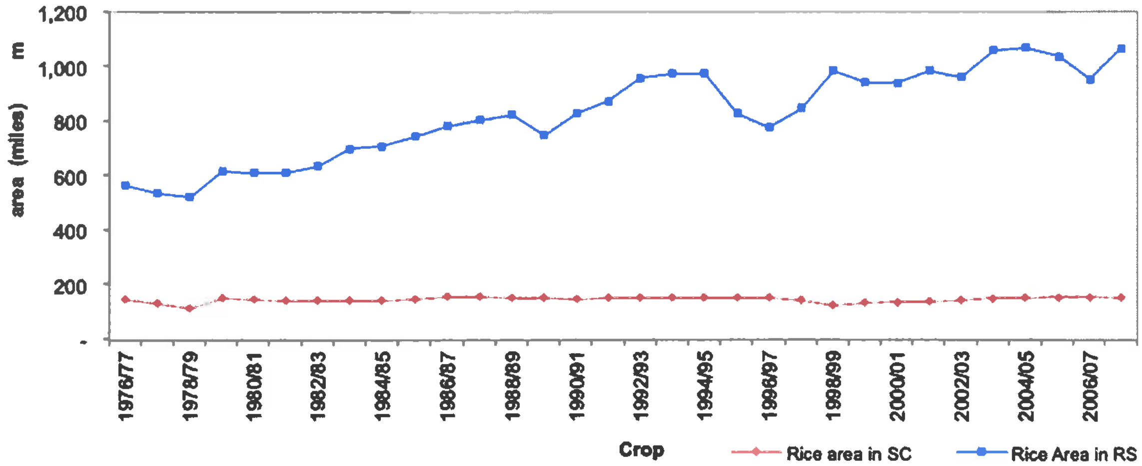


Figure 2: Evolution of the Sown area in RS and SC – from crop 1976/77 to 2007/08

Between 1978/79 and 1987/88 crops, Rio Grande do Sul observed an average area of 828.5 thousand ha, with minimum of 525 thousand ha (season 1978/79) and a maximum of 1,071.2 thousand ha (2004/05). In the last five years the area remained above one million ha, with the exception of 2006/07, with an area of 954.4 thousand ha, caused by water constrains.

Similarly, the production in the RS has significantly expanded in recent decades, from 1.675 million tons (1978/79) to 6.493 million tonnes (2006/07), an increase of 287.6%. This robust expansion in the production of rice reflects the leading position in terms of rice production. In the last crop (2007/08), production of rice in Rio Grande do Sul increased further, ending the harvest, according to the Rice Institute of Rio Grandense (IRGA) with a production record of 7.5 million t (Figure 3). Thus, in the last five years the RS obtained an average of 6.720 million tons.

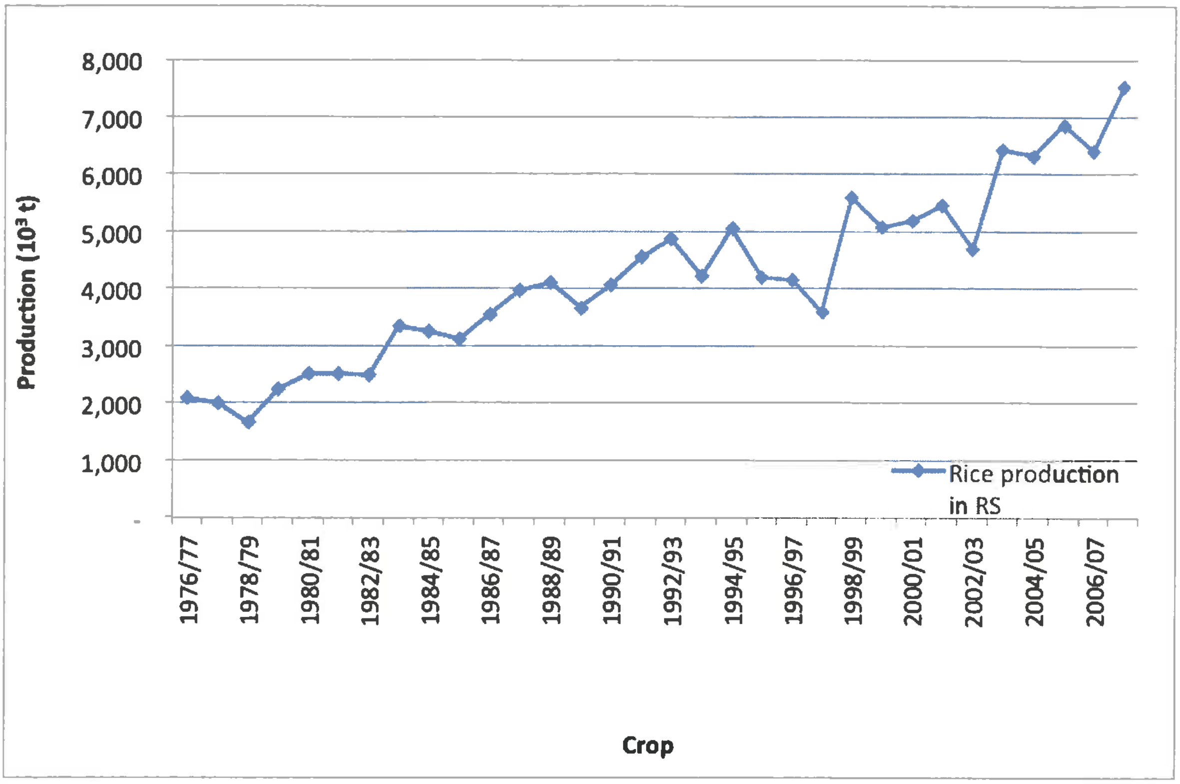


Figure 3: Evolution of rice production in RS: 1976/77 to 2007/08

In relation to crop yield, both the Rio Grande do Sul and Santa Catarina states have similarities. Although the Rio Grande do Sul has been counting higher productivity from a longer time, Santa Catarina yield obtained significant expansion in the recent years. Until the early 1980s, the average productivity in SC was 2.3 t/ha, while the RS observed 3.6 t/ha. In the mid-1990s SC exceeds the yield obtained by the RS, at a level around 5 t/ha. From 2000 the SC yield reached more than 6 t/ha, with RS obtaining similar results only from 2004. In the last season, again the RS yield supplanted the SC, with average yields above 7 t/ha, while SC showed yield of 6.5 t/ha.

The main factors that contributed to this evolution were:

- introduction of improved varieties of rice adapted to the agronomical conditions the southern region and with high yield potential,
- more efficient cropping systems (minimum tillage in RS and pre-germinated in SC),
- adoption of integrated crop management of rice cultivation,
- use large-scale modern agrochemicals to control weeds, pests and diseases in crops,
- change in the fertilization, with intensive use of base and cover fertilization, seeking higher yields,
- clearfield system of rice production, efficient tool to control red rice (Mainly used in RS),
- intensification of the development and transfer of technology to production, through public entities (IRGA, Epagri, Emater and Embrapa) and private companies,
- availability of industrial capacity for the processing of rice in two states.

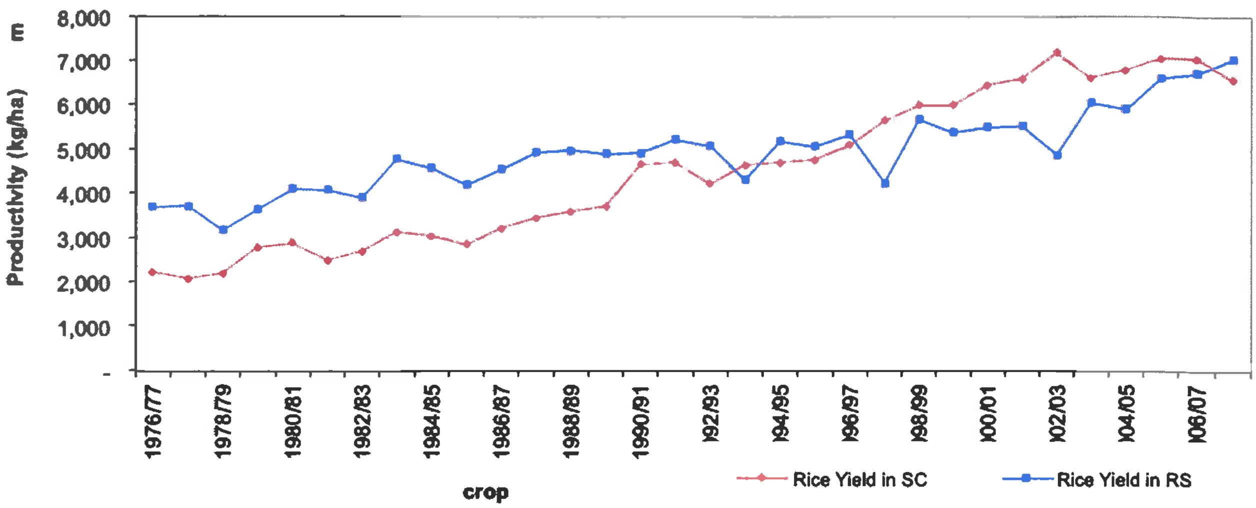


Figure 4: Evolution of productivity in rice – SC and RS - 1976/77 a 2007/08

Despite the evident progress of the production of rice in the two states, the question is where the production is to remain increasing in the Southern States, or, what is the growth potential and development trend of production in these two Brazilian states. In relation to the area sown with rice, Santa Catarina seems to have reached its full potential. The constrains on rice-producing regions in SC determine the possibility of a small increase that may reach up to 180 thousand ha of irrigated rice production.

In the case of Rio Grande do Sul the potential widens. In terms of areas to the cultivation of rice, the state has 3 million hectares. Moreover, in regions of the West Frontier, and Southern Campaign, localities which have larger average farms, the turnover of land is a reality (two or three sections of land, being a part of the area for the cultivation of rice and other party or two resting and/or livestock or crop rotation in areas). The production in these areas could increase 50% by only using the part of the areas already prepared for the cultivation of rice, with the elimination or reducing the areas on resting. The limitation in the RS case is related to water availability not land. With the current existing water reserves (dams and weirs), the variation of the cultivated area has fluctuated between 900 thousand and 1,150 thousand ha. Increases over this limit should only occur with private investments in dams (limited by the environmental permits) and public investment in major projects for construction of water reservoirs for multiple uses (agriculture, industry and urban population). Thus, expansion of credit lines to producers, with this specific purpose - construction of dams - combined with the relaxation in licensing, could raise the limit to about 1.4 million ha.

Another important aspect that could possibly expand into more 50 thousand ha to 100 thousand hectares in area planted with rice in the RS is the most efficient use of water resources. The reduction of the layer of water on crops and fast cycle rice would require a shorter period of irrigation and can provide expansion of the area even without new investments in water reserves. Thus, the upper limit in terms of water resources for rice farming is in 1.5 million hectares, combining the efficiency of resource use and private investment.

In summary the increased in area for rice cultivation depends on investment, but increased production can be also be reached by the continuous increase in crop yields in these two states. The process of technological change at the producers is making possible continuous improvement. For the next five years, projecting that the average yields of crops in SC and RS exceed 8 t/ha, the local production can exceed 9.5 million tonnes of rice. Thus, it seems, the availability of rice in these two States will continue to growth, expanding participation in relation to national production.

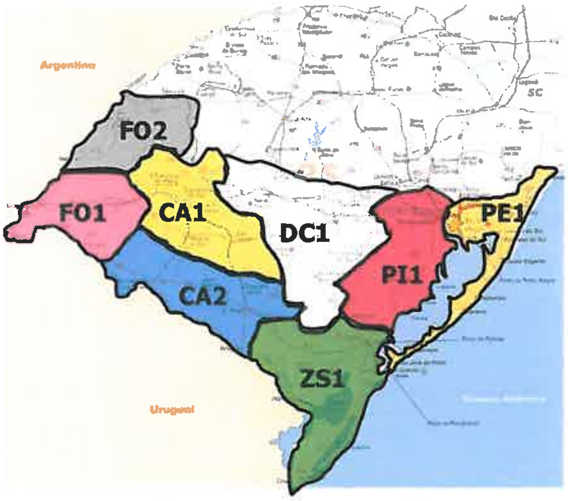


Figure 5: Rice producing regions in RS
Legend:
•FO1 – West Fronteir 1 (South)
•FO2 – West Fronteir 2 (North)
•CA1 – Campaign 1 (North)
•CA2 – Campaign 2 (South)
•DC1 –Central Hollow
•PI1 – Internal coastal Plain
•PE1 – External Coastal Plain
•ZS1 – Southern Zone

Figure 5 presents the Rice producing region in Rio Grande do Sul state.

The area sown with rice has expanded in almost all regions of the state. The exception is the Southern Zone (ZS1), which maintains some stability on the cultivated area, ranging between 145 thousand ha and 180 thousand ha in the last decade. However, with an average area close to 165 thousand ha, according to the IRGA. The largest expansion of the area is on the Coastal Plain (PE1 and PI1), in the West Frontier (FO1 and FO2) and in the Central Hollow (DC1). All these regions expanded in the last ten seasons more than 30% of the area. In absolute terms, the West frontier was responsible for an increase of 79.4 thousand ha in the period. There was an increase of more than 200 thousand ha in the last decade, from 859.6 thousand ha in 1997/98 to 1.066 million ha in 2007/08, growth of 24.1% (Table 1).
Another relevant factor is related to the Campaign region (CA1 and CA2). This region showed the lowest growth rate, with 18.1% of increase in ten seasons. The explanation for this is the greater dependence on rainfall to ensure the supply of water to the reservoirs, since 77.8% of the region depends on the dams for the irrigation of the crops. The constant drought that hit the state in the last decade resulted in the inability to maintain the optimum water level in the dams, reducing the productive potential of the region. As an example, the location and surroundings of Bagé city faced serious problems of water rationing, including the municipal supply, and turning the region Campaign 2 (CA2) the riskier in terms of water availability. The 2006/07 season proved this climate factor by making impossible the cultivation of about 35 thousand hectares. Nevertheless, if it were not for the water reservoirs across the region, rice is not likely to remain as the predominant culture in the Campaign, even with the strong variations in the area sown with grain.

Table 1: Harvested area – irrigated rice - Rio Grande do Sul, per hectare, by region-s 1997/98 and 2004/05 to 2007/08

Region		1997/98	2004/05	2005/06	2006/07	2007/08	Var. 97/98 a 07/08
Campaign 1	CA1	74,777	81,634	86,680	81,240	89,494	19.68%
Campaign 2	CA2	70,282	83,477	76,280	45,781	78,708	11.99%
Central Hollow	DC1	122,720	154,701	163,226	163,996	166,349	35.55%
West Frontier 1	FO1	131,070	147,907	163,945	136,904	173,177	32.13%
West Frontier 2	FO2	101,780	112,540	131,401	117,207	134,598	32.24%
External Costal Plain	PE1	93,249	132,097	120,287	117,799	125,122	34.18%
Internal Coastal Plain	PI1	97,758	127,443	132,565	128,212	136,097	39.22%
Southern Zone	ZS1	167,953	178,390	154,769	149,659	163,787	-2.48%
Rio Grande do Sul		**859,589**	**1,018,189**	**1,029,153**	**940,798**	**1,067,331**	**24.17%**

Source: IRGA, developed by study authors

If the last decade points out to the 24.2% expansion in the area sown with rice in the RS, further highlight is deserved to the technological evolution that began in the State. On average, there was a change of 72.4% in yield from 4,094 kg/ha in the 1997/98 season to 7060 kg/ha in the 2007/08. The current rate of productivity achieved puts the state in a prominent position worldwide in terms of yield.
The main factor that contributed to this change in the level of technology in the State was the integrated work between rural extension and the research, both by public and private companies. The highlight is the *Projeto 10*, developed by the *Instituto Rio Grandense do Arroz* (IRGA)[48], that had the objective of implementing on the largest number of crops of the State the philosophy of technology transfer by the producer-producer (one-to-one), training groups of producers and implementing practices of integrated management of the culture, demonstrating on their own crop the benefits of technology adoption. In practical terms, the recommendations derived from these projects focused on rational use of available resources, such as early preparation of the soil, sowing on the ideal period (between September and early November), reducing the density of seeds (below 120kg/ha), increasing the dosage of fertilizer- base and coverage, the first application of urea in the dry, early control of weeds, pests and diseases and harvesting in the dry. All these processes, which did not resulted on raising the costs - except for fertilizer, provided the farmers with improved crop management and resulted in high yield (kg/ha).
Of course, other technological tools contributed to this growth in terms of productivity. The highlight is in the production system called Clearfield (BASF), which in partnership with the IRGA developed a seed, IRGA 422CL, resistant to a particular group of effective herbicides in controlling the primary intruder of the culture in the state, the red rice. This technology enabled the rehabilitation of areas formerly condemned to the cultivation of cereal and increased the productivity of the crops. Besides these two technologies, one can also emphasize the introduction of most productive hybrid varieties, with high yield potential. Allied to this, the recommendations on fertilizers and agrochemicals completed the range of new technologies available to producers in the region.
In terms of high yields, the West Frontier (FO1) and (FO2) resulted in the largest yield in the last crop, respectively 7.852 t/ha and 7.434 t/ha. Also the Campaign region had yield exceeding 7 t/ha in the Southern Campaign (CA2) and 7.911 t/ha and 7.055kg/ha in the North Campaign (CA1). This last resulted in the higher increase in a decade, from low 2.688 t/ha for more than 7 tons/ha (Table 2).

Table 2: Average Yield of irrigated rice in RS – Kg per hectare, distributed by region, crops 1997/98 and 2004/05 to 2007/08

Region		**1997/98**	**2004/05**	**2005/06**	**2006/07**	**2007/08**	**Var. 97/98 a 07/08**
Campaign 1	CA1	2,688	5,760	6,591	6,836	7,055	162.45%
Campaign 2	CA2	4,395	6,476	7,243	7,800	7,911	80.00%
Central Hollow	DC1	3,810	6,251	6,351	6,752	6,928	81.83%
West Frontier 1	FO1	4,733	6,882	7,332	7,426	7,852	65.90%
West Frontier 2	FO2	3,898	6,894	6,483	7,025	7,434	90.71%
External Coastal Plain	PE1	4,276	5,794	6,098	6,183	6,259	46.37%
External Coastal Plain	PI1	4,082	5,693	5,831	6,528	6,331	55.08%
Southern Zone	ZS1	4,326	5,539	6,122	7,140	6,861	58.60%
Rio Grande do Sul		**4,094**	**6,139**	**6,479**	**6,902**	**7,060**	**72.44%**
Source: IRGA, developed by study authors							

The coastal areas of RS, the External and Internal Coastal Plains (PI1 and PE2) and Southern Zone (ZS1) were the regions with lower growth of yield for 1997/98 and also presented the lower crop yields in

[48] Rice Institute of Rio Grande do Sul State

2007/08. The Internal Coastal Plain (PI1) yielded 6.33 t/ha, the External Coastal Plain (PE1) 6.26 t/ha and the Southern Zone (ZS1) 6.86 t/ha.
Combining an increase in area with technological advances, the result could only be a strong increase in production of rice, making the RS with more than 60% of national production. In the last season (2007/08), according to the IRGA, the production in the country reached 7.5 million tones, a record that should not be sustained for long, except for adverse climatic factors. This is due to new seeds with even higher yield potential, like IRGA 424 and the new hybrid materials (RICETEC, BAYER and IRGA), all in the marketing process for the 2008/09 season. Another important point is in the relation to the new materials, with respect to regions with lower productivity. The hybrid varieties should help the Coastal Plains to improve yield and IRGA 424, as a material suitable for the conditions of the Southern Zone (adaptation to cold), should contribute to the growth of average yield in that region.
In terms of production, higher volumes produced were in the West Frontier 1 with 1.36 million t, the Center Hollow with 1.12 million tons and West Frontier 2 with 1 million t (Table 3).

Table 3: Production of rice in Rio Grande do Sul, per tones, distributed by region, crops 1997/98 and 2004/05 to 2007/08

Region		1997/98	2004/05	2005/06	2006/07	2007/08	Var. 97/98 a 07/08
Campaign 1	CA1	200,968	470,251	571,274	555,320	631,352	214.16%
Campaign 2	CA2	308,873	540,579	552,465	357,083	622,649	101.59%
Central Hollow	DC1	467,547	967,078	1,036,611	1,107,381	1,152,444	146.49%
West Frontier 1	FO1	620,377	1,017,929	1,202,097	1,016,595	1,359,826	119.19%
West Frontier 2	FO2	396,776	775,801	851,812	823,370	1,000,567	152.17%
External Coastal Plain	PE1	398,755	765,434	733,531	728,334	783,088	96.38%
Internal Coastal Plain	PI1	399,015	725,562	773,038	836,965	861,563	115.92%
Southern Zone	ZS1	726,521	988,101	947,431	1,068,588	1,123,730	54.67%
Rio Grande do Sul		**3,518,832**	**6,250,734**	**6,668,259**	**6,493,634**	**7,535,219**	**114.14%**
Source: IRGA, developed by study authors							

In relationship with the trend in the production regions of RS, there is the possibility to increase both horizontally and vertically. There is a possible small increase in area sown with rice, mainly due to more efficient and rational use of water of about 5% to 8% of the actual area sown. From this point on, investments in water reservoirs become necessary for the extension of the cultivation. As for the productivity, it is expected that the new varieties being available to the producers, in the 2008/09 season, could result in up to 10% increase in average yields of the crops. Considering all factors, the yield can reach over 8 t/ha. Thus, unless there is occurrence of severe weather problems, these factors acting together can result in a production close to 9 million tones between the next three or five seasons.

The West Frontier

The West frontier of Rio Grande do Sul is the main rice-producing region of southern Brazil represented by West Frontier 1(FO1) and West Frontier 2 (FO2) to the north, where UTE São Borja will be located. Thus, the region has 18 municipalities producing rice described in table below:

Table 4: Municipalities of the West Frontier		
West Frontier 1 (FO1)	**West Frontier 2 (FO2)**	
Alegrete	Bossoroca	Santo Antônio das Missões
Barra do Quaraí	Caibaté	São Borja
Manoel Viana	Garruchos	São Luiz Gonzaga
Quaraí	Itacurubí	São Miguel das Missões
Uruguaiana	Itaquí	São Nicolau
	Maçambará	Vitória das Missões
	Santiago	

The region is characterized by farms averaging 250ha, with 51% of rice crops in farms larger than 500ha. There are 1,084 farms in the region. In relation to the possession of land, 62.7% of the areas are rented. In terms of sources of water for irrigation, 61.6% comes from dams or weirs and 37.5% from rivers, creeks or streams. The cultivation system prevalent in the region is the minimum tillage, with 91%, which enables reduction operations related soil preparation and planting of the field. In relationship to the number of workers per farm, the West Frontier is the most efficient in this respect, maintaining the density of a worker for every 46.5 hectares cultivated. By 2005, 33.9% of crops had their own storage.

The producers of this region are characterized, mostly due to the size of their properties and production structures formed by a more entrepreneurial mindset and constantly improving technology. The main investment focus in on the expansion of the post-harvest, or investments in the capacity of drying and storage of grain and the expansion of areas, whether in the region or in the neighboring countries (Argentina and More recently, Paraguay). Most producers have investment capacity and their leverage levels are controlled.

Among the main producing municipalities it should be noted some important differences. Uruguaiana has closer links with the producers of Argentina, with several investments in the production of rice on both sides of the border area. The industrialization of rice in the city is still small compared to the volume produced, determining a greater capacity for storage of rice by producers as part of their marketing strategy. Itaqui, in turn, is noted to present large industrial enterprises for processing of rice, with producers concentrating the outcome on the industrial production (deposit of rice), with low storage in the properties.

Producers in this region are characterized by being early technology adopters and are very active in terms of sector mobilization. In Sao Borja, the cooperatives provide good technical assistance to producers, that is complemented by the assistance of IRGA and also from other private companies. The city has a large industrial enterprise (Pirahy Alimentos) that because of the need of a specific product type (IRGA 409 and IRGA 417) foment production through credit lines to its integrated producers. Alegrete presents the largest number of farms in the region, 325, with lower technology adoption and productivity below other large cities in the region. There are two industries processing rice, and a cooperative (Cooperativa Agroindustrial Alegrete - CAAL) with great presence in the sale of feedstock and technical assistance to producers.

Finally, it should be noted that the region is prepared to maintain the position of largest producer in the South, being able to improve the issues related to water, ensuring the expansion of the production. In relation to the prices paid to producers, they are similar to the state average.

List of all rice mills in the West Frontier Region

Rice mills in the West Frontier I (FOI)	
Rice Mill	**Municipality**
COOPERATIVA AGROINDUSTRIAL ALEGRETE LTDA.	Alegrete
PILECO & CIA. LTDA.	Alegrete
ENGENHO MORIN LTDA.	Barra do Quaraí
COLPO IND. E COM. DE CEREAIS LTDA.	Manoel Viana
BRANDALISE INSDUSTRIA E COMERCIO DE CEREAIS LTDA.	Uruguaiana
CERATTI AGRONEGOCIOS LTDA.	Uruguaiana
CEREALISTA GUAIRA LTDA .	Uruguaiana
EMBRARROZ ALIMENTOS LTDA.	Uruguaiana
GENESIO CEOLIN & CIA. LTDA.	Uruguaiana
JUMA AGRICULTURA E PECUÁRIA IMP. E EXPORTAÇÂO LTDA.	Uruguaiana
NATESUL ALIMENTOS LTDA.	Uruguaiana
S. MAIOLE E CIA. LTDA.	Uruguaiana
SANO E CIA LTDA.	Uruguaiana
TANIA CRISTINA MENEZES MONTEIRO	Uruguaiana
ZAELI ALIMENTOS SUL LTDA.	Uruguaiana
Source: IRGA, developed by study authors	

Rice mills in the West Frontier II (FO2)	
Rice Mill	**Municipality**
CAMIL ALIMENTOS S.A	Itaquí
COMERCIAL DE PRODUTOS AGRICOLAS PITANGUEIRAS LTDA.	Itaquí
JOSAPAR - JOAQUIM OLIVEIRA S/A PARTICIPACOES	Itaquí
JOSAPAR - JOAQUIM OLIVEIRA S/A PARTICIPACOES	Itaquí
PRADEBOM & CIA LTDA.	Itaquí
RAROZ AGROINDUSTRIAL DO SUL LTDA.	Itaquí
CAMIL ALIMENTOS S.A	Maçambará
COOPERATIVA REGIONAL TRITICOLA SANTIAGUENSE LTDA.	Santiago
IEDA MARIA N. BERGUENMAYER-ME	Santiago
JORGE DAMIAN & CIA. LTDA.	Santiago
4M ALIMENTOS LTDA.	São Borja
A. MILANEZ & CIA. LTDA.	São Borja
ADRIANA REGINA PEREIRA	São Borja
ARROZEIRA BEIRA RIO LTDA.	São Borja
CERALISTA ALBARUSKA LTDA.	São Borja
CEREAIS BACCIN LTDA.	São Borja
CEREAIS PASSO LTDA.	São Borja
CEREALISTA MANUA LTDA.	São Borja
CEREALISTA ORYZA LTDA.	São Borja
CEREALISTA STRECK LTDA.	São Borja
CIAGRO-COMERCIO E REPRESENTAÇOES DE INSUMOS AGRICOLAS LTDA.	São Borja
COMERCIAL DE CEREAIS SANTOS MENDES LTDA.	São Borja
COOPERATIVA AGRICOLA IMEMBUY LTDA.	São Borja

COOPERATIVA TRITICOLA SAOBORJENSE LTDA.	São Borja
ENGENHO DE ARROZ SAO JOSE LTDA.	São Borja
ENIO ROLIM	São Borja
ICR CEREAIS LTDA.	São Borja
ITAMAR A. DELLA FLORA	São Borja
PIRAHY ALIMENTOS LTDA.	São Borja
PIRAHY ALIMENTOS LTDA.	São Borja
COOPERATIVA TRITICOLA REG. SAO LUIZENSE LTDA.	São Luiz Gonzaga
Source: IRGA, developed by study authors	

Rice Husk availability and procurement

During the planning phase of the project activity, the project participant identified possible regional suppliers of rice husks and promoted signature of Letter of Intent of the annual volume required for the operation of the plant. The supply contracts are intended to provide a mandatory rate of monthly delivery of biomass, which will vary according to the supplier. Monthly delivery will be done a day to day planning stratifying the loading and will be gauged through the monitoring reports of vehicle weigh, considering the planned and achieved.
The distance of the supplier is standard, but the volume can change according to the monthly supply. Therefore, the monitoring will be done based on the volume removed from the supplier
instead of his distance.
Moreover, the evidence presented in Section A.2.4.1.1 show a scenario of increasing availability of rice in the coming years. These elements were removed from the research "Study about the availability of rice husk for energy production in the region of São Borja - western border of Rio Grande do Sul – Brazil". This research studied the market and the availability of rice husk in the region where the project activity will be implemented.
UTE São Borjahas secured all its needs through biomass from more than a dozens suppliers.

Rice Husks availability in Rio Grande do Sul State.

The table 5 bellow summarizes the supply and demand balance of the rice husks in the state.

Region	Rice production	Rice husks production	Seeds	Manufacturing (t)	Manufacturing (no accounting) (t)	Off-specs (t)
CA1	631352	138897	16109	199913	63135	22097
CA2	622649	136983	14167	264861	62265	21793
DC1	1152444	253538	29943	732782	115244	40336
FO1	1359826	299162	31172	447665	135983	47594
FO2	1000567	220125	24228	1002446	100057	35020
PE1	783088	172279	22522	208576	78309	27408
PI1	861563	189544	24497	884349	86156	30155
ZS1	1123730	247221	29482	823407	112373	39331
Total	7535219	1657748	192120	4563999	753522	263734

Although the RS state produces the equivalent of more than 60% of rice in Brazil, this production is not all consumed. Of the total produced in the 2007/08 crop (7.5 million tons), about 192.1 thousand tons became seeds, 263.7 thousand tons were accounted as losses in the harvesting, drying, storage, transport,

processing and marketing; approximately 1.7 million tones were exported from Rio Grande do Sul without being industrialized and 5.3 million t in the state were industrialized.
Therefore, of the total rice husks produced in 2007(1.66 million t), there is a potential available for use of 1.17 million tones which accounts for the husks that stays in the state. About this value, according to research conducted, 369 thousand tons are consumed by the industries themselves in their industrial processes (self-consumption), being a fuel for the drying of the grain coming from the crop, in the parboiling process or as a fuel for the production of energy for the entire industrial complex. Besides the self-consumption, approximately 174 thousand tones of rice husks are marketed, sold for the use by other companies. Further, 145 thousand tones are destined for landfills, with no direct use in any industrial processes and with high environmental impact, as well as reducing the potential of using rice husk for energy generation. Other 481 thousand tons of rice husk are used in other ways, being mainly used in open deposit. According to the environmental agency of the Rio Grande do Sul State, *Fundação Estadual de Proteção Ambiental Henrique Luiz Roessler* (FEPAM), the open deposit is possible, allowing to deposit rice husks in the crops or in other open areas. However, this is the practice of greater environmental impact, because the husks are left in stock piles or spread in the fields without direct control of the environmental agency. This process generates high costs to the owners since it is required to transport the husks and to ensure the spread in fields (see figures bellow).

Rice Husks stockpiled .

Thus, in the state of Rio Grande do Sul it is estimated that over 800 thousand tons of rice husks were available in 2007. When you convert energy into power, it appears that the volume of available husks effectively amounts to 236 thousand tons of oil equivalent. The following table brings more information about this numbers.

Table 6: Uses of Rice Husks produced in Rio Grande do Sul - 2007 - All producing regions

Region	Rice husks availability (t)	Rice husks uses (t)					
		Self-consumption	Rice husks Sales	Rice husks lanfilled	Stockpilled	Rice Husks Available	Rice husks available (TOE)
CA1	**57,871**	36,169	0	7,234	14,468	**21,702**	**6,402**
CA2	**71,968**	59,973	0	0	11,995	**11,995**	**3,539**
DC1	**186,566**	51,972	21,322	21,655	91,617	**113,272**	**39,705**
FO1	**128,402**	24,182	0	42,801	61,419	**104,220**	**30,745**
FO2	**242,551**	74,351	11,195	25,188	131,817	**157,005**	**49,619**
PE1	**63,115**	4,102	17,357	3,156	38,500	**41,656**	**17,409**
PI1	**213,511**	68,446	29,282	39,164	76,619	**115,783**	**42,794**
ZS1	**205,872**	50,115	95,289	5,882	54,586	**60,468**	**45,948**
Total	**1,169,856**	369,310	174,445	145,080	481,021	**626,101**	**236,161**

The total of rice husk that the project activity will consume annually (96 thousand tons) represents approximately 12% of the total rice husks available (800 thousand tons).

Partial boiling (parboiling) production process influence on Rice husks availability.

The parboiling process can be considered a bypass in the conventional rice manufacturing. When considering mills that process for parboiling rice, it is considered a fallacy "parboiling does not lead to rice husks surplus." The laconic expression hides two things that deserve consideration. The first aspect is, in the course of the year, which amount of rice is parboiled because many times the engine produces white rice and parboiling rice. Also deserves attention what amount is effectively available considering each month, because annual averages can hide problems in short term supply. The attention to the just-in-time supply chain management must be investigated through analysis of historical series of the past five years, for example.

Once defined this participation, one should analyze a second point: whether the amount available of husks is attractive to business, both to the buyer and to the seller. This warning is given on the basis of practical cases of disaffection found. In addition, secondary factors such as the combustion efficiency may also be important. Examples of this case are the type of equipment (combustion in fixed bed or fluidized bed) and environmental concerns. Often - but fewer - the engines burn more rice husks than necessary "to stay with less problem." For directing the combustion ashes rather than rice husks," they only get 20% of the problem."

The increasing volume of parboiling rice brings a negative impact on the availability of rice husks, including the generation of energy. The major fact is that the parboiling is a hydrothermal process and the most convenient energy source is the rice husks. Today there is a clear trend among national parboiling rice producers to make co-generation of energy using the husks. To get an idea of the process works, the

steam is generated in a boiler with a pressure of around $150kg/cm^2$. This steam drives a turbine, with the saturated vapor pressure reduced to about $12kg/cm^2$, ideal value for the transfer of heat in sensible heat exchanges in various operations. The kinetic energy of the steam that moves the turbine turns a generator of electricity, resulting in the expression co-generation (heat and electricity).
In the recent III-Southern Brazilian Symposium on Quality of Rice (Camaquã-RS, 10-12/dez./2008) it was discussed the growing subgroup of parboiling rice in the total share of production. With a privileged plenary to talk on the topic, it was raised by a representative of the main rice producer in Brazil (and Uruguay) the hypothesis that the parboiling share already exceeds 30% in the production of RS. On one hand, represents a positive factor for the characteristics of the functional foods. However, in terms of availability of rice husks, may represent more than a couple of thousand tons of rice husks no longer available as a surplus, only in Rio Grande do Sul.
In the second producing state, Santa Catarina, the availability of rice husks is practically inexistent, due to the parboiling of more than 90% of the production, like in "parboiling" countries of Asia. And the small amount of rice husks that is surplus is already consumed by two units of co-generation.

Wood influence on Rice husks availability

Drying with wood has an important role in the drying of rice in the RS, having a comparative advantage over the rice husks. Wood and rice husks enter into competition when drying of rice occurs in the crop or in its proximity. However, both are generated in different places: the rice husks are available in the rice mills and the wood in the forests.
Comparing the costs, it is taken into account the logistics cost and the amount of purchase. Logistics is a decisive factor, since the apparent density (bulk density) is considerably less critical for wood. The rice husks are still about three times more "light" than wood.
From the point of view of combustion, both have the same magnitude in calorific value, but the rice husks has a better performance during the combustion, caused by a more favorable fuel-oxidant ratio.
An analysis worthy of attention is on the trend in the medium term, difficult to quantify, on the reduction in drying with wood made in the field. The fact is on the systematic use of green wood, given that the pyrolysis products add an unpleasant flavor (odor and taste) to rice, noticed during its cooking. This factor is used as clue on the recognition of the rice origin, especially when comparing the raw rice from the RS (more intense flavor) and the rice from the SC. The problem is most noticeable in places that prepare large quantities, such as industrial kitchens.
The most reliable data on the use of wood for drying is available on the last Census of Rice in RS (IRGA, 2005, p. 81-82). The next survey, in 2010, should not result in major differences.
The term "own drying" used in the Census of rice means the use of wood for drying. The regions of the picture below are those classified by the IRGA, according to vegetation and climatic conditions. Table 7 indicates that more than a half of the drying of the rice in the crop in the RS is made with wood. Often this is only a partial drying, the survey does not take into account the energy for final drying in the rice mill. Also does not take into account the energy of the husk used in the process of parboiling, and even less in the new cold storage system, which begins to be used by large-size rice mills.

Table 7: Own storage facility, by number of answers (% and total) and drying (%) and quantity (t) – All Regions – 2004/05

Regions	Own Storage			Drying		
	Yes (%)	No (%)	Total (t)	Own (%)	Outsourced (%)	Total informed (t)
R1	33.9	66.1	1,049	60.2	39.8	1,756,493
R2	28.4	71.6	1,115	47.4	52.6	1,086,789
R3	29.1	70.9	3,331	55.2	44.8	902,713
R4	19.1	80.9	1,366	37.7	62.3	723,727
R5	30.7	69.3	1,454	59.1	40.9	626,975
R6	31.2	68.8	596	56.4	43.6	977,588
RS	**28.4**	**71.6**	**8,911**	**53.8**	**46.2**	**6,074,284**

Source: IRGA, developed by study authors

Considering the slow dynamics, the percentages found in 2005 can be applied in the current crop. In terms of drying, 53.8% of the production was "own dried", and 46.2% were outsourced. As occurred in the previous census, once again, the West Frontier had higher rates of drying, with 60.2% and Interior Coastal Plain was the lowest, with 37.7%.

Rice husks potential use in RS State - Official Statistics

The main official document on the husks as energy source in the state of Rio Grande do Sul is the "Energy Balance of Rio Grande do Sul 2005-2006-2007", produced by Companhia Estadual de Energia Elétrica - CEEE and launched in December 11, 2008. Most data related to the husks were provided by the authors of this work, but they did not participate on its interpretation. The major finds are presented here, with analytical comments.

It is important to note that the deepness of the analysis of the husks has a direct relationship with its relative importance (low) in the energy matrix. One positive point is related to the quality of the document in comparison with previous editions. On the energy used in the industrial sector in 2007, the first position is occupied by electricity, with 29.09% followed by wood, with 22.18%. The rice husks is in the group called Other primary sources, along with wind energy, wood by products and other products, this group was responsible for 18.8%, equivalent to 495,000 toe (tons of oil equivalent). Follow the coal, natural gas and fuel oil, with 60.12% of the consumption on the primary sources.

The group of rice husks kept in the same position in the ranking, ranging in the three years period from 457 thousand toe, through the peak in 2006 with 504 thousand toe and up to 495 thousand toe.

Conversions used as a reference assumes that the husk represents 22% of the rice in weight. The Census states that 38% of the husk in the state is not used as energy.

The assumption about conversion indicates that 1,000 tones of rice husks equals to 0.295 toe. Comparing with wood, the equivalency is 0,310 toe. To the wood is attributed the following drying capacity: 1m^3 of wood, equivalent to 390kg, dries about 15t of rice. In another moment, the report lists the value of 12.5 t. Taking an intermediate value (13.75 t) and using the relationship between the calorific power of both fuels (310 and 295tep), the equivalency is: 1t of rice husk dries 33.6 t of rice.

Useful Conversions:

1 barrel of oil = 0.159m^3
1 m^3 = 6.29 barrels
1 ton of oil equivalent (TOE) = 7.2 Barrels of oil equivalent (BOE) = 10^4 Mcal
1 BOE = 0.14 TOE
1 J = 0.24 x 10^{-4} Kcal = 277.7 x 10^{-9} kWh

Rice Husks: 1000 t =
✓ 295 TOE
✓ 2,124 BOE
✓ 295 x 10^4 Mcal
✓ Dries 33,600t of rice

The forecast for 2008 presented in the report showed 1.628 million tons of rice husks or 480,000 TOE available in RS, and placed the rice husks in third position among the sources of biomass such as wood, alcohol, sawdust, bagasse and charcoal, as presented in Table 8, below.

Table 8: Annual potential production for renewable energy in RS

Energy source	**Total annual**	**Total annual: TOE**
Ethanol	1,000,000 m^3	510,000
Sugar Cane bagasse	2,800,000 t	596,400
Rice husks	1,628,000 t	480,260
Biodiesel B 100	200,000 m^3	169,600
Wood	15,504,414 m^3	1,874,000
Total – Biomass		3,630,260
Source: Energy balance report for RS		

Table 9 and the Figure 6, shows the "total supply" of rice husks, represented by the wording "gross domestic supply," "final consumption", "final energy consumption" and "industrial consumption." Certainly, based on the qualifications of the group that drafted the final wording of balance, the misunderstanding in terminology should be attributed to the need for a standardized framework specification. Regarding the item "food and drink," the relevance to this Report is the fact of being the place that covers the rice husks. Another strange issue is the item named "ceramic". Despite significant use of the rice husks occurs in the glass-making industry, bricks, tiles etc.., the high values of participation in the energy matrix causes surprises.

Table 9: Evolution of the rice husks used in RS- Different uses - 2005 to 2007

Use	Year		
	2005 tons	2006 tons	2007 tons
Food and Drink	623,346	720,085	661,822
Ceramic	360,770	360,770	360,770
Total	990,116	1,086,855	1,028,592

Source: Energy balance report for RS

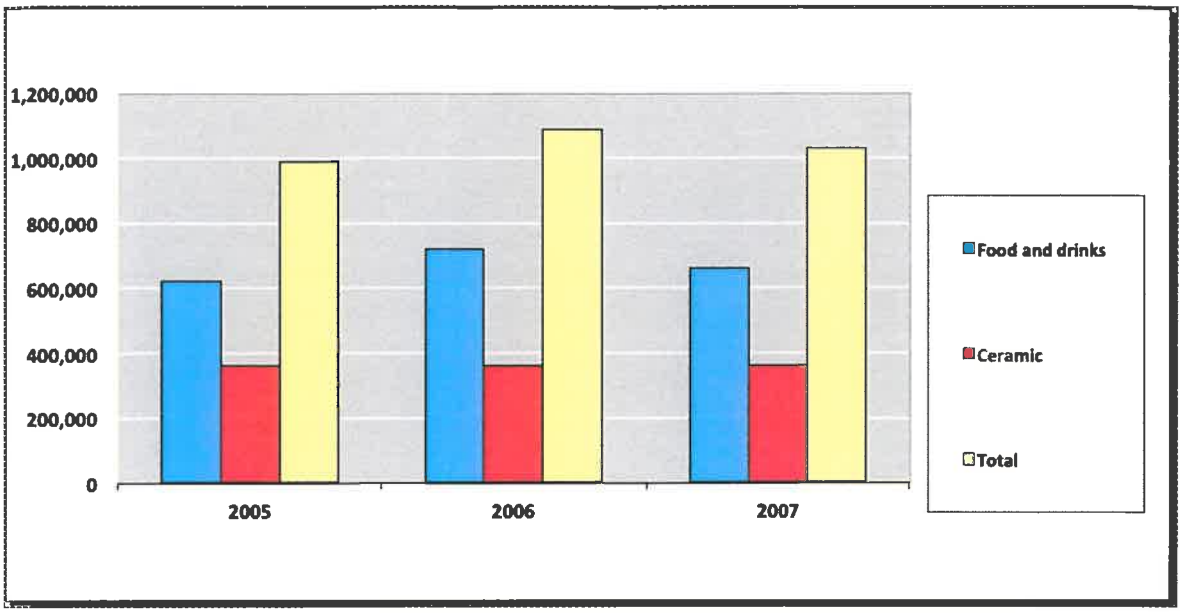


Figure 6: Evolution of the rice husks production (t) used as energy source in RS - 2005 to 2007

Definition of UTE São Borja area of influence

When calculating the feasibility of transport of the rice husks to be used for energy generation, it is necessary to compare with the rice husks with other energy sources. Thus, it was compared the rice husks with oil on an energy equivalency basis. In the comparison the estimated values for a barrel of oil, ranged from $ 40 to $ 120 with three different exchange rates from R$/US$ 2.00 R$/US$ 2.25 and R$/US$ 2.50. Also it was assumed that there was no cost in the acquisition of the rice husks, taking into account, thus, only the logistics cost (table bellow).

Table 10: Logistic feasibility of the rice husks in km, considering zero its acquisition cost

Oil price (US$/ barrel)	Exchange Rate R$/ US$	Oil price (R$/ barrel)	Logistics feasibility range
US$ 40	R$ 2	R$ 80	457.3
US$ 60		R$ 120	304.9
US$ 80		R$ 160	228.6
US$ 100		R$ 200	182.9
US$ 120		R$ 240	152.4
US$ 40	R$ 2.25	R$ 90	406.5
US$ 60		R$ 135	271.0
US$ 80		R$ 180	203.2
US$ 100		R$ 225	162.6
US$ 120		R$ 270	135.5
US$ 40	R$ 2.5	R$ 100	365.8
US$ 60		R$ 150	243.9
US$ 80		R$ 200	182.9

US$ 100		R$ 250	146.3
US$ 120		R$ 300	121.9
Logistic feasibility range (average)			237.7

The main conclusion is that the transportation of the rice husks presents some obstacles. The first one refers to the density of the product those results in a large volume of losses in the transportation process. Moreover, to improve the efficiency of the logistics only certain types of vehicles may be used, restricting the supply of freight. Thus, excluding from the analysis the high losses arising from the process of moving the rice husks, it was found that the average feasibility range for the transportation of the rice husk is about 237 kilometers. The sensibility analysis showed variation reaching a maximum value of 457 km and a minimum of 122 km.
For the rice husks, even without considering its cost, the transportation range is limited, requiring the use near its production. Thus, it is considered that up to 150 kilometers from the consumption point as a very feasible region and between 150.3 km and 237.7 km a range that is possible to use the rice husks. So for the remaining analysis of this work it was used 150.3 km as the zone of influence for the purchase of most of the rice husks and up to 237.7 kilometers as a secondary zone for the purchase of the raw material.

Rice production and industrialization in Sao Borja

The results in Figure 7 show a recovery in the last decade in relation to the area in the first half of the 90s. In the last ten years there is an upward trend related to the planted area.

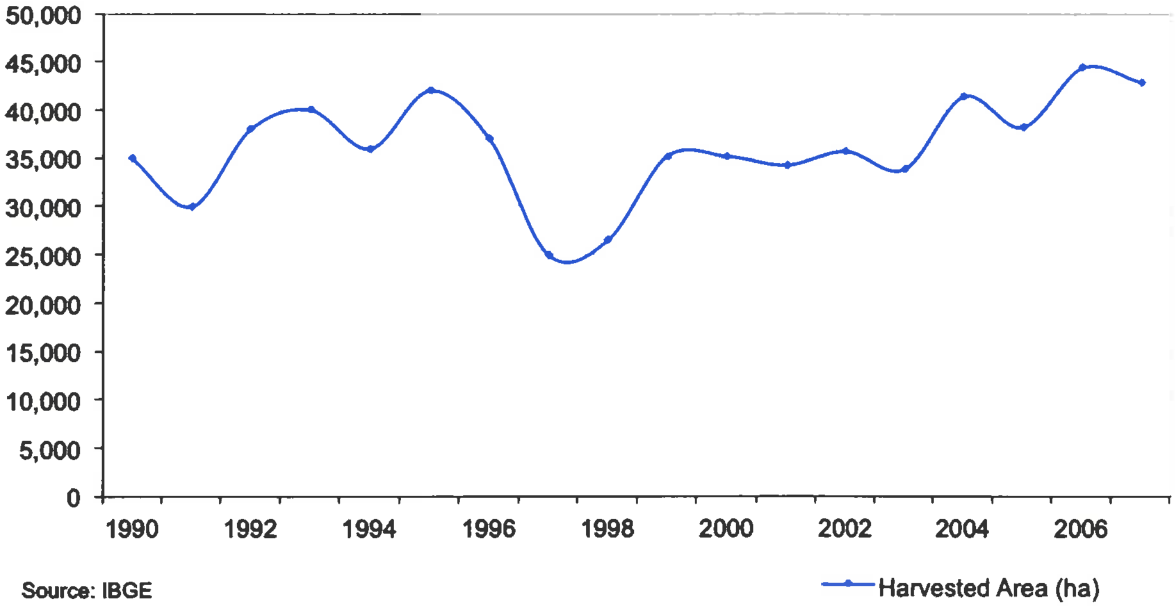


Figure 7: Rice harvested area (ha) in the municipality of São Borja, 1990 to 2007

Figure 8, presents the production (t) of rice in Sao Borja and reflects the results of the increased area. However, other factor of the same relevance is related to productivity, resulting in larger production. The productivity is shown in Figure 9.

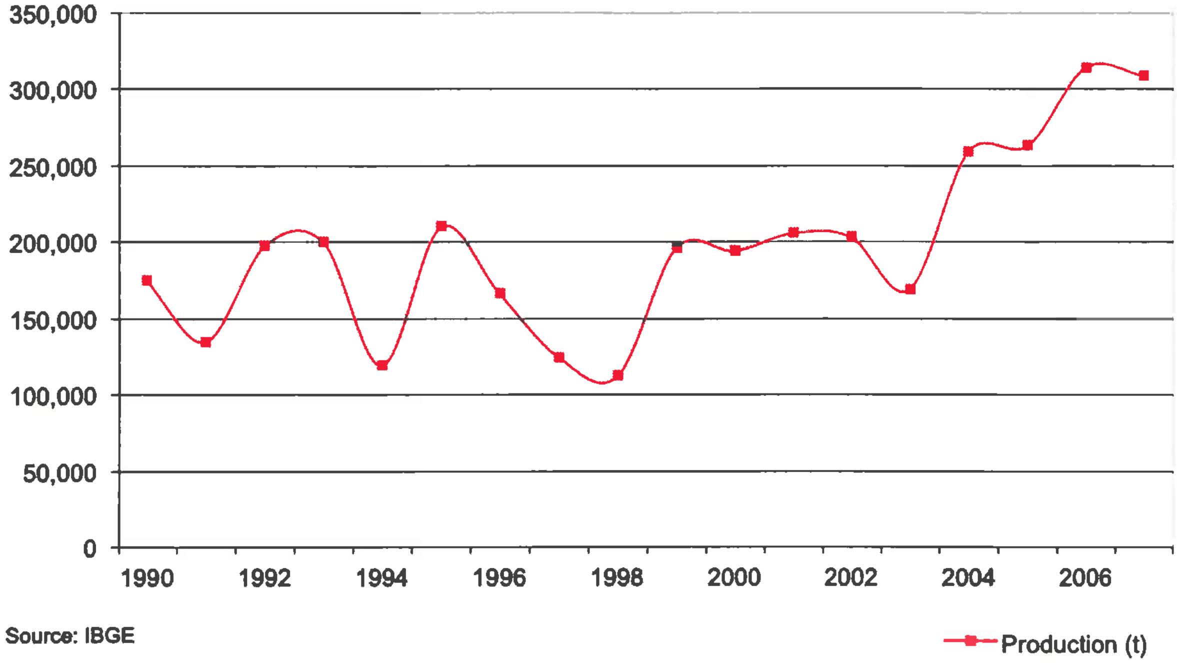


Figure 8: Rice production (t) in São Borja, 1990 to 2007

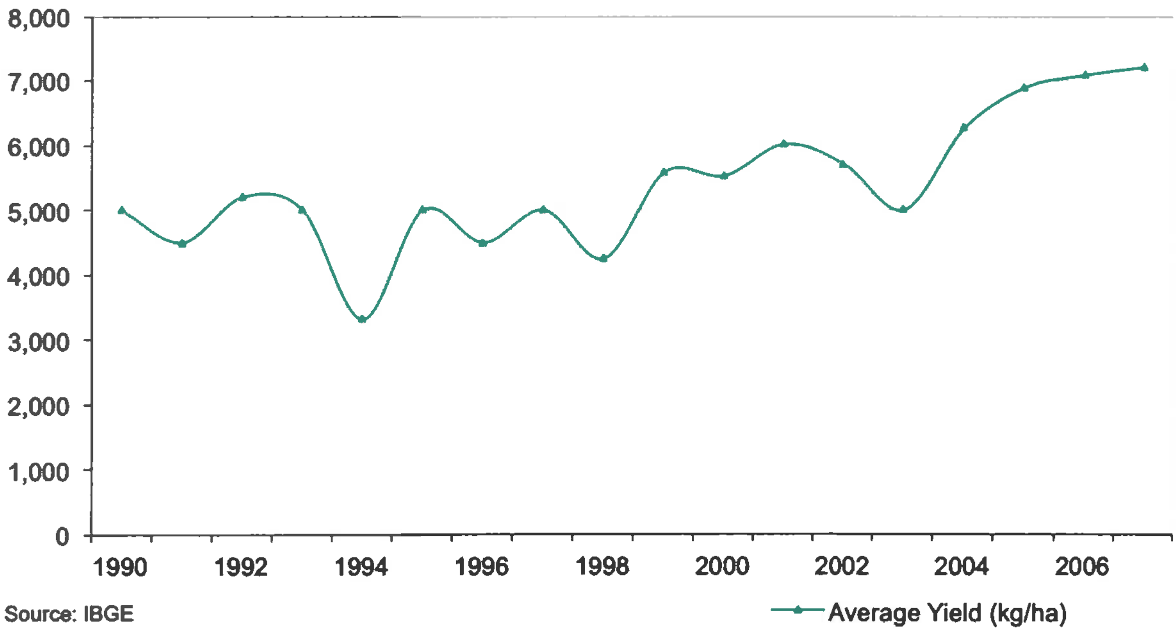


Figure 9: Rice yield in (t/ ha) São Borja 1990 to 2007

Table 11 presents the rice industrialization in the last three years and shows a significant increase of rice and consequently rice husks. For the production of rice husks it was used the 22% factor, so 1 ton of rice will generate 0.22 tons of rice husks. With average annual availability of husks being over 100 thousand tons, the growth rate in the three years period has achieved a significant double-digit: 11% per year.

Table 11: Rice industrialization in São Borja per rice mill, tons, 2005 to 2007 and 3 yr average				
Rice Mill	**2005**	**2006**	**2007**	**3 yr average**
PIRAHY ALIMENTOS LTDA.	282,947	266.579	298,858	282,795
CERALISTA ALBARUSKA LTDA.	26,025	39,318	46,902	37,415
A. MILANEZ & CIA. LTDA.	21,636	21,654	26,533	23,274
CIAGRO-COM. E REP. DE INSUMOS AGRICOLAS LTDA.	20,323	21,412	23,846	21,860
ENGENHO DE ARROZ SAO JOSE LTDA.	20411	19,745	19,910	20,022
CEREALISTA STRECK LTDA.	13,102	18,715	18,417	16,744
ENIO ROLIM	12,059	12,661	13,180	12,633
ICR CEREAIS LTDA.	9,912	16,741	12,132	12,928
CEREALISTA ORYZA LTDA.	10,132	10,011	9,518	9,887
CEREALISTA MANUA LTDA.	6,283	6,513	7,088	6,628
4M ALIMENTOS LTDA.	2,119	3,170	2,474	2,588
CEREAIS PASSO LTDA.	7,103	2,290	2,317	3,904
COOPERATIVA AGRICOLA IMEMBUY LTDA.			2,311	2,311
ARROZEIRA BEIRA RIO LTDA.	4,176	3,154	889	2,740
COOPERATIVA TRITICOLA SAOBORJENSE LTDA.	211	5,101	734	2,015
ITAMAR A. DELLA FLORA	122	235	521	293
CEREAIS BACCIN LTDA.	65	65	107	79
COMERCIAL DE CEREAIS SANTOS MENDES LTDA.	956	880	60	632
ADRIANA REGINA PEREIRA		178	21	99
FRAMBAIL COM. REPRES. DE CEREAIS LTDA.	234			234
JOSE CARTURANI	56	90		73
Total Sao Borja	**437,869**	**448,511**	**485,818**	**457,399**
Total rice husks availability in Sao Borja	**96,331**	**98,672**	**106,880**	**100,628**
Source: IRGA, developed by study authors				

Research on the mills in the project area of influence

- <u>Research on the mills in Sao Borja</u>

Supplementing the data of the previous item, it was gathered in the last Census of IRGA information that could be useful. In the case of data subject to forfeiture due to the elapsed time (since 2005), which certainly have changed, the authors preferred not to take comments based on outdated data.
An example, as shown in Table 12, is the recent admission of the company Pirahy in parboiling. Since 2005 the company represents 15% of installed capacity in Sao Borja. The companies' brand for parboiling rice was produced by Milanez, the only parboiling rice producer in the municipality. This fact impacts in the availability of rice husks, both by parboiling, or by starting the production of energy.

Table 12: Social-economic characteristics of the industries in Sao Borja's region

Rice Mill	Installed capacity (bags per hour)	% used capacity	Nº of employees	Nº of bales (30kg) produced	Polished rice (%)	Parboiling (%)
4 M ALIMENTOS LTDA.	80	33	4	70,424	100	0
A MILANEZ & CIA LTDA.	96	75	30	47,.594	0	100
ADRIANA REGINA PEREIRA	16	9	2	3,982	100	0
ARROZEIRA BEIRA RIO LTDA.	55	48	10	60,892	100	0
CERALISTA ALBARUSKA LTDA.	300	100	70	850.926	100	0
CEREAIS BACCIN LTDA.	20	4	4	980	100	0
CEREAIS PASSO LTDA.	106	14	5	40,438	100	0
CEREALISTA MANUÃ LTDA.	90	60	35	139,036	100	0
CEREALISTA ORYZA LTDA.	106	79	13	213,642	100	0
CEREALISTA STRECK LTDA.	106	92	19	374,898	100	0
CIAGRO - COM. REPRES. LTDA.	210	85	14	451,980	100	0
COM. CER. SANTOS MENDES LTDA.	100	7	8	18,760	100	0
COTRISAL – COOP. TRIT. SAMBORJENSE	100	43	210	116,.208	100	0
ENGENHO SÃO JOSÉ LTDA.	176	75	19	423,028	100	0
ENIO ROLIM	125	85	23	265,938	100	0
I.C.R. - CEREAIS LTDA.	150	36	17	359.,550	100	0
ITAMAR A DELLA FLORA	26	8	3	5,326	100	0
JOSÉ CARTURANI	25	4	2	2,020	100	0
PIRAHY ALIMENTOS LTDA.	985	93	188	3,629,000	100	0
PIRAHY ALIMENTOS LTDA.	500	92	172	2,146,667	100	0
Total	**3,372**		**848**	**9,645,289**		

Source: IRGA, 2005 Census. Developed by study authors

The data gathered in 2005 on the Rice mills of Sao Borja shows differences in relation to the main uses of the rice husks. It is emphasized that the municipality of Sao Borja is in the main area of influence in terms of the project logistics, being directly favored in terms of rice husks purchase for energy generation. In addition to Sao Borja, the municipalities of Itaqui and Maçambará are also in the main area of logistic influence of the project.

Considering the rice mills in Sao Borja, Pirahy, leader in the city, was using at that time 25% of rice husks in their facility as a source of heat. The second mill in production volume, Albaruska, was using 16% for the same purpose. The third, Milanez, dedicated to parboiling, was using most of its husks to generate steam, complementing with 18% to generate heat, presumably to direct drying.

Of the twenty selected mills, six reported not to use their rice husks, representing a theoretical availability of 3,216 t on that year. Of this, two mills, Manuã and Cotrisal made up to 85%.

On that year, no mill of this group was using the rice husks for electricity generation. It is noted that the electricity generation in the rice mills occurs worldwide from the use of the steam generated by burning the rice husks. The high-pressure steam turns a generator, converting kinetic energy into electricity, in co-generation system based on the lowering of steam pressure.

A fact worthy of attention is that more than 50% of the mills reported direct all of their self-consumption for heat generation, certainly related to their need to reduce the moisture content of the rice for better preservation. In terms of availability of rice husks in the mills surveyed in the municipality of Sao Borja, it was found that the volume of the rice husks produced was 106.8 thousand tons, and 74.9 thousand t were not used, allowing the acquisition of this volume for the use in the UTE São Borja(Table 13).

Table 13 – Rice husks availability by industry in São Broja – 2007

Company	Municipality	Industrialization (t)	Rice husks (t)	Self consumption (%)	Availability of husks (t)
4M ALIMENTOS LTDA.	São Borja	2,474	544	16.0%	457
ADRIANA REGINA PEREIRA	São Borja	21	5	0.0%	5
ARROZEIRA BEIRA RIO LTDA.	São Borja	889	195	39.0%	119
A. MILANEZ & CIA. LTDA.	São Borja	26,533	5,837	86.0%	817
CERALISTA ALBARUSKA LTDA.	São Borja	46,902	10,318	16.0%	8,667
CEREAIS BACCIN LTDA.	São Borja	107	24	70.0%	7
CEREAIS PASSO LTDA.	São Borja	2,317	510	0.0%	510
CEREALISTA MANUA LTDA.	São Borja	7,088	1,559	0.0%	1,559
CEREALISTA ORYZA LTDA.	São Borja	9,518	2,094	16.0%	1,759
CEREALISTA STRECK LTDA.	São Borja	18,417	4,052	100.0%	-
CIAGRO-COM. E REP. DE INSUMOS AGRICOLAS LTDA.	São Borja	23,846	5,246	29.0%	3,725
COMERCIAL DE CEREAIS SANTOS MENDES LTDA	São Borja	60	13	30.0%	9
COOPERATIVA AGRICOLA IMEMBUY LTDA.	São Borja	2,311	508	0.0%	508
COOPERATIVA TRITICOLA SAOBORJENSE LTDA.	São Borja	734	162	0.0%	162
ENGENHO DE ARROZ SAO JOSE LTDA.	São Borja	19,910	4,380	16.0%	3,679
ENIO ROLIM	São Borja	13,180	2,900	50.0%	1,450
ICR CEREAIS LTDA.	São Borja	12,132	2,669	20.0%	2,135
ITAMAR A. DELLA FLORA FILIAL 01	São Borja	521	115	0.0%	115
PIRAHY ALIMENTOS LTDA.	São Borja	298,858	65,749	25.0%	49,312
Total		**485,817**	**106,880**		**74,995**

Source: IRGA

- Research on the mills in the other municipalities in the logistic area of influence

Itaqui and Maçambará are in the 150 km radius of UTE São BorjaUTE São Borja, in the main logistic feasibility. These two industrial cities produced in 2007 506.9 thousand tons of rice, generating a total of 111.5 thousand tons of rice husks.

The main mill of the region, Camil Alimentos, has the higher use of rice husks (self-consumption), with 87%. In terms of percentage of self-consumption, the mill Com. Pitangueiras uses 40% and Pradebom and Raroz self-consumes 16% of their availability. The other mills did not use their rice husks in their processes.

Thus, the municipalities Itaqui and Maçambará together made available in 2007 55.1 thousand tons of rice husks, which could be used in the generation of energy in UTE São Borja(Table 14).

Table 14 – Rice husks availability in Itaqui and Macambara - 2007

Company	Município ality	Industrialization (t)	Husks (t)	Self-consumption (%)	Rice husks availability (t)
CAMIL ALIMENTOS S/A	Itaqui	289,620	63,716	87.0%	8,283
COM. DE PROD. AGRICOLAS PITANGUEIRAS LTDA.	Itaqui	16,361	3,599	40.0%	2,160
JOSAPAR - JOAQUIM OLIVEIRA S/A PARTICIPACOES	Itaqui	151,189	33,262	0.0%	33,262
PRADEBOM & CIA LTDA.	Itaqui	6,971	1,534	16.0%	1,288
RAROZ AGROINDUSTRIAL DO SUL LTDA.	Itaqui	37,975	8,354	16.0%	7,018
CAMIL ALIMENTOS S/A	Maçambará	4,882	1,074	0.0%	1,074
Total		**506.997**	**111.539**		**53.084**

Source: IRGA

Thus, the total rice husks available in 2007 by the rice mills in the logistic feasibility area, which includes the municipalities Itaqui, Maçambará and Sao Borja was 128.1 thousand tons of rice husks.

Another important consideration relates to the future potential of rice industrialization and, consequently, the availability of rice husks. The existing installed capacity of the three municipalities is of 4,766 bags of rice per hour, which equates to over 1.7 million tons of rice per year. From this factor, one can conclude that, given the same level of self-consumption of rice husks found in the mills, there is a potential of more than 245.8 thousand tons of rice husks without any new investments in industrial parks, only using the already existing capacity (Table 15).

Table 15 – Quantity of rice husks imediately available and estimated potential based on rice milling installed capacity - 2007

Company	Municipality	Quantity of rice husks available (t)	Rice milling installed capacity (sc/h)	Rice milling Potential in tons (t)	Rice husks potential (t)
CAMIL ALIMENTOS S/A	Itaqui	8,283	1,000	360,000	10,296
COMERCIAL DE PROD. AGRICOLAS PITANGUEIRAS LTDA.	Itaqui	2,160	40	14,400	1,901
JOSAPAR - JOAQUIM OLIVEIRA S/A PARTICIPACOES	Itaqui	33,262	706	254,160	55,915
PRADEBOM & CIA LTDA.	Itaqui	1,288	110	39,600	7,318
RAROZ AGROINDUSTRIAL DO SUL LTDA.	Itaqui	7,018	190	68,400	12,640
CAMIL ALIMENTOS S/A	Maçambará	1,074	125	45,000	9,900
4M ALIMENTOS LTDA.	São Borja	457	26	9,504	1,756
ADRIANA REGINA PEREIRA	São Borja	5	1	518	114
ARROZEIRA BEIRA RIO LTDA.	São Borja	119	26	9,504	1,275
A. MILANEZ & CIA. LTDA.	São Borja	817	82	29,520	909
CERALISTA ALBARUSKA LTDA.	São Borja	8,667	300	108,000	19,958
CEREAIS BACCIN LTDA.	São Borja	7	1	288	19
CEREAIS PASSO LTDA.	São Borja	510	15	5,342	1,175
CEREALISTA MANUA LTDA.	São Borja	1,559	54	19,440	4,277
CEREALISTA ORYZA LTDA.	São Borja	1,759	84	30,146	5,571
CEREALISTA STRECK LTDA.	São Borja	-	98	35,107	-
CIAGRO-COM. E REP. DE INSUMOS AGRICOLAS LTDA.	São Borja	3,725	179	64,260	10,037
COMERCIAL DE CEREAIS SANTOS MENDES LTDA	São Borja	9	7	2,520	388
COOPERATIVA AGRICOLA IMEMBUY LTDA.	São Borja	508	10	3,600	792
COOPERATIVA TRITICOLA SAOBORJENSE LTDA.	São Borja	162	43	15,480	3,406
ENGENHO DE ARROZ SAO JOSE LTDA.	São Borja	3,679	132	47,520	8,782
ENIO ROLIM	São Borja	1,450	106	38,250	4,208
ICR CEREAIS LTDA.	São Borja	2,135	54	19,440	3,421
ITAMAR A. DELLA FLORA FILIAL 01	São Borja	115	2	749	165
PIRAHY ALIMENTOS LTDA.	São Borja	49,312	1.375	495,000	81,675
Total Itaqui		**52,010**	**2,046**	**736,560**	**88,070**
Total Maçambará		**1,074**	**125**	**45,000**	**9,900**
Total São Borja		**74,995**	**2,595**	**934,189**	**147,929**
Total (Itaqui + Maçambará + São Borja)		**128,080**	**4,766**	**1,715,749**	**245,899**

In addition to these three cities, Uruguaiana and Alegrete are located in the secondary zone of logistics for UTE São BorjaUTE São Borja. Thus, the potential of rice husks available for the project can significantly increase if these two municipalities are considered.

Alegrete has two mills: Cooperativa Agroindustrial Alegrete (CAAL) and Pileco e Cia Ltda. These two companies together were responsible for the industrialization of 244.3 thousand tons of rice in 2007, generating a total of 53.7 thousand tons of rice husks.

In Uruguaiana there are eleven rice mills, which in 2007 industrialized 202.0 thousand tons of rice, generating 44.4 thousand tons of rice husks. Thus, the two municipalities produced 447.3 thousand tons of rice in 2007 and generated 98.4 thousand tons of rice husks (Table 16). In both cities it is estimated that around 35% of this amount is not used for self-consumption in the mills, so there is more 35.7 thousand tons of rice husks available.

Table 16 – Rice milling in Alegrete and Uruguaiana and total of rice husks produced - 2007

Municípality	Company	Rice milling (t)	Rice husks volume (t)
Alegrete	Cooperativa Agroindustrial Alegrete	137,593	30,270
Alegrete	Pileco & Cia Ltda.	106,712	23,477
Uruguaiana	Brandalise Ind. e Com. de Cereais Ltda.	1,011	222
Uruguaiana	Ceratti Agronegócios ltda.	8,982	1,976
Uruguaiana	Cerealista Guaíra Ltda.	62,785	13,813
Uruguaiana	Embrarroz Alimentos Ltda.	5,431	1,195
Uruguaiana	Gebésio Ceolin & Cia Ltda.	3,239	712
Uruguaiana	Juma Agr. e Pec. Imp. e Exp. Ltda.	6,390	1,406
Uruguaiana	Natesul Alimentos Ltda.	13,701	3,014
Uruguaiana	S. Maiole e Cia Ltda.	228	50
Uruguaiana	Sano e Cia Ltda.	9,616	2,116
Uruguaiana	Tânia Cristina Menezes Monteiro	2,942	647
Uruguaiana	Zaeli Alimentos Sul Ltda.	88,724	19,519
Total		**447,353**	**98,418**

Source: IRGA

Conclusion

In short, the research identified availability of about 128.1 thousand tons of rice husks in the main logistics feasibility area and 35.7 thousand tons in the secondary area, which totaled 163.8 thousand tons of rice husks that may be purchased for use in UTE São Borja for energy generation. Considering the potential on the five municipalities, it is estimated that these mills are able to generate over 300 thousand tons of rice husks only considering the existing installed capacity in 2007. Table 17 shows a summary of this research.

Table 17: Summary of the Research – Rice husks availability, potential and project consumption (2007)

<table>
<tr><th rowspan="2">Area of influence</th><th rowspan="2">Distance from UTE São Borja (km)(1)</th><th colspan="3">Rice Husks Supply(tons)</th><th rowspan="2">UTE São Borja Demand</th><th colspan="4">Surplus</th></tr>
<tr><th>Cities</th><th>Available</th><th>Potential (2)</th><th>Tons ('000)</th><th>%</th><th>Tons ('000)</th><th>%</th></tr>
<tr><td>Central</td><td>15</td><td>Sao Borja</td><td>74,995</td><td>147,929</td><td rowspan="3">96,000</td><td>(21)</td><td>(22%)</td><td>52</td><td>54%</td></tr>
<tr><td>Primary Area.</td><td>150.7</td><td>Itaqui
Macambara</td><td>128,079</td><td>245,899</td><td>32.1</td><td>33%</td><td>150</td><td>156%</td></tr>
<tr><td>Secondary Area</td><td>237.5</td><td>Uruguaiana
Alegrete</td><td>163,779</td><td>344,317</td><td>67.8</td><td>71%</td><td>300</td><td>312.5%</td></tr>
</table>

(1) Up to
(2) Considering the existing installed capacity

Annex 4

MONITORING INFORMATION

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