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

CONTENTS

Revision history of this document

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

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

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

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JOSAPAR Itaqui Biomass Co-generation Project

Version: 5
Date: 17/10/2006

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

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Purpose

The Josapar Itaqui Biomass Co-generation Project developed by JOSAPAR is a project for installation in the Itaqui city, Rio Grande do Sul state, Brazil. Josapar is a rice mill company, of which the core business is the production of paddy and parboiled rice to internal and exporting markets. Josapar is placed 2nd company in the ranking of rice companies in Brazil (Brazilian Rice Year Book 2005, pg. 59)[1].
The project eliminates Josapar's electricity demand from the grid, will sell the small surplus generated electricity to the grid and provide process steam to the rice mill.

Project description

The main activity in the region where the project will be located is rice production and industrialization. Rice mills generate huge amounts of biomass residues (rice husks), and the Brazilian and local state legislation prohibits the unlicensed displacement and/or uncontrolled burning of rice husks, and restricts the land filling of it, allowing the displacement only in previously licensed areas. As a result, the rice mills have huge amounts of biomass that are left for decay.

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

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

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

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

At the present time a considerable amount of rice husks, around 31,878 t/years, is generated in the Josapar rice mills. A furnace is used to burn 38% of the biomass production. The resulting amount of 19,827 tonnes per year of biomass is disposed in legal landfills outside the location where the project activity will be placed.

Contribution of the project to sustainable development

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

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

A.3. Project participants:

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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)	JOSAPAR – Joaquim Oliveira Participações S.A.	No
Brazil (host)	PTZ BioEnergy Ltd.	No
The Netherlands	Bioheat International B.V.	No

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

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

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

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A.4.1.1. Host Party(ies):

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Brazil

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

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Rio Grande do Sul State

A.4.1.3. City/Town/Community etc:

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Itaqui

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

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

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

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

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

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

Reference: version 09: 12 May 2006 of Appendix B of the simplified modalities and procedures for small scale CDM project activities.

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

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

<u>Type I; Category I.D.: Grid connected renewable electricity generation</u>
Type I project activities are defined as renewable energy project activities with a maximum output capacity equivalent to up to 15 megawatts (or an appropriate equivalent) (decision 17/CP.7, paragraph 6 (c) (i)). The project comprises combustion of renewable rice husks in a biomass boiler for electricity generation. The nominal capacity of the installation is 6.0 MWe, which is below the limit of 15 MW for type I projects.

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

Type III project activities are defined as other project activities that both reduce anthropogenic emissions by sources and directly emit less than 15 kilotonnes of carbon dioxide equivalent annually (decision 17/CP.7, paragraph 6 (c) (iii) over the entire crediting period.

The project activity emissions of category III.E. consist of:
a. CO_2 emissions related to the combustion of the non-biomass carbon content of the waste (plastics, rubber and fossil derived carbon) and auxiliary fuels used in the combustion facility.
b. Incremental CO_2 emissions due to incremental distances between the collection points to the controlled combustion site and to the baseline disposal site as well as transportation of combustion residues and final waste from controlled burning site to disposal site.
c. CO2 emissions related to the power used by the project activity facilities, including the equipments for air pollution control required by regulations. In case the project activity consumes grid based electricity, the grid emission factor (kg CO_2e / kWh is used, or it is assumed that diesel generator would have provided a similar amount of electric power, calculated as described in category I.D.

Ad a. Emissions through combustion of non-biomass carbon are null once the waste composition is 100% rice husks.
Ad. b. The emissions related to the biomass transportation are zero because all the rice husks are generated in the rice mill, where the project will be implemented. The project emissions will result just from the ash transportation, which is maximally 5 tonnes of carbon dioxide equivalent annually.
Ad c. The emissions through electricity or diesel consumption are zero, once the Biomass Power Plant will be fully supplied by a renewable source.
Therefore, project emissions leads to direct carbon emissions of less than 15 kilo tonnes of carbon dioxide equivalent annually.

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

Use of environmentally sound technologies and transfer of know how
The JOSAPAR project will operate using state of art conventional Rankine steam cycle technology. The combustion of the fuel will be performed with proven technologies like a high pressured boiler (65 bar). The power plant control is supervised by a high standard automation set of LPCs and computers.

A condensing steam turbine drives an electrical generator. The system is managed by control panels and devices that keep a steady condition of voltage, frequency and load. Under current operational conditions, the boiler produces up to 35,000 kg/h of steam at 65 bar and 520°C while it consumes 10.5 t/h of rice husks. The boiler will operate with an utilization factor of 35% due to the fact of the limitation of the rice husks supply. The steam feeds a multistage steam condensing turbine at 0.09 bar. Before the turbine inlet, up to 50% of total steam generated is deviated to process heat. The steam turbine drives a 3 phase synchronous generator producing up to 6,000 kWe at 13,800 V and 60 Hz.

An integration panel allows synchronicity and full load control for the auxiliary power plant services, rice mill and export to the grid. Electricity is sent to the utility distribution lines through a transformer of 13.8 kV. The project will complies with the Brazilian and State environmental standards, mainly regarding to the control flue gas emissions and wastes. The ash from the plant can be sold as a beneficial by-product, however it was not considered in the feasibility study aiming a conservative scenario.

The project uses the above described environmentally safe and sound technology, which leads to utilization of husks otherwise left for decay and replacement of carbon based electricity generation. PTZ

Bioenergy Ltd already has accumulated a large experience in engineering, projecting and constructing power plants at rice industries with conventional high pressure boilers in co-generation, with a similar concept of process engineering. Similar technology has been used by PTZ to combust rice husks at the CAMIL rice mill project (2001), a 4.2 MWe power plant in Itaqui-RS, Brazil, and a 3.0 MWe project at the URBANO rice mill Project (1999) in Jaraguá do Sul city, Santa Catarina State, Brazil, differing only in the equipment's scale.

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

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

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

Rio Grande do Sul and Santa Catarina States are the only two states in Brazil that use coal fired thermal power plants complementing the electricity demand in the integrated electrical south-southeast-midwest brazilian grid. By the replacement of power from the grid and by supply of electricity to the grid, carbon emissions from the coal combustion in electricity plants are avoided. The grid emission factor was calculated in a transparent way, using the most recent data from ONS[2], Eletrobrás[3] and ANEEL[4] corresponding to the south-southeast-midwest Brazilian interconnected Electrical System. The grid emission factor obtained was 0.248 tonnes of CO_2/MWh.

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

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

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[2] Operador Nacional do Sistema Elétrico (www.ons.org.br)

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

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

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

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

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

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

Source: IRGA (2004).

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

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

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

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

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Table 3: Net emission reduction by the bundle of project emissions (tonnes CO_2 equivalent per year)

Year	**Type I.D grid connected renewable electricity generation**	**Type III.E Avoidance of methane production**	**Total net emission reduction**
	Net emission reduction (A)	Net emission reduction (B)	(A) + (B)
1 Sep - 31 Dec 2008	**2,700**	**2,853**	**5,553**
2009	**8,100**	**8,099**	**16,199**
2010	**8,100**	**12,265**	**20,365**
2011	**8,100**	**15,572**	**23,672**
2012	**8,100**	**18,197**	**26,297**
2013	**8,100**	**20,280**	**28,380**
2014	**8,100**	**21,934**	**30,034**
1 Jan - 31 Aug 2015	**5,400**	**15,497**	**20,897**
Total estimated reductions	**56,700**	**114,697**	**171,397**
Total number of crediting years	**7**	**7**	**7**
Annual average over the first crediting period of estimated reductions (tonnes of CO_2 e)	**8,100**	**16,385**	**24,485**

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

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There has been no public funding to the project.

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

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

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

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

SECTION B. Application of a baseline methodology:

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

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

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

Reference: Appendix B of the simplified modalities and procedures for small scale CDM project activities (version 09: 12 May 2006).

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

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The applicability criteria of the Category I.D. 'Grid connected renewable electricity generation' are:
Technology/measure

1. This category comprises renewable energy generation units, such as photovoltaics, hydro, tidal/wave, wind, geothermal, and renewable biomass, that supply electricity to and/or displace electricity from an electricity distribution system that is or would have been supplied by at least one fossil fuel fired generating unit.
2. If the unit added has both renewable and non-renewable components (e.g.. a wind/diesel unit), the eligibility limit of 15MW for a small-scale CDM project activity applies only to the renewable component. If the unit added co-fires fossil fuel, the capacity of the entire unit shall not exceed the limit of 15MW.

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

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

The project conforms to the above mentioned conditions in the following ways:
Ad. 1. The project comprises the use of rice husks, which is a renewable biomass to be used to supply electricity to and/or displace electricity from the south-southeast Brazilian electricity distribution system. Rio Grande do Sul and Santa Catarina States are the only two states in Brazil who presents coal fired power plants complementing the energy demand in the integrated electrical south-southeast Brazilian grid. Thus the project activity replaces the use of at least one fossil fuel.
Ad. 2. The unit uses only rice husks, which is renewable biomass.
Ad. 3. The plant has a maximum output of heat (15.5 MWth) and power (6.0 MWe). The sum of these outputs is below the limit of 45 MWthermal.
Ad. 4. The biomass power plant is the first one to be installed in JOSAPAR Itaqui. The maximum output power of 6.0 MWe is below the limit of 15 MW established to be qualified as a small scale CDM project activity.
Ad. 5. The project is not a retrofitted or modified facility. The biomass power plant will be a new facility that will produce a maximum of 6.0 MWe that is below the limit of 15 MW.

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

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

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

3. This category is applicable for project activities resulting in annual emission reductions lower than 25,000 ton CO_2e. If the emission reduction of a project activity exceeds the reference value of 25,000 ton CO_2e in any year of the crediting period, the annual emission reduction for that particular year is capped at 25,000 ton CO_2e.

Decay is prevented through controlled combustion of rice husks and less methane is produced and emitted to the atmosphere. Emissions through combustion of non-biomass carbon are null once the waste composition is 100% rice husks. The emissions through electricity or diesel consumption are zero, once the Biomass Power Plant will be fully supplied by a renewable source. The emissions related to the biomass transportation are zero because all the rice husks are generated in the rice mill, where the project will be implemented. The project emissions will result just from the ash transportation, which is maximally 5 tonnes of carbon dioxide equivalent annually. Therefore, project emissions leads to direct carbon emissions of less than 15 kilo tonnes of carbon dioxide equivalent annually. The maximum emission reduction for this project activity is 21,934 tCO_2e, which is below the established limit of 25,000 tCO_2e in any year of the crediting period.

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

Assumptions of the baseline methodology

To estimate the baseline emissions related to grid connected renewable electricity generation the baseline calculations as indicated under category I.D. of Appendix B are applied. The combined margin (CM), consisting of the combination of operating margin (OM) and build margin (BM), was calculated according to the procedures prescribed in the approved methodology ACM0002. The option for the ex-ante estimation of the Simple Adjusted OM and the Build Margin (BM) was choose.

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

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

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Attachment A to Appendix B indicated that project participants shall provide an explanation to show that the project activity would not have occurred anyway due to at least one of the following barriers:

(a) Investment barrier: a financially more viable alternative to the project activity would have led to higher emissions;

(b) Technological barrier: a less technologically advanced alternative to the project activity involves lower risks due to the performance uncertainty or low market share of the new technology adopted for the project activity and so would have led to higher emissions;

(c) Barrier due to prevailing practice: prevailing practice or existing regulatory or policy requirements would have led to implementation of a technology with higher emissions;

(d) Other barriers: without the project activity, for another specific reason identified by the project participant, such as institutional barriers or limited information, managerial resources, organizational capacity, financial resources, or capacity to absorb new technologies, emissions would have been higher.

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

Scenario 1 - Continuation of current activities

This scenario represents continuation of the current practices. Rice husks are left for decay, and because no electricity is produced with rice husks, all needed -fossil fuel based- electricity is delivered by the grid.

Scenario 2 - Construction of a renewable energy plant

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

With respect to the **investment** barrier:

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

The financial barrier is demonstrated through a financial analysis, which the results are presented in table 4 below. The carbon revenues increase the returns of the project transforming this into an attractive investment for the company and financial agents.

Table 4: Financial Analysis Results

	With Carbon	Without Carbon
Net Present Value (US$)	587,244.45	-324,597.68
IRR	12.61%	8.23%
Discount Rate	9.75%	
Present Value of carbon sold (7 years) US$	1,546,426.93	

The Internal rate return and the Net Present Value were obtained based on the power plant cash flow presented in Table 5 below.

Table 5: Cash Flow

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
(+) Electricity Revenues	-	794,880	866,419	944,397	1,029,393	1,122,038	1,223,021	1,333,093	1,453,072	1,583,848
(-) Taxes	-	35,770	38,989	42,498	46,323	50,492	55,036	59,989	65,388	71,273
(-) Fixed Costs	-	178,684	180,470	182,275	184,098	185,939	187,798	189,676	191,573	193,489
(-) Variable Costs	-	88,304	89,187	90,079	90,980	91,889	92,808	93,736	94,674	95,621
(-) Interest	690,582	1,162,686	1,027,826	839,816	654,814	469,812	285,784	99,807	0	0
(-) Depreciation	-	373,005	373,005	373,005	373,005	373,005	373,005	373,005	373,005	373,005
(=) Gross profit	**-**	**-1,043,568**	**-843,058**	**-583,276**	**-319,826**	**-49,098**	**228,590**	**516,880**	**728,432**	**850,461**
(-) Income tax	-	0	0	0	0	0	77,721	175,739	247,667	289,157
(+) Electricity save	-	593,720	666,569	748,357	840,181	943,271	1,059,010	1,188,951	1,334,835	1,498,619
(+) Transportation fuel save	-	90,667	98,827	107,721	117,416	127,983	139,502	152,057	165,742	180,659
(+) Carbon Credits	-	73,639	220,918	220,918	220,918	220,918	220,918	147,279	0	0
(=) Net profit	**-**	**-285,542**	**143,256**	**493,721**	**858,689**	**1,243,074**	**1,570,300**	**1,829,427**	**1,981,342**	**2,240,582**
(+) Depreciation	-	373,005	373,005	373,005	373,005	373,005	373,005	373,005	373,005	373,005
(=) Incomes generated	**-**	**87,463**	**516,261**	**866,725**	**1,231,693**	**1,616,079**	**1,943,305**	**2,202,432**	**2,354,347**	**2,613,587**
(-) Loan repayments	-	388,533	1,165,598	1,165,598	1,165,598	1,165,598	1,165,598	1,165,598	0	0
(-) JOSAPAR equity	1,800,159	45,371	0	0	0	0	0	0	0	0
(+) Current Asset applications	354,577	354,577	0	0	0	0	0	0	0	0
(=) Cash Flow	**-2,136,163**	**-82,710**	**-649,337**	**-298,873**	**66,095**	**450,481**	**777,707**	**1,036,834**	**2,354,347**	**2,613,587**

*All presented values are in US$

With respect to the **technological** barrier:

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

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

- The continuation of current practices (Scenario 1) presents no particular obstacles. This practice has been used effectively in the past with good results, and the continued operation of existing facilities and actual practices presents no real barriers. Moreover, Brazil has a huge rice industry, with more than 350 rice mills. A considerable fraction, about 60%, of rice production is located in the south region (IRGA 2004)[5]. The south Brazilian region, i.e. the states of Rio Grande do Sul, Santa Catarina and Paraná, have no recorded problems with power supply, even along the electricity crisis observed at 2001. Environmental agencies have been approving new areas for disposing the industrial residues, as rice husks, with clear and effective rules, in such a way that only the distance, and by consequence the costs, will represent obstacles for taking the residues into consideration as a pressure to perform future projects.

- The Brazilian technologies in rice mills are very updated with global technologies employed, representing the state of art on rice mills technology. The efficiency of the process reaches around 98% of the commercial matter in the grain. Usually 78% of the rice is transformed in products. The other 22-23% are rice residues. Given the large number of rice mills in the south region the biomass residue generation is concentrated in the south region, creating an excess of biomass residues that the market cannot absorb. According to CIENTEC[6] more than 59,60 % of residues are not used or sold. Currently only 6 small-scale power plants operate at the south region of Brazil. From 2002, no new plants were build, mainly due to the lack of feasibility. Thus, there are many large biomass piles that are left for decay, generating methane during this process.

- The construction of a new renewable energy plant (Scenario 2) doesn't represent a deviation from the company's core business (rice production) once the energy costs avoided will be utilized to sell beneficed rice for a lower price or to increment the profit margin of the product. Therefore, the steam generated by the boiler will be used to achieve a higher quality in the rice process. Currently JOSAPAR has a great amount of rice husks that guaranties the supply for the future plant.

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

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

Table 6 below summarises the results of the analysis regarding the barriers faced by each of the plausible scenarios. As the table indicates, Scenario 1 faces no barriers, whereas Scenario 2 faces the financial/economic barrier.

Table 6: Summary of Barriers Analysis

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

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

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

- The Baseline Scenario presents the discharge of 19,827 t/year of rice husks in the landfills. The amount 12,051 tonnes of rice husks per year is already prevented to be land filled through the combustion in furnaces. All electricity is delivered by the grid, which is partly based on fossil fuels, mainly in the south region that has a considerable concentration of coal Thermo power plants, and consequently has associated CO_2 emission.

- The Project Scenario is represented by the construction of a new renewable energy plant of 6,0 MW. This implementation will provide steam for the drying rice process, process heat and electricity. The amount of rice husks consumed will be 31,878 tonnes per year. The methane emissions due to biomass decay will be eliminated. The electricity imported from the grid, which is partly generated by fossil fuel, will be displaced, contributing to GHG emission reductions.

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

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

>>

According to category I.D. the project boundary encompasses the physical, geographical site of the renewable generation source.

According to category III.E. the project boundary is the physical, geographical sites where:

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

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

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

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

Landfill location: Rio Grande do Sul State
Itaqui City
Granja Sementeiro – Horto Florestal

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

>>

The baseline for grid connected renewable electricity generation is based on methodology AMS I.D. of annex B of the simplified modalities and procedures for small-scale CDM project activities (Version 09: 28 July 2006). The baseline is the kWh produced by the renewable generating unit multiplied by an emission coefficient, calculated in a transparent and conservative manner as described in the methodology AMS I.D. of Appendix B.

The baseline for avoidance of methane production from biomass decay through controlled combustion is based on methodology AMS III.E. of annex B of the simplified modalities and procedures for small-scale CDM project activities (Version 09: 12 May 2006). The baseline scenario is the situation where, in the absence of the project activity, biomass and other organic matter is left to decay within the project boundary and methane is emitted to the atmosphere. The baseline emissions are the amount of methane from the decay of the biomass or organic waste treated in the project activity.

Date of completion: 18/05/2006

Name of person/entity determining the baseline:

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

Contact details are listed in Annex I.

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

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

>>

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

>>

01/07/2007

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

>>

30 years

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

>>

C.2.1. Renewable crediting period:

>>

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

>>

01/09/2008

C.2.1.2. Length of the first crediting period:

>>

7 years, 0 months

C.2.2. Fixed crediting period:

>>

C.2.2.1. Starting date:

>>

C.2.2.2. Length:

>>

SECTION D. Application of a monitoring methodology and plan:

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

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Monitoring methodology of category I.D. as described in 'Appendix B of the simplified modalities and procedures for small-scale CDM project activities' (Version 09: 28 July 2006).

Monitoring methodology of category III.E. as described in 'Appendix B of the simplified modalities and procedures for small-scale CDM project activities' (Version 09: 12 May 2006).

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

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

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

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

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

$ER_y = BE_y – (PE_y + Leakage_y)$

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

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

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

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

Project activity emissions consist of:

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

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

where:

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

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

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

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

where:

EF_{CO2} CO_2 emission factor from fuel use due to transportation ($kgCO_2/km$, IPCC default values or local values can be used.

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

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

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

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

It is justified to apply monitoring methodology belonging to category III E as described in 'Appendix B of the simplified modalities and procedures for small-scale CDM project activities' (Version 09: 12 May 2006).

D.3 Data to be monitored:

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Table 7: D 3.1 Data to be collected necessary for determining the baseline of anthropogenic emissions and the project emissions and how this data will be archived, related to project category I.D. ' grid connected renewable electricity generation':

ID-number	*Data variable*	*Source of data*	*Data unit*	*Measured (m), calculated (c) or estimated (e)*	*Recording frequency*	*Proportion of data to be monitored*	*How will the data be archived? (Electronic/ paper)*	*Comment*
D.3.1	Electricity imported from the grid	Electricity ingress register and electricity bills	kWh	m	Continuous and monthly	100%	Electronic and paper	The electricity imported from the grid is monitored by an energy ingress register and by the energy bills expedited monthly by the electricity concessionary
D.3.2	Gross electricity generated by the project	Electronic supervisory system of the biomass power plant.	kWh	m	Continuous	100%	Electronic and paper	The gross electricity generated by the project activity (electricity delivered to the grid and delivered to the own rice mill) is recorded in the electronic supervisory system of the power plant.
D.3.3	Net electricity delivered to the grid	Electronic supervisory system of the biomass power plant.	kWh	m	Continuous	100%	Electronic and paper	The net electricity delivered to the grid is recorded in the electronic supervisory system of the power plant.
D 3.4	Baseline emission factor	ONS, Eletrobrás and ANEEL	tonnes CO_2/ MWh	c	At validation	100%	Electronic and paper	Baseline emission factor consists of Operating Margin emission factor and Build Margin emission factor, and calculated from the efficiency, carbon emission factor , electricity production and fuel consumption of the electricity generation plants connected to the south-southeast-midwest interconnected grid.

Table 8: D 3.2 Data to be collected necessary for determining the baseline of anthropogenic emissions and the project emissions and how this data will be archived, related to project category III.E. ' Avoidance of methane production from biomass decay through controlled combustion':								
ID-number	*Data variable*	*Source of data*	*Data unit*	*Measured (m), calculated (c) or estimated (e)*	*Recording frequency*	*Proportion of data to be monitored*	*How will the data be archived? (Electronic/ paper)*	*Comment*
D.3.5	Amount of rice husks generated	Rice production	tonne / month	m	Monthly	100%	Electronic and paper	The monthly rice production times the rice to husk factor (22%) indicates the amount of rice husks generated.
D. 3.6	Amount or rice husks removed by truck	Documentation on transportation transactions	tonne/ month	m	Monthly	100%	Electronic and paper	The weight of the empty truck and the loaded truck are measured by a weight measure system at the rice mill. The resulting amounts of rice husks removed by truck are registered on truck bills and archived.
D. 3.7	Amount of biomass consumed by the project	D 3.5 D 3.6	tonne / month	c	Monthly	100%	Electronic and paper	Value calculated as generated rice husks (D 3.5) minus removed rice husks (D. 3.6)
D 3.8	Amount of biomass that would have been consumed in baseline scenario	Rice production and documentation on transportation transactions	tonne/ year	m	At validation	100%	Electronic and paper	Value calculated as generated rice husks (D 3.5) minus removed rice husks (D. 3.6) from the year before the project implementation.
D 3.9	Net amount of biomass prevented from being left to decay	D. 3.7 D. 3.8	tonne/ month	c	Monthly	100%	Electronic and paper	D.3.7 - D.3 8. This value equals $Q_{biomass}$ in the formulae in section E

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

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

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Table 9: D. 4.1 Quality control (QC) and quality assurance (QA) procedures are being undertaken for data monitored, related to category I.D.

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

Table 10: D. 4.2 Quality control (QC) and quality assurance (QA) procedures are being undertaken for data monitored, related to category III.E.		
ID number	*Uncertainty level of data (High/Medium/Low)*	*Explain QA/QC procedures planned for these data, or why such procedures are not necessary.*
D.3.5	Low	Rice is the main product of the factory and its production volumes known in detail. Production of rice husks is directly related to the production of rice and can be derived from rice production numbers.
D. 3.6	Low	The amount of rice husks removed by truck is monitored accurately, as all truck loads are registered.
D. 3.7	Low	The rice husk consumption is measured by the difference between the produced rice husks and the rice husks removed by truck. This data can be double-checked in two ways: 1. By measuring the ash production. The ash production is directly related to the quantity of rice husks consumed. The average ash content of rice husks can be obtained from literature or lab analysis. Truck bills provide the mass of the removed ash, thereby taking into account that a slight percentage of the flying ashes are not captured in the cyclones. 2. By determination of the steam enthalpy. Temperature, pressure and flow of the boiler outlet steam are constantly monitored by the supervisory system. This information can give the steam enthalpy. With the steam enthalpy and the boiler efficiency, the amount of rice husks demanded can be determined. Formulae: Qbiomass = (Hsteam/ η_{BOILER})/$LHV_{RICE\ HUSK}$
D. 3.8	Low	See D.3.5 and D.3.6
D.3.9	Low	It is a calculated value based on D 3.7-D 3.8, so no additional QC and QA procedures will be applied.
D. 3.10	Low	The ash content of rice husks hardly varies. No additional QC and QA procedures are necessary.
D. 3.11	Low	The ash removal is measured in a flux balance. This data can be double-checked in two ways: 1. By the weight registered in the truck bills for the trucks removing the ash from the industry. 2. Multiplying the biomass combusted (D.3.9) by the ash content in the rice husk (18%).
D. 3.12	Low	A standard truck with a constant volume is used. This value can be double-checked by ash quantity generated in a given period divided by the amount of trucks with ash leaving the industry, which is registered in the truck bill, in a given period.
D. 3.13	Low	It can be easily determined running the truck itinerary and registering the distance in the kilometer counting system of the vehicle. It can be double-checked establishing the starting and the ending point of the trajectory and than measuring the distance in the map.
D. 3.14	Low	Most recent IPPC default values
D. 3.15	Low	It is a calculated value based on D.3.11, D.3.12, D.3.13, D.3.14 so besides QC and QA of these separate values (as described elsewhere in this table), no additional QC and QA procedures need to be applied.

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

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

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

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

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

>>

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

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

SECTION E. Estimation of GHG emissions by sources:

E.1. Formulae used:

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E.1.1 Selected formulae as provided in Appendix B:

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Category I.D.

No formula is provided to quantify the emission reduction of electricity generation in the Baseline of category I.D. of appendix B. In words it is described that:

Baseline emissions

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

(a) A combined margin (CM), consisting of the combination of operating margin (OM) and build margin (BM) according to the procedures prescribed in the approved methodology ACM0002. Any of the four procedures to calculate the operating margin can be chosen, but the restrictions to use the Simple OM and the Average OM calculations must be considered

OR

(b) The weighted average emissions (in kg CO_2equ/kWh) of the current generation mix. The data of the year in which project generation occurs must be used.

Category III.E.

Baseline emissions

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

where,

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

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

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

where:

F	is fraction of methane in the landfill gas (default 0.5)
DOCj	is per cent of degradable organic carbon (by weight) in the waste type j
DOCf	is fraction of DOC dissimilated to landfill gas (IPCC default 0.77)
MCF	is Methane Correction Factor (fraction, IPCC default 1.0)
Aj,x	is amount of organic waste type j landfilled in the year x (tonnes/year)
kj	is decay rate for the waste stream type j

J is waste type distinguished into the waste categories (from A to D), as illustrated in the table below

x is year since the landfill started receiving wastes: x runs from the first year of landfill operation (x=1) to the year for which emissions are calculated (x=y)

y is year for which LFG emissions are calculated

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

[1)] Excluding lignin-C

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

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

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

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

where:

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

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

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

where:

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

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

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

where:

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

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

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

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

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

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

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

$$BEy = EGy * EFy$$

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

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

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

The Operating Margin emission factor (*EF_OMy*) is calculated according to the procedures prescribed in the approved methodology ACM0002 – option (b):

Simple Adjusted OM:

$$EF_{OM,simple\_adjusted,y} = (1-\lambda_y)\cdot\frac{\sum_{(i,j)} F_{i,j,y}\cdot COEF_{i,j}}{\sum_j GEN_{i,j}} + \lambda_y\cdot\frac{\sum_{(i,k)} F_{i,k,y}\cdot COEF_{i,k}}{\sum_k GEN_{k,y}}$$

Where:

k	low-cost/must-run power sources;
j	power sources delivering electricity to the grid, not including low-operating cost and mustrun power plants, and including imports to the grid;
$F_{i,j,y}$	is the amount of fuel *i* (in a mass or volume unit) consumed by relevant power sources *j* in year(s) *y*;
$F_{i,k,y}$	is the amount of fuel *i* (in a mass or volume unit) consumed by relevant power sources *k* in year(s) *y*;
$COEF_{i,j,y}$	is the CO_2 emission coefficient of fuel *i* (tCO_2 / mass or volume unit of the fuel), taking into account the carbon content of the fuels used by relevant power sources *j* and the percent oxidation of the fuel in year(s) *y*;
$COEF_{i,k,y}$	is the CO_2 emission coefficient of fuel *i* (tCO_2 / mass or volume unit of the fuel), taking into account the carbon content of the fuels used by relevant power sources *k* and the percent oxidation of the fuel in year(s) *y*;
$GEN_{j,y}$	is the electricity (MWh) delivered to the grid by source *j*.
$GEN_{k,y}$	is the electricity (MWh) delivered to the grid by source *k*.

$$\lambda_y = \frac{\text{"number of hours per year for which low - cost / must - run souces are on margin"}}{\text{"8760 hours per year"}}$$

Lambda (λy) should be calculated as follows:

Step i) Plot a Load Duration Curve. Collect chronological load data (typically in MW) for each hour of a year, and sort load data from highest to lowest MW level. Plot MW against 8760 hours in the year, in descending order.
Step ii) Organize Data by Generating Sources. Collect data for, and calculate total annual generation (in MWh) from low-cost/must-run resources (i.e. *ΣkGENk,y*).
Step iii) Fill Load Duration Curve. Plot a horizontal line across load duration curve such that the area under the curve (MW times hours) equals the total generation (in MWh) from lowcost/must-run resources (i.e. *ΣkGENk,y*).
Step iv) Determine the "Number of hours per year for which low-cost/must-run sources are on the margin". First, locate the intersection of the horizontal line plotted in step (iii) and the load duration curve plotted in step (i). The number of hours (out of the total of 8760 hours) to the right of the intersection is the number of hours for which low-cost/must-run sources are on the margin. If the lines do not intersect, then one may conclude that lowcost/must-run sources do not appear on the margin and λy is equal to zero. Lambda (λy) is the calculated number of hours divided by 8760.

The CO_2 emission coefficient *COEFi* is obtained as:

$COEF_i = NCV_i \,.\, EF_{CO2,i} \,.\, OXID_i$

where:

NCV_i	is the net calorific value (energy content) per mass or volume unit of a fuel *i*;
$OXID_i$	is the oxidation factor of the fuel (see page 1.29 in the 1996 Revised IPCC Guidelines for default values);
$EF_{CO2,i}$	is the CO_2 emission factor per unit of energy of the fuel *i*.

Where available, local values of NCV_i and $EF_{CO2,i}$ should be used. If no such values are available, country-specific values (see e.g. IPCC Good Practice Guidance) are preferable to IPCC world-wide default values.

The *Simple Adjusted* OM was calculated using the following data vintage:

(Ex-ante) the full generation-weighted average for the most recent 3 years for which data are available at the time of PDD submission

The Build Margin emission factor (EF_BM_y) is the weighted average emission factor of a sample of power plants *m*:

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

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

The option 1 was selected to calculate the Build Margin emission factor:

Ex-ante based on the most recent information available on plants already built for sample group *m* at the time of PDD submission. The sample group *m* consists of either the five power plants that have been built most recently, or the power plant capacity additions in the electricity system that comprise 20% of the system generation (in MWh) and that have been built most recently. Project participants should use from these two options that sample group that comprises the larger annual generation.

Formulae to supplement equations presented in category III.E of annex B.
The amount of combustion residues produced is determined in the following way:

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

Where,
Q_{ash} quantity of combustion residues produced (tones/year)
AC ash content in rice husks (18% weight)
$Q_{biomass}$ Quantity of biomass treated under the project activity (tones/year)

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

Category I.D.

The project emissions are negligible.

Category III.E.

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

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

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

$PE_{y,comb} = Q_{y,non\text{-}biomass} * 44/12 + Q_{y,fuel} * E_{y,fuel}$
where:
$Q_{y,non\text{-}biomass}$ Non-biomass carbon of the waste combusted in the year "y" (tonnes of Carbon)
$Q_{y,fuel}$ Quantity of auxiliary fuel used in the year "y" (tonnes)
$E_{y,fuel}$ CO_2 emission factor for the combustion of the auxiliary fuel (tonnes CO2 per tonne fuel, according to IPCC Guidelines)

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

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

where:
Q_y quantity of waste combusted in the year "y" (tonnes)
CT_y average truck capacity for waste transportation (tonnes/truck)
DAF_w average incremental distance for waste transportation (km/truck)

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

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

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

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

>>

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

Category III.E.
No leakage calculation is required.

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

>>

Category I.D.
The small-scale project activities are zero.

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

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

>>

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

$BE_{el} = EGy * EFy$

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

Category III.E.
Baseline emissions

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

where,

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

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

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

where:

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

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

[1)] Excluding lignin-C

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

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

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

>>

Category I.D.

Emission reduction by grid connected renewable electricity production during a given period equals:

$ER_{ID} = BE_{el}$

where,

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

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

$ER_{IIIE} = BE_y - PE_y$

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

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

$ER_{total} = ER_{ID} + ER_{IIIE}$

ER_{total} Total net emission reduction by the bundle of project activities (tonnes CO_2 equivalent)
ER_{ID} Emission reduction due to grid connected renewable electricity production (tonnes CO_2equ)
ER_{IIIE} Emission reduction by the avoidance of methane production from biomass decay through controlled combustion (tonnes of CO_2 equivalent)

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

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

>>

Table 11: Emission reduction by grid connected renewable electricity generation

Indicator	Abbreviation	Value	Unit
Lambda at 2003	λ_{2003}	0,531	dimensionless fraction
Lambda at 2004	λ_{2004}	0.506	dimensionless fraction
Lambda at 2005	λ_{2005}	0.513	dimensionless fraction
Operating margin emission factor	EF_OMy	0.404	tonnes CO_2/MWh
Build margin emission factor	EF_BMy	0.092	tonnes CO_2/MWh
Baseline emission factor	EFy	0.248	tonnes CO_2/MWh
Annual net electricity generated by the Project	EGy	32,663	MWh
Baseline emissions	BEel	8,100	tonnes CO_2/year
Project emissions	n.a.	0	tonnes CO_2/year
Emission reduction from electricity generation	ERID	8,100	tonnes CO_2/year

Table 12: Emission reduction by avoidance of methane production from biomass decay through controlled combustion

Indicator	Abbreviation	Value	Unit
methane correction factor	MCF	1.0	dimensionless fraction
degradable organic carbon	DOC	0.15	dimensionless fraction
fraction DOC dissimilated to landfill gas	DOC_F	0.77	dimensionless fraction
fraction of CH_4 in landfill gas	F	0.5	dimensionless fraction
decay rate for the rice husk	k	0.231	$year^{-1}$
Quantity of biomass treated under the project activity	$Q_{biomass}$	19,827	tonnes/year
GWP for CH_4	CH_4_GWP	21	tonnes of CO2 equivalent/tonne of CH4
Baseline methane emissions from biomass decay	BEy	16,391	tonnes of CO2 equivalent/year
Non-biomass carbon of the waste combusted	$Q_{y,non\text{-}biomass}$	0	tonnes of Carbon/year
Quantity of auxiliary fuel used	$Q_{y,fuel}$	0	tonnes/year
CO_2 emission factor for the combustion of the auxiliary fuel	$E_{y,fuel}$	n.a.	tonnes CO_2/tonne fuel
Emissions through combustion of non-biomass carbon	$PE_{y,comb}$	0	tonnes of CO2 equivalent/year
Quantity of waste combusted	Q_y	19,827	tonnes/year
Average truck capacity for waste transportation	CT_y	n.a.	tonnes/truck
Average incremental distance for waste transportation	DAF_w	0	km/truck
CO_2 emission factor from fuel use due to transportation	EF_{CO2}	0.674	kgCO2/km
Ash content in the rice husk	AC	0.18 [a]	dimensionless fraction (%wt)
Quantity of combustion residues produced	$Q_{y,ash}$	5,569	tonnes/year
Average truck capacity for combustion residues transportation	$CT_{y,ash}$	4.5	tonnes/truck
Average distance for combustion residues transportation	DAF_{ash}	10	km/truck
Emissions through incremental transportation	$PE_{y,transp}$	5	tonnes of CO2 equivalent/year
Emissions through electricity or diesel consumption	$PE_{y,power}$	0	tonnes of CO2 equivalent/year
Project activity emissions	PE_y	5	tonnes of CO2 equivalent/year
Emission reduction by avoidance of methane production from biomass decay	ER_{IIIE}	16,385	tonnes of CO2 equivalent/year

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

Table 13: Net emission reduction by the bundle of projects (tonnes CO_2 equivalent per year)

	Type I.D grid connected renewable electricity generation			**Type III.E Avoidance of methane production**			**Total net emission reduction**
Year	Baseline emissions (A)	Project emissions (B)	Net emission reduction (A-B)	Baseline emissions (C)	Project emissions (D)	Net emission reduction (C-D)	(A-B) + (C-D)
1 Sep - 31 Dec 2008	**2,700**	**0**	**2,700**	**2,855**	**2**	**2,853**	**5,553**
2009	**8,100**	**0**	**8,100**	**8,104**	**5**	**8,099**	**16,199**
2010	**8,100**	**0**	**8,100**	**12,270**	**5**	**12,265**	**20,365**
2011	**8,100**	**0**	**8,100**	**15,577**	**5**	**15,572**	**23,672**
2012	**8,100**	**0**	**8,100**	**18,202**	**5**	**18,197**	**26,297**
2013	**8,100**	**0**	**8,100**	**20,285**	**5**	**20,280**	**28,380**
2014	**8,100**	**0**	**8,100**	**21,939**	**5**	**21,934**	**30,034**
1 Jan - 31 Aug 2015	**5,400**	**0**	**5,400**	**15,501**	**4**	**15,497**	**20,897**
Total estimated reductions	**56,700**	**0**	**56,700**	**114,733**	**36**	**114,697**	**171,397**
Total number of crediting years	**7**	**7**	**7**	**7**	**7**	**7**	**7**
Annual average over the first crediting period of estimated reductions (tonnes of CO_2 e)	**8,100**	**0**	**8,100**	**16,390**	**5**	**16,385**	**24,485**

*to not exceeds the limit of 25,000 ton CO_2-eq/year established in the methodology AMS III.E

SECTION F. Environmental impacts

>>

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

>>

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

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

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

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

SECTION G. Stakeholders' comments:

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

>>

According to the Resolution nº 1 dated on 2nd December 2003, from the Brazilian Inter-Ministerial Commission of Climate Change - CIMGC, decreed on 7th July 1999, any CDM projects must send a letter with description of the project and an invitation for comments by local stakeholders. In this case, letters were sent to the following local stakeholders:

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

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

G.2. Summary of the comments received:

>>

1. City Hall of Itaqui.

2. Local communities associations

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

>>

1. The City Hall of Itaqui congratulated the project initiative.
2. The local communities associations congratulated the project initiative and suggest destining the surplus of electricity generated to social institutions.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Project participants

Organization:	JOSAPAR – Joaquim Oliveira S.A. Participações
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Annex 2

INFORMATION REGARDING PUBLIC FUNDING

This project will not receive any public funds.

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Annex 3

Summary Table

Ex-ante estimation

Year	2003	2004	2005	**Average**
Electricity generated (MWh)	295,666,971	301,422,618	315,754,960	**304,281,516**
Electricity generated excluding low cost/must-run power sources (MWh)	14,262,645	18,157,904	17,842,905	**16,754,485**
Emissons (tCO_2)	12,086,653	14,922,077	14,919,154	**13,975,961**
λ	0.531	0.506	0.513	**0.517**
EF_OM (tCO_2/MWh)	0.397	0.406	0.407	**0.404**
20% of Total generated (MWh)	59,133,394	60,284,524	63,150,992	**60,856,303**
Total generated by the last 5 plants built (MWh)	1,177,754	2,605,422	777,845	**1,520,340**
EF_BM (tCO_2/MWh)	0.078	0.102	0.097	**0.092**
w_OM	0.5	0.5	0.5	**0.5**
w_BM	0.5	0.5	0.5	**0.5**
EF (tCO_2/MWh)	0.238	0.254	0.252	**0.248**

Biomass and electricity aspects in the JOSAPAR Biomass Co-generation Project

Year	**Electricity generated/year (MWh)**	**Amount of rice husks produced (kg/year)**	**Amount of rice husks consumed (kg/year)**	**Amount of rice husks consumed in the Project Activity (kg/year)**	**Amount of rice husks to the landfill (kg/year)**	**% Consumed**
2007	-	31,878,000	12,051,000	0	19,827,000	38%
2008	10,888	31,878,000	20,612,000	8,561,000	11,266,000	65%
2009	32,663	31,878,000	31,878,000	19,827,000	0	100%
2010	32,663	31,878,000	31,878,000	19,827,000	0	100%
2011	32,663	31,878,000	31,878,000	19,827,000	0	100%
2012	32,663	31,878,000	31,878,000	19,827,000	0	100%
2013	32,663	31,878,000	31,878,000	19,827,000	0	100%
2014	32,663	31,878,000	31,878,000	19,827,000	0	100%
2015	32,663	31,878,000	31,878,000	19,827,000	0	100%
2016	32,663	31,878,000	31,878,000	19,827,000	0	100%
2017	32,663	31,878,000	31,878,000	19,827,000	0	100%
2018	32,663	31,878,000	31,878,000	19,827,000	0	100%
2019	32,663	31,878,000	31,878,000	19,827,000	0	100%

BASELINE INFORMATION

The grid factor calculation was conduced with the following databases:

- Efficiency for thermal power plants:

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

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

- Electricity Generated at 2003, 2004, 2005:

National Operator from the Electricity System: www.ons.org.br

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

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

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

ONS Dispatched Data

Year: 2003

Grid	Fuel Source	Power Plant[1]	Start Date	Fossil Fuel Conversion Efficiency[4]	Efficiency for EF_BM calculations[5]	Carbon emission Factor[3] (tC/TJ)	Fraction carbon oxidized[3]	MWh generated[2]	tCO_2 for EF_OM calculation	tCO_2 for EF_BM calculation
SE-CO	H	Jauru	Sep-2003	1	1	0.0	0.0%	78.921	0	0
SE-CO	H	Gauporé	Sep-2003	1	1	0.0	0.0%	86.201	0	0
SE-CO	G	Três Lagoas	Aug-2003	0,32	0,32	15,3	99,5%	233.793	146.815	146.815
SE-CO	H	Funil (MG)	jan/03	1	1	0.0	0.0%	370.111	0	0
SE-CO	H	Itiquira I	Sep-2002	1	1	0.0	0.0%	408.728	0	0
S	G	Araucária	Sep-2002	0,32	0,32	15,3	99,5%	22	14	14
S	G	Canoas	Sep-2002	0,32	0,32	15,3	99,5%	182.256	114.451	114.451
SE-CO	H	Piraju	Sep-2002	1	1	0.0	0.0%	417.894	0	0
SE-CO	G	Nova Piratininga	jun/02	0,2197	0,32	15,3	99,5%	47.847	43.764	30.046
S	O	PCT CGTEE	jun/02	0,33	0,33	20,7	99,0%	0	0	0
SE-CO	H	Rosal	jun/02	1	1	0.0	0.0%	316.262	0	0
SE-CO	G	Ibirité	May-2002	0,32	0,32	15,3	99,5%	530.761	333.302	333.302
SE-CO	H	Cana Brava	May-2002	1	1	0.0	0.0%	2.200.434	0	0
SE-CO	H	Sta. Clara	jan/02	1	1	0.0	0.0%	169.471	0	0
S	H	Machadinho	jan/02	1	1	0.0	0.0%	3.436.304	0	0
SE-CO	G	Juiz de Fora	nov/01	0,32	0,32	15,3	99,5%	5.845	3.670	3.670
SE-CO	G	Macaé Merchant	nov/01	0,32	0,32	15,3	99,5%	2.389.507	1.500.537	1.500.537
SE-CO	H	Lajeado (ANEEL res. 402/2001)	nov/01	1	1	0.0	0.0%	4.457.790	0	0
SE-CO	G	Eletrobolt	Oct-2001	0,32	0,32	15,3	99,5%	242.364	152.197	152.197
SE-CO	H	Porto Estrela	Sep-2001	1	1	0.0	0.0%	410.136	0	0
SE-CO	G	Cuiaba (Mario Covas)	Aug-2001	0,32	0,32	15,3	99,5%	2.228.109	1.399.184	1.399.184
SE-CO	G	W. Arjona	jan/01	0,32	0,32	15,3	99,5%	549.729	345.213	345.213
S	G	Uruguaiana	jan/00	0,5	0,5	15,3	99,5%	1.751.486	703.923	703.923
S	H	S. Caxias	jan/99	1	1	0.0	0.0%	5.556.125	0	0
SE-CO	H	Canoas I	jan/99	1	1	0.0	0.0%	594.298	0	0
SE-CO	H	Canoas II	jan/99	1	1	0.0	0.0%	507.843	0	0
SE-CO	H	Igarapava	jan/99	1	1	0.0	0.0%	1.140.260	0	0
SE-CO	H	Porto Primavera	jan/99	1	1	0.0	0.0%	9.059.670	0	0
SE-CO	D	Cuiaba (Mario Covas)	Oct-1998	0,32	0,33	20,2	99,0%	0	0	0
SE-CO	H	Sobragi	Sep-1998	1	-	0.0	0.0%	341.073	0	0
SE-CO	H	PCH EMAE	jan/98	1	-	0.0	0.0%	103.188	0	0
S	H	PCH CEEE	jan/98	1	-	0.0	0.0%	240.724	0	0
S	H	PCH ENERSUL	jan/98	1	-	0.0	0.0%	119.405	0	0
SE-CO	H	PCH CEB	jan/98	1	-	0.0	0.0%	76.857	0	0
SE-CO	H	PCH ESCELSA	jan/98	1	-	0.0	0.0%	260.910	0	0
S	H	PCH CELESC	jan/98	1	-	0.0	0.0%	442.080	0	0
SE-CO	H	PCH CEMAT	jan/98	1	-	0.0	0.0%	966.348	0	0
SE-CO	H	PCH CELG	jan/98	1	-	0.0	0.0%	80.656	0	0
SE-CO	H	PCH CERJ	jan/98	1	-	0.0	0.0%	256.284	0	0
S	H	PCH COPEL	jan/98	1	-	0.0	0.0%	421.439	0	0
SE-CO	H	PCH CEMIG	jan/98	1	-	0.0	0.0%	564.461	0	0
SE-CO	H	PCH CPFL	jan/98	1	-	0.0	0.0%	328.332	0	0
SE-CO	H	S. Mesa	jan/98	1	-	0.0	0.0%	4.490.258	0	0
SE-CO	H	PCH EPAULO	jan/98	1	-	0.0	0.0%	0	0	0
SE-CO	H	Guilmam Amorim	jan/97	1	-	0.0	0.0%	511.414	0	0
SE-CO	H	Corumbá	jan/97	1	-	0.0	0.0%	1.604.930	0	0
SE-CO	H	Miranda	jan/97	1	-	0.0	0.0%	1.778.457	0	0
SE-CO	H	Noav Ponte	jan/94	1	-	0.0	0.0%	2.208.901	0	0
S	H	Segredo (Gov. Ney Braga)	jan/92	1	-	0.0	0.0%	5.253.636	0	0
SE-CO	H	Taquaruçu	jan/89	1	-	0.0	0.0%	2.251.810	0	0
SE-CO	H	Manso	jan/88	1	-	0.0	0.0%	841.600	0	0
S	H	D. Francisca	jan/87	1	-	0.0	0.0%	895.131	0	-
S	H	Itá	jan/87	1	-	0.0	0.0%	5.222.285	0	-
SE-CO	H	Rosana	jan/87	1	-	0.0	0.0%	2.029.045	0	-
SE-CO	N	Angra	jan/85	1	-	0.0	0.0%	13.355.432	0	-
SE-CO	H	T. Irmãos	jan/85	1	-	0.0	0.0%	2.493.761	0	-
SE-CO	H	Itaipu 60 Hz	jan/83	1	-	0.0	0.0%	46.309.279	0	-
SE-CO	H	Itaipu 50 Hz	jan/83	1	-	0.0	0.0%	36.692.448	0	-
SE-CO	H	Emborcação	jan/82	1	-	0.0	0.0%	3.928.062	0	-
SE-CO	H	Nova Avanhandava	jan/82	1	-	0.0	0.0%	1.377.657	0	-
S	H	Gov. Bento Munhoz - GBM	jan/80	1	-	0.0	0.0%	4.178.204	0	-
S	H	S.Santiago	jan/80	1	-	0.0	0.0%	6.124.508	0	-
SE-CO	H	Itumbiara	jan/80	1	-	0.0	0.0%	7.342.183	0	-
SE-CO	O	Igarapé	jan/78	0,2938	-	20,7	99%	33.791	31.112	-
S	H	Itauba	jan/78	1	-	0.0	0.0%	1.895.033	0	-
SE-CO	H	A. Vermelha (Jose E. Moraes)	jan/78	1	-	0.0	0.0%	7.280.135	0	-
SE-CO	H	S.Simão	jan/78	1	-	0.0	0.0%	10.850.060	0	-
SE-CO	H	Capivara	jan/77	1	-	0.0	0.0%	3.527.028	0	-
S	H	S.Osório	jan/75	1	-	0.0	0.0%	4.305.490	0	-
SE-CO	H	Marimbondo	jan/75	1	-	0.0	0.0%	6.614.912	0	-
SE-CO	H	Promissão	jan/75	1	-	0.0	0.0%	998.520	0	-
S	C	Pres. Medici	jan/74	0,2085	-	26	98%	1.306.186	2.107.038	-
SE-CO	H	Volta Grande	jan/74	1	-	0.0	0.0%	1.892.826	0	-
SE-CO	H	Porto Colombia	jun/73	1	-	0.0	0.0%	1.849.042	0	-
S	H	Passo Fundo	jan/73	1	-	0.0	0.0%	1.176.518	0	-
S	H	Passo Real	jan/73	1	-	0.0	0.0%	771.223	0	-
SE-CO	H	Ilha Solteira	jan/73	1	-	0.0	0.0%	16.060.345	0	-
SE-CO	H	Mascarenhas	jan/73	1	-	0.0	0.0%	777.134	0	-
S	H	Gov. Parigot de Souza - GPS	jan/71	1	-	0.0	0.0%	1.001.495	0	-
SE-CO	H	Chavantes	jan/71	1	-	0.0	0.0%	2.026.711	0	-
SE-CO	H	Jaguara	jan/71	1	-	0.0	0.0%	2.649.364	0	-
SE-CO	H	Sá Carvalho	Apr-1970	1	-	0.0	0.0%	302.343	0	-
SE-CO	H	Estreito (Luiz Carlos Barreto)	jan/69	1	-	0.0	0.0%	3.084.368	0	-
SE-CO	H	Ibitinga	jan/69	1	-	0.0	0.0%	600.891	0	-
SE-CO	H	Jupiá	jan/69	1	-	0.0	0.0%	8.944.402	0	-
S	O	Alegrete	jan/68	0,26	-	20,7	99%	0	0	-
SE-CO	G	Campos (Roberto Silveira)	jan/68	0,24	-	15,3	99,5%	0	0	-
SE-CO	G	Santa Cruz (RJ)	jan/68	0,3314	-	15,3	99,5%	540.073	327.483	-
SE-CO	H	Paraibuna	jan/68	1	-	0.0	0.0%	265.808	0	-
SE-CO	H	Limoeiro (Armando Sal es de Oliviera)	jan/67	1	-	0.0	0.0%	128.521	0	-
SE-CO	H	Caconde	jan/66	1	-	0.0	0.0%	340.046	0	-
S	C	J.Lacerda C	jan/65	0,3395	-	26	98%	1.985.975	1.967.467	-
S	C	J.Lacerda B	jan/65	0,2771	-	26	98%	1.126.809	1.367.688	-
S	C	J.Lacerda A	jan/65	0,2635	-	26	98%	583.250	744.470	-
SE-CO	H	Bariri (Alvaro de Souza Lima)	jan/65	1	-	0.0	0.0%	541.316	0	-
SE-CO	H	Funil (RJ)	jan/65	1	-	0.0	0.0%	619.432	0	-
S	C	Figueira	jan/63	0,166	-	26	98%	54.554	110.533	-
SE-CO	H	Furnas	jan/63	1	-	0.0	0.0%	4.499.554	0	-
SE-CO	H	Barra Bonita	jan/63	1	-	0.0	0.0%	477.594	0	-
S	C	Charqueadas	jan/62	0,2011	-	26	98%	136.595	228.453	-
SE-CO	H	Jurumirim (Armando A. Laydner)	jan/62	1	-	0.0	0.0%	439.132	0	-
S	H	Jacui	jan/62	1	-	0.0	0.0%	1.419.402	0	-
SE-CO	H	Pereira Passos	jan/62	1	-	0.0	0.0%	326.708	0	-
SE-CO	H	Tres Marias	jan/62	1	-	0.0	0.0%	1.818.886	0	-
SE-CO	H	Euclides da Cunha	jan/60	1	-	0.0	0.0%	419.565	0	-
SE-CO	H	Camargos	jan/60	1	-	0.0	0.0%	157.100	0	-
SE-CO	H	Santa Branca	jan/60	1	-	0.0	0.0%	134.029	0	-
SE-CO	H	Cachoeira Dourada	jan/59	1	-	0.0	0.0%	2.959.147	0	-
SE-CO	H	Salto Grande (Lucas N. Garcez)	jan/58	1	-	0.0	0.0%	427.192	0	-
SE-CO	H	Salto Grande (MG)	jan/56	1	-	0.0	0.0%	513.869	0	-
SE-CO	H	Mascarenhas de Moraes (Peixoto)	jan/56	1	-	0.0	0.0%	2.207.257	0	-
SE-CO	H	Itutinga	jan/55	1	-	0.0	0.0%	210.152	0	-
S	C	S. Jerônimo	jan/54	0,114	-	26	98%	43.993	129.793	-
SE-CO	O	Carioba	jan/54	0,3	-	20,7	98%	0	0	-
SE-CO	O	Piratininga	jan/54	0,2378	-	20,7	99%	289.700	329.546	-
S	H	Canastra	jan/53	1	-	0.0	0.0%	237.695	0	-
SE-CO	H	Nilo Peçanha	jan/53	1	-	0.0	0.0%	2.386.456	0	-
SE-CO	H	Fontes Nova	jan/40	1	-	0.0	0.0%	719.497	0	-
SE-CO	H	Henry Borden Sub.	jan/26	1	-	0.0	0.0%	63.638	0	-
SE-CO	H	Henry Borden Ext.	jan/26	1	-	0.0	0.0%	448.281	0	-
SE-CO	H	I. Pombos	jan/24	1	-	0.0	0.0%	680.168	0	-
SE-CO	H	Jaguari	jan/17	1	-	0.0	0.0%	54.835	0	-
International Import	H	-	-	1	-	0.0	0.0%	360.234	0	-
International Export	H	-	-	1	-	0.0	0.0%	0	0	-
Import from NNE	H	-	-	1	-	0.0	0.0%	99.532	0	-
Export to NNE	H	-	-	1	-	0.0	0.0%	7.632.626	0	-

Year: 2004

Grid	Fuel Source	Power Plant[1]	Start Date	Fossil Fuel Conversion Efficiency[4]	Efficiency for EF_BM calculations[5]	Carbon emission Factor[3] (tC/TJ)	Fraction carbon oxidized[3]	MWh generated[2]	tCO_2 for EF_OM calculation	tCO_2 for EF_BM calculation
SE-CO	G	TermoRio	Nov-2004	0,32	0,32	15,3	99,5%	120.326	75.561	75.561
SE-CO	H	Candonga	Sep-2004	1	1	0,0	0.0%	129.327	0	0
SE-CO	H	Queimado	May-2004	1	1	0,0	0.0%	360.952	0	0
SE-CO	G	Norte Fluminense	Feb-2004	0,32	0,32	15,3	99,5%	1.507.181	946.464	946.464
SE-CO	H	Jauru	Sep-2003	1	1	0.0	0.0%	487.636	0	0
SE-CO	H	Gauporé	Sep-2003	1	1	0.0	0.0%	335.127	0	0
SE-CO	G	Três Lagoas	Aug-2003	0,32	0,32	15,3	99,5%	1.419.067	891.131	891.131
SE-CO	H	Funil (MG)	jan/03	1	1	0.0	0.0%	667.597	0	0
SE-CO	H	Itiquira I	Sep-2002	1	1	0.0	0.0%	856.539	0	0
S	G	Araucária	Sep-2002	0,32	0,32	15,3	99,5%	22	14	14
S	G	Canoas	Sep-2002	0,32	0,32	15,3	99,5%	527.587	331.308	331.308
SE-CO	H	Piraju	Sep-2002	1	1	0.0	0.0%	466.775	0	0
SE-CO	G	Nova Piratininga	jun/02	0,2197	0,32	15,3	99,5%	13.820	12.638	8.679
S	O	PCT CGTEE	jun/02	0,33	0,33	20,7	99,0%	0	0	0
SE-CO	H	Rosal	jun/02	1	1	0.0	0.0%	384.555	0	0
SE-CO	G	Ibirité	May-2002	0,32	0,32	15,3	99,5%	1.245.228	781.965	781.965
SE-CO	H	Cana Brava	May-2002	1	1	0.0	0.0%	2.214.839	0	0
SE-CO	H	Sta. Clara	jan/02	1	1	0.0	0.0%	345.880	0	0
S	H	Machadinho	jan/02	1	1	0.0	0.0%	4.337.016	0	0
SE-CO	G	Juiz de Fora	nov/01	0,32	0,32	15,3	99,5%	66.002	41.447	41.447
SE-CO	G	Macaé Merchant	nov/01	0,32	0,32	15,3	99,5%	740.098	464.759	464.759
SE-CO	H	Lajeado (ANEEL res. 402/2001)	nov/01	1	1	0.0	0.0%	4.331.991	0	0
SE-CO	G	Eletrobolt	Oct-2001	0,32	0,32	15,3	99,5%	1.324.501	831.746	831.746
SE-CO	H	Porto Estrela	Sep-2001	1	1	0.0	0.0%	554.865	0	0
SE-CO	G	Cuiaba (Mario Covas)	Aug-2001	0,32	0,32	15,3	99,5%	1.659.230	1.041.946	1.041.946
SE-CO	G	W. Arjona	jan/01	0,32	0,32	15,3	99,5%	538.087	337.902	337.902
S	G	Uruguaiana	jan/00	0,5	0,5	15,3	99,5%	2.270.176	912.385	912.385
S	H	S. Caxias	jan/99	1	1	0.0	0.0%	6.015.459	0	0
SE-CO	H	Canoas I	jan/99	1	1	0.0	0.0%	578.928	0	0
SE-CO	H	Canoas II	jan/99	1	1	0.0	0.0%	486.299	0	0
SE-CO	H	Igarapava	jan/99	1	1	0.0	0.0%	1.090.945	0	0
SE-CO	H	Porto Primavera	jan/99	1	1	0.0	0.0%	9.472.700	0	0
SE-CO	D	Cuiaba (Mario Covas)	Oct-1998	0,32	0,33	20,2	99,0%	0	0	0
SE-CO	H	Sobragi	Sep-1998	1	-	0.0	0.0%	395.652	0	0
SE-CO	H	PCH EMAE	jan/98	1	-	0.0	0.0%	137.132	0	0
S	H	PCH CEEE	jan/98	1	-	0.0	0.0%	215.617	0	0
S	H	PCH ENERSUL	jan/98	1	-	0.0	0.0%	174.892	0	0
SE-CO	H	PCH CEB	jan/98	1	-	0.0	0.0%	109.606	0	0
SE-CO	H	PCH ESCELSA	jan/98	1	-	0.0	0.0%	353.471	0	0
S	H	PCH CELESC	jan/98	1	-	0.0	0.0%	468.240	0	0
SE-CO	H	PCH CEMAT	jan/98	1	-	0.0	0.0%	1.353.714	0	0
SE-CO	H	PCH CELG	jan/98	1	-	0.0	0.0%	73.309	0	0
SE-CO	H	PCH CERJ	jan/98	1	-	0.0	0.0%	297.264	0	0
S	H	PCH COPEL	jan/98	1	-	0.0	0.0%	707.277	0	0
SE-CO	H	PCH CEMIG	jan/98	1	-	0.0	0.0%	672.546	0	0
SE-CO	H	PCH CPFL	jan/98	1	-	0.0	0.0%	458.822	0	0
SE-CO	H	S. Mesa	jan/98	1	-	0.0	0.0%	4.397.135	0	0
SE-CO	H	PCH EPAULO	jan/98	1	-	0.0	0.0%	0	0	0
SE-CO	H	Guilmam Amorim	jan/97	1	-	0.0	0.0%	661.366	0	0
SE-CO	H	Corumbá	jan/97	1	-	0.0	0.0%	2.163.267	0	0
SE-CO	H	Miranda	jan/97	1	-	0.0	0.0%	1.069.831	0	0
SE-CO	H	Noav Ponte	jan/94	1	-	0.0	0.0%	1.302.583	0	0
S	H	Segredo (Gov. Ney Braga)	jan/92	1	-	0.0	0.0%	5.897.593	0	0
SE-CO	H	Taquaruçu	jan/89	1	-	0.0	0.0%	2.022.042	0	-
SE-CO	H	Manso	jan/88	1	-	0.0	0.0%	732.036	0	-
S	H	D. Francisca	jan/87	1	-	0.0	0.0%	683.674	0	-
S	H	Itá	jan/87	1	-	0.0	0.0%	6.054.272	0	-
SE-CO	H	Rosana	jan/87	1	-	0.0	0.0%	1.864.543	0	-
SE-CO	N	Angra	jan/85	1	-	0.0	0.0%	11.581.987	0	-
SE-CO	H	T. Irmãos	jan/85	1	-	0.0	0.0%	2.058.733	0	-
SE-CO	H	Itaipu 60 Hz	jan/83	1	-	0.0	0.0%	46.853.256	0	-
SE-CO	H	Itaipu 50 Hz	jan/83	1	-	0.0	0.0%	36.935.778	0	-
SE-CO	H	Emborcação	jan/82	1	-	0.0	0.0%	4.312.481	0	-
SE-CO	H	Nova Avanhandava	jan/82	1	-	0.0	0.0%	1.406.957	0	-
S	H	Gov. Bento Munhoz - GBM	jan/80	1	-	0.0	0.0%	5.352.443	0	-
S	H	S.Santiago	jan/80	1	-	0.0	0.0%	6.886.744	0	-
SE-CO	H	Itumbiara	jan/80	1	-	0.0	0.0%	7.854.963	0	-
SE-CO	O	Igarapé	jan/78	0,2938	-	20,7	99%	19.989	18.406	-
S	H	Itauba	jan/78	1	-	0.0	0.0%	1.233.332	0	-
SE-CO	H	A. Vermelha (Jose E. Moraes)	jan/78	1	-	0.0	0.0%	6.520.363	0	-
SE-CO	H	S.Simão	jan/78	1	-	0.0	0.0%	12.205.751	0	-
SE-CO	H	Capivara	jan/77	1	-	0.0	0.0%	3.302.087	0	-
S	H	S.Osório	jan/75	1	-	0.0	0.0%	484.648	0	-
SE-CO	H	Marimbondo	jan/75	1	-	0.0	0.0%	6.349.261	0	-
SE-CO	H	Promissão	jan/75	1	-	0.0	0.0%	1.048.625	0	-
S	C	Pres. Medici	jan/74	0,2178	-	26	98%	1.492.153	2.304.140	-
SE-CO	H	Volta Grande	jan/74	1	-	0.0	0.0%	1.793.617	0	-
SE-CO	H	Porto Colombia	jun/73	1	-	0.0	0.0%	1.715.325	0	-
S	H	Passo Fundo	jan/73	1	-	0.0	0.0%	705.586	0	-
S	H	Passo Real	jan/73	1	-	0.0	0.0%	549.702	0	-
SE-CO	H	Ilha Solteira	jan/73	1	-	0.0	0.0%	15.868.207	0	-
SE-CO	H	Mascarenhas	jan/73	1	-	0.0	0.0%	786.812	0	-
S	H	Gov. Parigot de Souza - GPS	jan/71	1	-	0.0	0.0%	1.204.667	0	-
SE-CO	H	Chavantes	jan/71	1	-	0.0	0.0%	1.935.377	0	-
SE-CO	H	Jaguara	jan/71	1	-	0.0	0.0%	2.506.033	0	-
SE-CO	H	Sá Carvalho	Apr-1970	1	-	0.0	0.0%	464.819	0	-
SE-CO	H	Estreito (Luiz Carlos Barreto)	jan/69	1	-	0.0	0.0%	2.948.054	0	-
SE-CO	H	Ibitinga	jan/69	1	-	0.0	0.0%	712.124	0	-
SE-CO	H	Jupiá	jan/69	1	-	0.0	0.0%	8.790.288	0	-
S	O	Alegrete	jan/68	0,26	-	20,7	99%	0	0	-
SE-CO	G	Campos (Roberto Silveira)	jan/68	0,24	-	15,3	99,5%	0	0	-
SE-CO	G	Santa Cruz (RJ)	jan/68	0,3342	-	15,3	99,5%	199.124	119.714	-
SE-CO	H	Paraibuna	jan/68	1	-	0.0	0.0%	199.289	0	-
SE-CO	H	Limoeiro (Armando Sal es de Oliviera)	jan/67	1	-	0.0	0.0%	165.483	0	-
SE-CO	H	Caconde	jan/66	1	-	0.0	0.0%	280.607	0	-
S	C	J.Lacerda C	jan/65	0,3400	-	26	98%	2.330.323	2.305.359	-
S	C	J.Lacerda B	jan/65	0,2781	-	26	98%	1.304.788	1.577.783	-
S	C	J.Lacerda A	jan/65	0,2663	-	26	98%	873.490	1.103.060	-
SE-CO	H	Bariri (Alvaro de Souza Lima)	jan/65	1	-	0.0	0.0%	638.646	0	-
SE-CO	H	Funil (RJ)	jan/65	1	-	0.0	0.0%	685.740	0	-
S	C	Figueira	jan/63	0,1663	-	26	98%	73.448	148.530	-
SE-CO	H	Furnas	jan/63	1	-	0.0	0.0%	4.288.104	0	-
SE-CO	H	Barra Bonita	jan/63	1	-	0.0	0.0%	567.300	0	-
S	C	Charqueadas	jan/62	0,2016	-	26	98%	239.467	399.441	-
SE-CO	H	Jurumirim (Armando A. Laydner)	jan/62	1	-	0.0	0.0%	445.781	0	-
S	H	Jacui	jan/62	1	-	0.0	0.0%	1.178.249	0	-
SE-CO	H	Pereira Passos	jan/62	1	-	0.0	0.0%	384.696	0	-
SE-CO	H	Tres Marias	jan/62	1	-	0.0	0.0%	1.892.922	0	-
SE-CO	H	Euclides da Cunha	jan/60	1	-	0.0	0.0%	561.413	0	-
SE-CO	H	Camargos	jan/60	1	-	0.0	0.0%	188.520	0	-
SE-CO	H	Santa Branca	jan/60	1	-	0.0	0.0%	99.619	0	-
SE-CO	H	Cachoeira Dourada	jan/59	1	-	0.0	0.0%	3.315.489	0	-
SE-CO	H	Salto Grande (Lucas N. Garcez)	jan/58	1	-	0.0	0.0%	484.648	0	-
SE-CO	H	Salto Grande (MG)	jan/56	1	-	0.0	0.0%	579.580	0	-
SE-CO	H	Mascarenhas de Moraes (Peixoto)	jan/56	1	-	0.0	0.0%	2.337.376	0	-
SE-CO	H	Itutinga	jan/55	1	-	0.0	0.0%	239.530	0	-
S	C	S. Jerônimo	jan/54	0,1140	-	26	98%	30.845	91.026	-
SE-CO	O	Carioba	jan/54	0,3	-	20,7	98%	0	0	-
SE-CO	O	Piratininga	jan/54	0,2378	-	20,7	99%	162.952	185.352	-
S	H	Canastra	jan/53	1	-	0.0	0.0%	148.084	0	-
SE-CO	H	Nilo Peçanha	jan/53	1	-	0.0	0.0%	2.689.893	0	-
SE-CO	H	Fontes Nova	jan/40	1	-	0.0	0.0%	803.368	0	-
SE-CO	H	Henry Borden Sub.	jan/26	1	-	0.0	0.0%	5.393	0	-
SE-CO	H	Henry Borden Ext.	jan/26	1	-	0.0	0.0%	417.167	0	-
SE-CO	H	I. Pombos	jan/24	1	-	0.0	0.0%	881.028	0	-
SE-CO	H	Jaguari	jan/17	1	-	0.0	0.0%	35.455	0	-
International Import	H	-	-	1	-	0.0	0.0%	189.847	0	-
International Export	H	-	-	1	-	0.0	0.0%	1.180.696	0	-
Import from NNE	H	-	-	1	-	0.0	0.0%	1.278.428	0	-
Export to NNE	H	-	-	1	-	0.0	0.0%	3.830.322	0	-

Year: 2005

Grid	Fuel Source	Power Plant[1]	Start Date	Fossil Fuel Conversion Efficiency[4]	Efficiency for EF_BM calculations[5]	Carbon emission Factor[3] (tC/TJ)	Fraction carbon oxidized[3]	MWh generated[2]	tCO_2 for EF_OM calculation	tCO_2 for EF_BM calculation
SE-CO	H	Quebra Queixo	Dec-2005	1	1	0,0	0.0%	16.197	0	0
SE-CO	H	Ourinhos	Nov-2005	1	1	0,0	0.0%	25.167	0	0
SE-CO	H	Barra Grande	Nov-2005	1	1	0,0	0.0%	248.690	0	0
SE-CO	H	Mimoso	Oct-2005	1	1	0,0	0.0%	48.329	0	0
SE-CO	H	Ponte de Pedra	Aug-2005	1	1	0,0	0.0%	439.462	0	0
SE-CO	H	Aimorés	Aug-2005	1	1	0,0	0.0%	122.877	0	0
SE-CO	H	Santa Clara PR	Aug-2005	1	1	0,0	0.0%	321.818	0	0
SE-CO	H	Monte Claro	Jan-2005	1	1	0,0	0.0%	243.331	0	0
SE-CO	G	TermoRio	Nov-2004	0,32	0,32	15,3	99,5%	1.150.380	722.403	722.403
SE-CO	H	PCH CESP	Sep-2004	1	1	0,0	0.0%	0	0	0
SE-CO	H	Candonga	Sep-2004	1	1	0,0	0.0%	565.935	0	0
SE-CO	H	Queimado	May-2004	1	1	0,0	0.0%	588.657	0	0
SE-CO	G	Norte Fluminense	Feb-2004	0,32	0,32	15,3	99,5%	3.635.646	2.283.074	2.283.074
SE-CO	H	Jauru	Sep-2003	1	1	0.0	0.0%	514.779	0	0
SE-CO	H	Gauporé	Sep-2003	1	1	0.0	0.0%	389.619	0	0
SE-CO	G	Três Lagoas	Aug-2003	0,32	0,32	15,3	99,5%	690.051	433.331	433.331
SE-CO	H	Funil (MG)	jan/03	1	1	0.0	0.0%	800.466	0	0
SE-CO	H	Itiquira I	Sep-2002	1	1	0.0	0.0%	1.104.190	0	0
S	G	Araucária	Sep-2002	0,32	0,32	15,3	99,5%	0	0	0
S	G	Canoas	Sep-2002	0,32	0,32	15,3	99,5%	927.537	582.465	582.465
SE-CO	H	Piraju	Sep-2002	1	1	0.0	0.0%	446.366	0	0
SE-CO	G	Nova Piratininga	jun/02	0,2197	0,32	15,3	99,5%	231.010	211.259	145.067
S	O	PCT CGTEE	jun/02	0,33	0,33	20,7	99,0%	0	0	0
SE-CO	H	Rosal	jun/02	1	1	0.0	0.0%	421.691	0	0
SE-CO	G	Ibirité	May-2002	0,32	0,32	15,3	99,5%	490.201	307.831	307.831
SE-CO	H	Cana Brava	May-2002	1	1	0.0	0.0%	2.316.663	0	0
SE-CO	H	Sta. Clara	jan/02	1	1	0.0	0.0%	332.249	0	0
S	H	Machadinho	jan/02	1	1	0.0	0.0%	4.480.027	0	0
SE-CO	G	Juiz de Fora	nov/01	0,32	0,32	15,3	99,5%	232.477	145.988	145.988
SE-CO	G	Macaé Merchant	nov/01	0,32	0,32	15,3	99,5%	119.568	75.085	75.085
SE-CO	H	Lajeado (ANEEL res. 402/2001)	nov/01	1	1	0.0	0.0%	4.539.333	0	0
SE-CO	G	Eletrobolt	Oct-2001	0,32	0,32	15,3	99,5%	190.904	119.882	119.882
SE-CO	H	Porto Estrela	Sep-2001	1	1	0.0	0.0%	593.357	0	0
SE-CO	G	Cuiaba (Mario Covas)	Aug-2001	0,32	0,32	15,3	99,5%	1.229.232	771.920	771.920
SE-CO	G	W. Arjona	jan/01	0,32	0,32	15,3	99,5%	728.835	457.686	457.686
S	G	Uruguaiana	jan/00	0,5	0,5	15,3	99,5%	1.733.424	696.664	696.664
S	H	S. Caxias	jan/99	1	1	0.0	0.0%	5.920.260	0	0
SE-CO	H	Canoas I	jan/99	1	1	0.0	0.0%	555.667	0	0
SE-CO	H	Canoas II	jan/99	1	1	0.0	0.0%	441.828	0	0
SE-CO	H	Igarapava	jan/99	1	1	0.0	0.0%	1.297.196	0	0
SE-CO	H	Porto Primavera	jan/99	1	1	0.0	0.0%	9.686.480	0	0
SE-CO	H	Sobragi	Sep-1998	1	-	0.0	0.0%	385.988	0	0
SE-CO	H	PCH EMAE	jan/98	1	-	0.0	0.0%	149.526	0	0
S	H	PCH CEEE	jan/98	1	-	0.0	0.0%	173.917	0	0
S	H	PCH ENERSUL	jan/98	1	-	0.0	0.0%	162.165	0	0
SE-CO	H	PCH CEB	jan/98	1	-	0.0	0.0%	114.097	0	0
SE-CO	H	PCH ESCELSA	jan/98	1	-	0.0	0.0%	500.563	0	0
S	H	PCH CELESC	jan/98	1	-	0.0	0.0%	481.799	0	0
SE-CO	H	PCH CEMAT	jan/98	1	-	0.0	0.0%	1.515.897	0	0
SE-CO	H	PCH CELG	jan/98	1	-	0.0	0.0%	72.592	0	0
SE-CO	H	PCH CERJ	jan/98	1	-	0.0	0.0%	311.762	0	0
S	H	PCH COPEL	jan/98	1	-	0.0	0.0%	578.787	0	0
SE-CO	H	PCH CEMIG	jan/98	1	-	0.0	0.0%	619.029	0	0
SE-CO	H	PCH CPFL	jan/98	1	-	0.0	0.0%	461.440	0	0
SE-CO	H	S. Mesa	jan/98	1	-	0.0	0.0%	4.731.322	0	0
SE-CO	H	PCH EPAULO	jan/98	1	-	0.0	0.0%	0	0	0
SE-CO	H	Guilmam Amorim	jan/97	1	-	0.0	0.0%	632.333	0	0
SE-CO	H	Corumbá	jan/97	1	-	0.0	0.0%	1.923.111	0	0
SE-CO	H	Miranda	jan/97	1	-	0.0	0.0%	1.480.071	0	0
SE-CO	H	Nova Ponte	jan/94	1	-	0.0	0.0%	2.015.019	0	0
S	H	Segredo (Gov. Ney Braga)	jan/92	1	-	0.0	0.0%	5.587.794	0	0
SE-CO	H	Taquaruçu	jan/89	1	-	0.0	0.0%	2.032.597	0	-
SE-CO	H	Manso	jan/88	1	-	0.0	0.0%	616.312	0	-
S	H	D. Francisca	jan/87	1	-	0.0	0.0%	761.279	0	-
S	H	Itá	jan/87	1	-	0.0	0.0%	5.940.371	0	-
SE-CO	H	Rosana	jan/87	1	-	0.0	0.0%	1.880.873	0	-
SE-CO	N	Angra	jan/85	1	-	0.0	0.0%	9.854.879	0	-
SE-CO	H	T. Irmãos	jan/85	1	-	0.0	0.0%	2.030.080	0	-
SE-CO	H	Itaipu 60 Hz	jan/83	1	-	0.0	0.0%	43.263.219	0	-
SE-CO	H	Itaipu 50 Hz	jan/83	1	-	0.0	0.0%	38.437.460	0	-
SE-CO	H	Emborcação	jan/82	1	-	0.0	0.0%	5.428.696	0	-
SE-CO	H	Nova Avanhandava	jan/82	1	-	0.0	0.0%	1.424.680	0	-
S	H	Gov. Bento Munhoz - GBM	jan/80	1	-	0.0	0.0%	5.264.925	0	-
S	H	S.Santiago	jan/80	1	-	0.0	0.0%	6.337.245	0	-
SE-CO	H	Itumbiara	jan/80	1	-	0.0	0.0%	8.818.284	0	-
SE-CO	O	Igarapé	jan/78	0,2938	-	20,7	99%	13.604	12.527	-
S	H	Itauba	jan/78	1	-	0.0	0.0%	1.725.629	0	-
SE-CO	H	A. Vermelha (Jose E. Moraes)	jan/78	1	-	0.0	0.0%	7.426.577	0	-
SE-CO	H	S.Simão	jan/78	1	-	0.0	0.0%	11.878.356	0	-
SE-CO	H	Capivara	jan/77	1	-	0.0	0.0%	3.445.003	0	-
S	H	S.Osório	jan/75	1	-	0.0	0.0%	4.404.318	0	-
SE-CO	H	Marimbondo	jan/75	1	-	0.0	0.0%	6.694.731	0	-
SE-CO	H	Promissão	jan/75	1	-	0.0	0.0%	1.022.782	0	-
S	C	Pres. Medici	jan/74	0,2178	-	26	98%	1.699.573	2.624.433	-
SE-CO	H	Volta Grande	jan/74	1	-	0.0	0.0%	2.181.749	0	-
SE-CO	H	Porto Colombia	jun/73	1	-	0.0	0.0%	1.955.931	0	-
S	H	Passo Fundo	jan/73	1	-	0.0	0.0%	994.464	0	-
S	H	Passo Real	jan/73	1	-	0.0	0.0%	671.226	0	-
SE-CO	H	Ilha Solteira	jan/73	1	-	0.0	0.0%	16.814.478	0	-
SE-CO	H	Mascarenhas	jan/73	1	-	0.0	0.0%	795.700	0	-
S	H	Gov. Parigot de Souza - GPS	jan/71	1	-	0.0	0.0%	1.240.817	0	-
SE-CO	H	Chavantes	jan/71	1	-	0.0	0.0%	1.785.328	0	-
SE-CO	H	Jaguara	jan/71	1	-	0.0	0.0%	2.694.735	0	-
SE-CO	H	Sá Carvalho	Apr-1970	1	-	0.0	0.0%	478.444	0	-
SE-CO	H	Estreito (Luiz Carlos Barreto)	jan/69	1	-	0.0	0.0%	4.208.999	0	-
SE-CO	H	Ibitinga	jan/69	1	-	0.0	0.0%	688.094	0	-
SE-CO	H	Jupiá	jan/69	1	-	0.0	0.0%	9.114.514	0	-
S	O	Alegrete	jan/68	0,26	-	20,7	99%	0	0	-
SE-CO	G	Campos (Roberto Silveira)	jan/68	0,24	-	15,3	99,5%	0	0	-
SE-CO	G	Santa Cruz (RJ)	jan/68	0,3342	-	15,3	99,5%	176.628	106.190	-
SE-CO	H	Paraibuna	jan/68	1	-	0.0	0.0%	272.422	0	-
SE-CO	H	Limoeiro (Armando Sal es de Oliviera)	jan/67	1	-	0.0	0.0%	157.213	0	-
SE-CO	H	Caconde	jan/66	1	-	0.0	0.0%	400.542	0	-
S	C	J.Lacerda C	jan/65	0,3400	-	26	98%	2.012.313	1.990.755	-
S	C	J.Lacerda B	jan/65	0,2781	-	26	98%	1.188.746	1.437.462	-
S	C	J.Lacerda A	jan/65	0,2663	-	26	98%	877.032	1.107.533	-
SE-CO	H	Bariri (Alvaro de Souza Lima)	jan/65	1	-	0.0	0.0%	603.788	0	-
SE-CO	H	Funil (RJ)	jan/65	1	-	0.0	0.0%	857.914	0	-
S	C	Figueira	jan/63	0,1663	-	26	98%	81.238	164.284	-
SE-CO	H	Furnas	jan/63	1	-	0.0	0.0%	5.687.817	0	-
SE-CO	H	Barra Bonita	jan/63	1	-	0.0	0.0%	547.013	0	-
S	C	Charqueadas	jan/62	0,2016	-	26	98%	213.418	355.990	-
SE-CO	H	Jurumirim (Armando A. Laydner)	jan/62	1	-	0.0	0.0%	454.698	0	-
S	H	Jacui	jan/62	1	-	0.0	0.0%	1.174.695	0	-
SE-CO	H	Pereira Passos	jan/62	1	-	0.0	0.0%	397.305	0	-
SE-CO	H	Tres Marias	jan/62	1	-	0.0	0.0%	2.543.413	0	-
SE-CO	H	Euclides da Cunha	jan/60	1	-	0.0	0.0%	534.411	0	-
SE-CO	H	Camargos	jan/60	1	-	0.0	0.0%	200.117	0	-
SE-CO	H	Santa Branca	jan/60	1	-	0.0	0.0%	148.713	0	-
SE-CO	H	Cachoeira Dourada	jan/59	1	-	0.0	0.0%	3.604.388	0	-
SE-CO	H	Salto Grande (Lucas N. Garcez)	jan/58	1	-	0.0	0.0%	486.456	0	-
SE-CO	H	Salto Grande (MG)	jan/56	1	-	0.0	0.0%	632.393	0	-
SE-CO	H	Mascarenhas de Moraes (Peixoto)	jan/56	1	-	0.0	0.0%	2.781.338	0	-
SE-CO	H	Itutinga	jan/55	1	-	0.0	0.0%	251.290	0	-
S	C	S. Jerônimo	jan/54	0,1140	-	26	98%	33.587	99.117	-
SE-CO	O	Carioba	jan/54	0,3	-	20,7	98%	0	0	-
SE-CO	O	Piratininga	jan/54	0,2378	-	20,7	99%	187.501	213.275	-
S	H	Canastra	jan/53	1	-	0.0	0.0%	213.576	0	-
SE-CO	H	Nilo Peçanha	jan/53	1	-	0.0	0.0%	2.818.325	0	-
SE-CO	H	Fontes Nova	jan/40	1	-	0.0	0.0%	748.752	0	-
SE-CO	H	Henry Borden Sub.	jan/26	1	-	0.0	0.0%	199.758	0	-
SE-CO	H	Henry Borden Ext.	jan/26	1	-	0.0	0.0%	551.061	0	-
SE-CO	H	I. Pombos	jan/24	1	-	0.0	0.0%	874.876	0	-
SE-CO	H	Jaguari	jan/17	1	-	0.0	0.0%	99.160	0	-
International Import	H	-	-	1	-	0.0	0.0%	490.209	0	-
International Export	H	-	-	1	-	0.0	0.0%	620.561	0	-
Import from NNE	H	-	-	1	-	0.0	0.0%	3.045.043	0	-
Export to NNE	H	-	-	1	-	0.0	0.0%	4.789.574	0	-

Legend

S: South	SE: Southeast
CO: Midwest	NNE: Northeast
C: Coal	D: Diesel
N: Natural Gas	O: Fuel oil
H: Hydro	N: Nuclear

References

[1] Agência Nacional de Energia Elétrica (ANEEL) - Banco de Informações de Geração (www.aneel.gov.br)
[2] Operador Nacional do Sistema Elétrico (ONS) (www.ons.org.br)
[3] Intergovernamental Panel on Climate Change. Revised 1996 Guidelines for National Greenhouse Gas Inventories.
[4] Roadtesting Baselines for GHG mitigation Projects in the Electric Power Sector, October 2002
[5] Executive Board recommended values

Assumption

The evaluation of the Operating Margin emission factor was conduced in a conservative way using the following consideration:

$COEF_k = 0$.:

$$\frac{\sum_{(i,k)} F_{i,k,y} \cdot COEF_{i,k}}{\sum_{k} GEN_{k,y}} = 0$$

Load Duration Curve

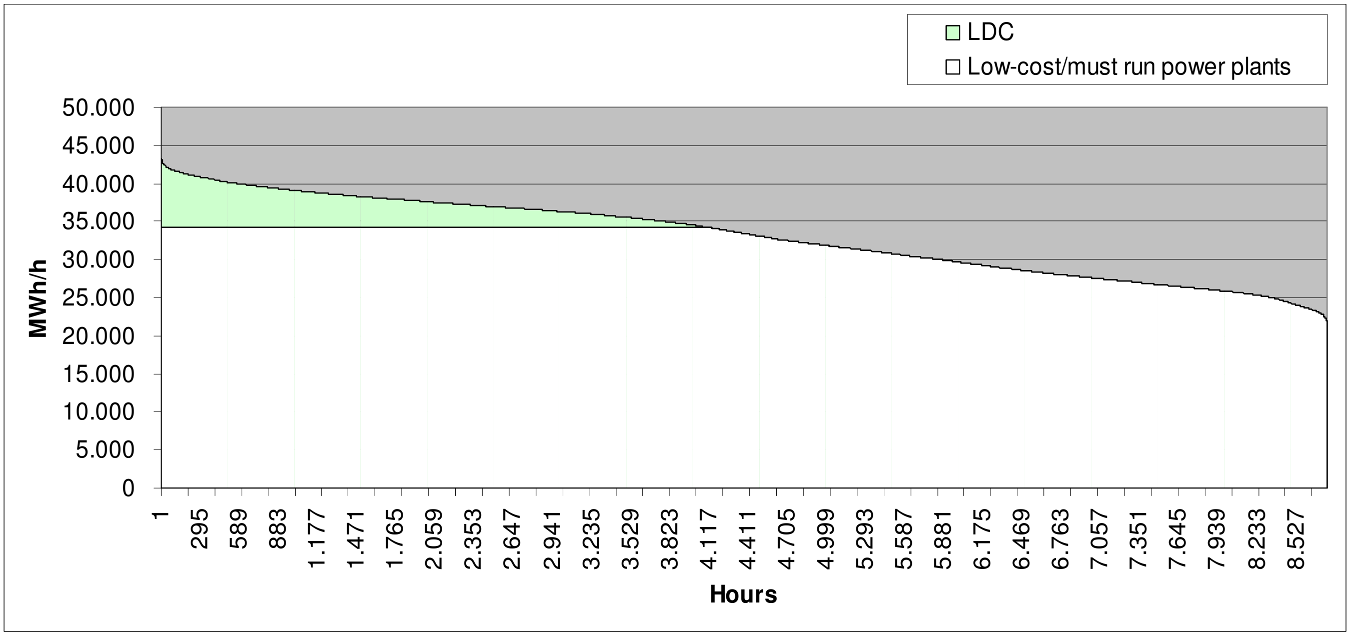

Figure 1. Load Duration Curve corresponding to the south-southeast-midwest Brazilian grid at 2003

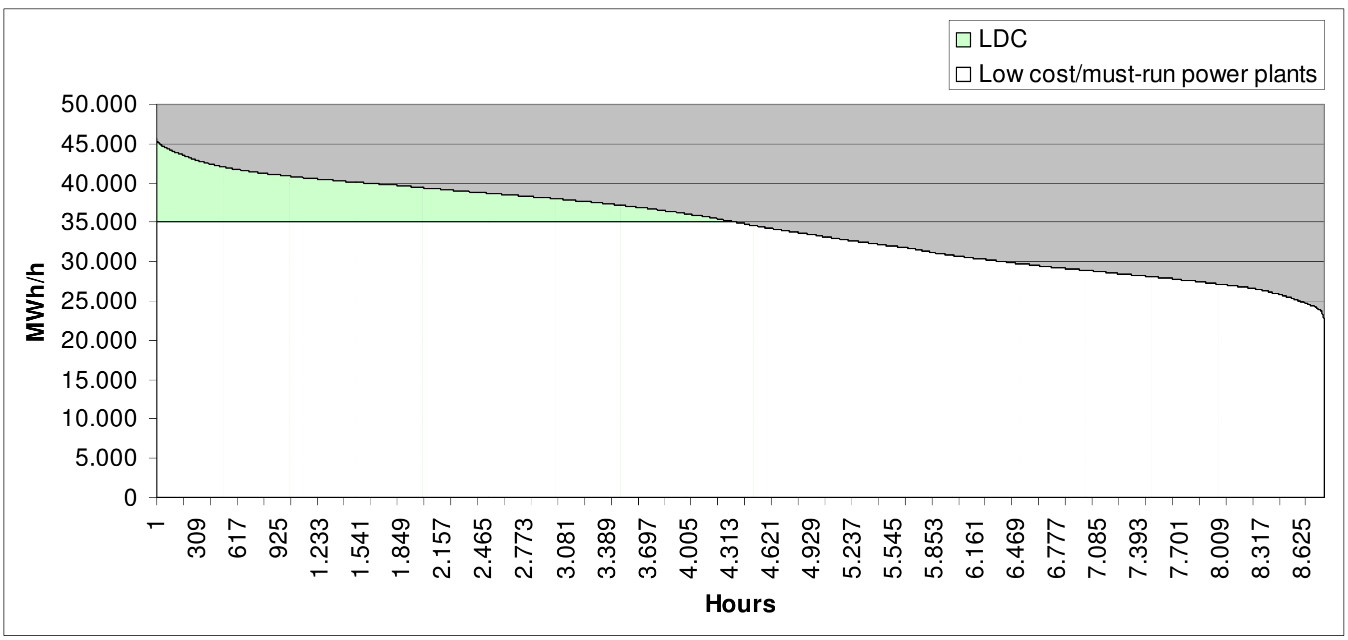

Figure 2. Load Duration Curve corresponding to the south-southeast-midwest Brazilian grid at 2004

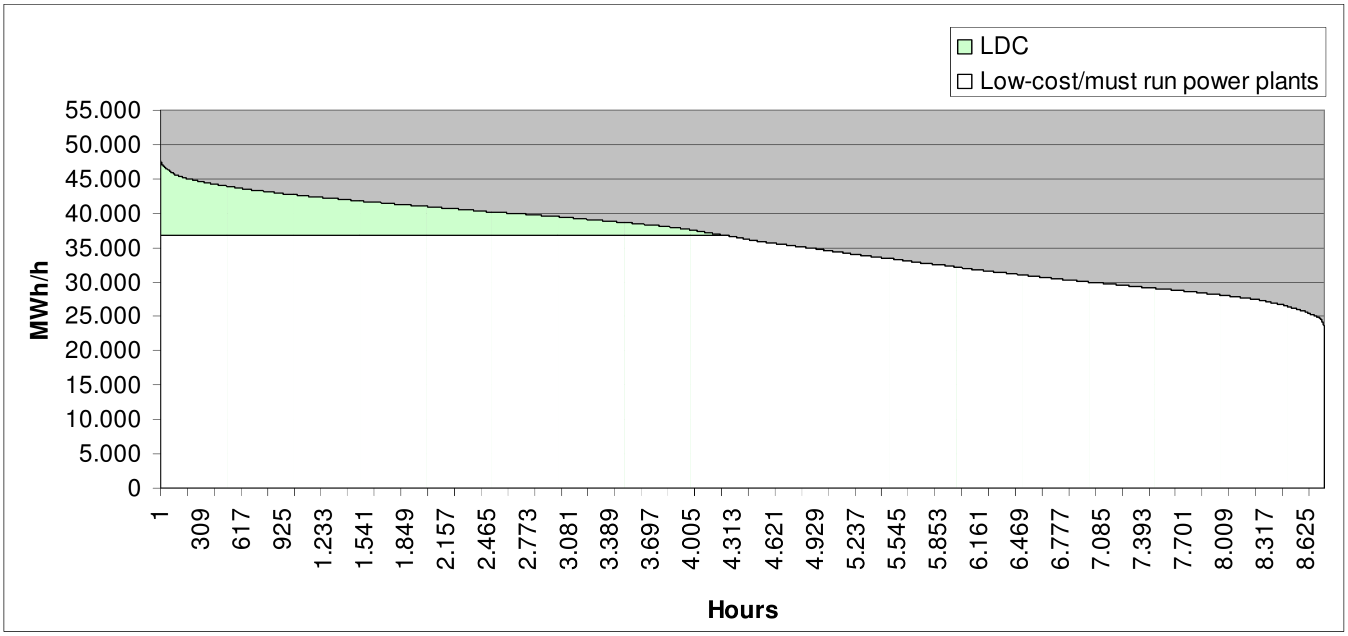

Figure 3. Load Duration Curve corresponding to the south-southeast-midwest Brazilian grid at 2005

Full details about the necessary data to plot the load duration curves were provided to DOE.