CLEAN DEVELOPMENT MECHANISM
PROJECT DESIGN DOCUMENT FORM (CDM-PDD)
Version 03 - in effect as of: 28 July 2006

CONTENTS

SECTION A. General description of project activity

A.1 Title of the project activity:

"Usina Interlagos Cogeneration Project"

PDD version number: 14

Date: August 24 2007

A.2. Description of the project activity:

The primary objective of the Usina Interlagos Cogeneration Project (hereinafter referred as Interlagos Project) is to supply Brazil's rising demand for energy due to economic growth and to improve the supply of electricity, while contributing to the environmental, social and economic sustainability by increasing renewable energy's share of total the Brazilian and the Latin America and the Caribbean region's electricity consumption. One fundamental goal of the project is the efficient use of resources, particularly indigenous resources, while minimizing impact on the environment.

Interlagos Project consists in the construction of a sugar mill, which will be operational in May 2007, capable of generating power surplus for sale (Figure 1) and, at the same time, generating carbon credits contributing to the sustainable development. This renewable energy project is owned by Usina Interlagos Ltda., a new unit of Usina Santa Adélia located in Jaboticabal. Both are sugar cane based distilleries.

The project will bee implemented in 2 phases. First phase started in February 2006 with seedling planting in an 8.2km^2 area and will be gradually increased each year up to 210km^2 in 2010, with a 40MW cogeneration power plant. In 2010 will start the second phase with plantation expansion to reach the goal of 3.6 million ton of sugarcane production and implementation with another 40MW cogeneration power plant. CO2 emissions reductions will be claimed for the first years for the one 40MW cogeneration plant, and in 2010 added by the other 40MW cogeneration plant.

The cogeneration project will generate enough energy not only for powering the sugar mill (thus eliminating the consumption of energy from the grid), but also for delivering surplus energy to the national grid. This electricity given to the grid will displace energy that the government would have provided with a strong use of fossil fuels. This displacement of energy thus creates a reduction of greenhouse gases emissions. This project also creates social and economical benefits that constitute a real contribution to Brazil's sustainable development.

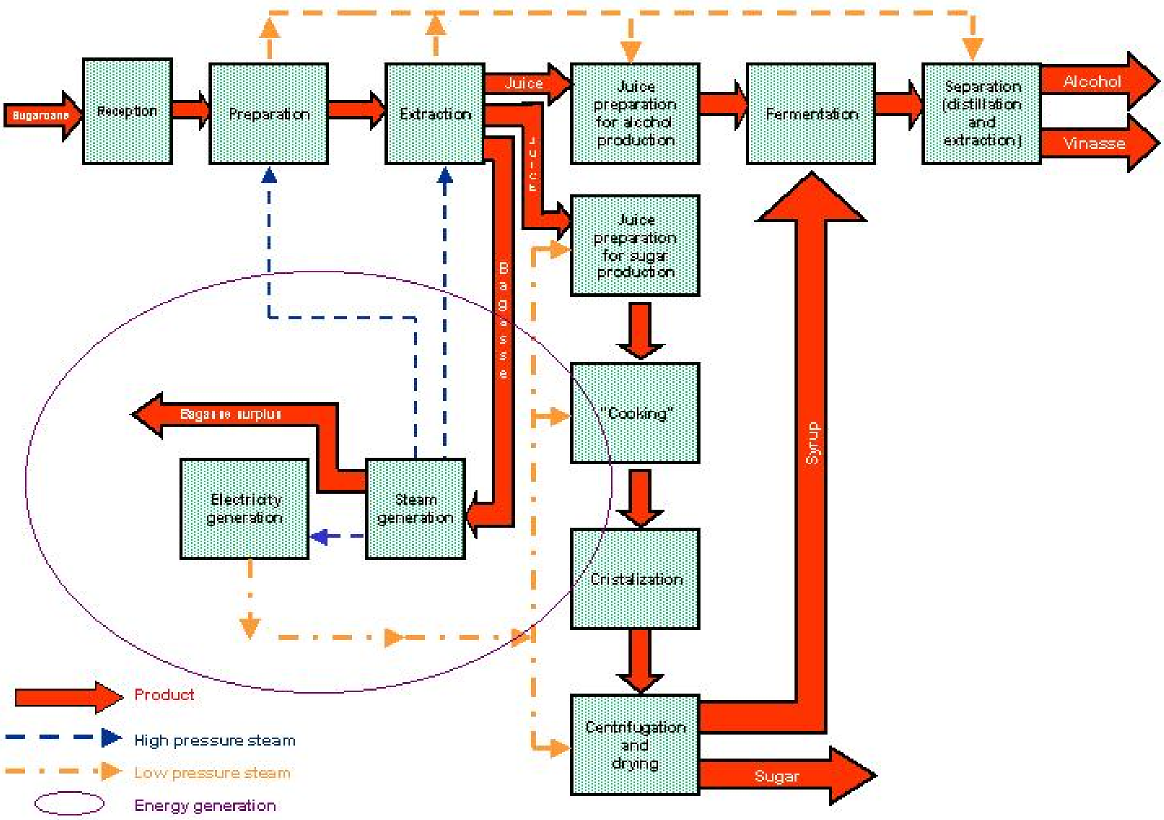


Figure 1 - Flowchart of the electricity generation inside a Sugar and Alcohol Production

(Source: Codistil)

The Project can be seen as an example of a solution by the private sector to the Brazilian electricity crisis of 2001, contributing to the sustainable development of the country. Interlagos Project thus comes to prove that with the commercialization of CERs, it is viable to develop a generation project in Brazil. This will have a positive effect for the country beyond the evident reductions in GHG.

The revenues obtained from the sale of the CERs will also help Usina Interlagos to support the community the way Usina Santa Adélia does. Usina Santa Adélia has a strong social responsibility evidenced in numerous initiatives, including: working with local communities on environmental education projects, reforestation of degraded areas, regular water quality assessment, support for environmental parks, hiring of local manpower, erosion control, and support for community agriculture. This revenue distribution and social efforts must be added to the environmental benefits when evaluating the contribution to sustainable development of this project activity.

Additionally, income distribution will be derived from this project due to job creation, employees' salaries and package of benefits such as social security and life insurance, and credits of emission reductions. Additionally, lower expenditure is achieved due to the fact that money will no longer be spent in the same amount to "import" electricity from other regions in the country through the grid. This money would stay in the region and be used for providing the population better services which would improve the availability of basic needs. This surplus of capital could be translated in investments in education and health that would directly benefit the local population and indirectly in a more equitable income distribution.

Sugarcane plantation is seeing as a land destroying cultivation. Usina Santa Adélia wich the owner of Usina Interlagos, has cultivate sugarcane for almost 60 years in the same land. The same techniques will be used on Usina Interlagos, among others using 7 different types of sugarcane, rotating land use, constant soil analyses and monitoring.

A.3. Project participants:

Detailed contact information on party(ies) and private/public entities involved in the project activity is listed in Annex 1.

Table 1 – Party(ies) and private/public entities involved in the TSACP Project activity

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)	Usina Santa Adélia S/A (Private Entity)	No
	Ecoinvest Carbon Brasil Ltda. (Private Entity)	
(*) 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 project activity:

A.4.1. Location of the project activity:

A.4.1.1. Host Party(ies):

Brazil

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

São Paulo State

A.4.1.3. City/Town/Community etc:

Pereira Barreto City

A.4.1.4. Detail of physical location, including information allowing the unique identification of this project activity (maximum one page):

Usina Interlagos is located in Pereira Barreto, state of São Paulo, southeast region of Brazil, Rodovia SP 310, km643, CEP: 15370-000, Pereira Barreto City. Pereira Barreto is a town of 24,680 inhabitants and its principal economic activity is the tourism.

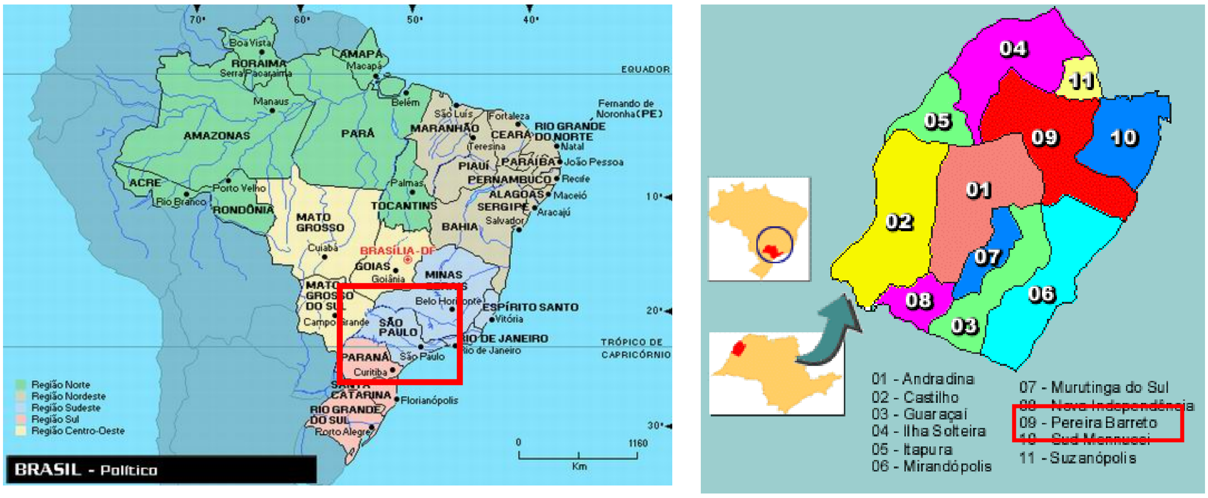
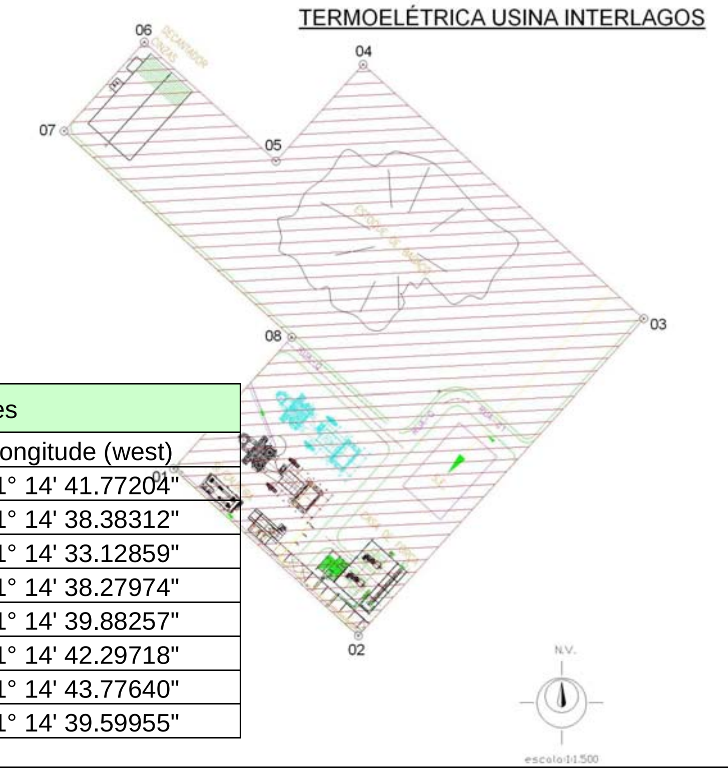


Figure 2: Political division of Brazil showing the state of São Paulo (Source: Portal Brasil, 2006) and the city involved in the project activity (Source: City Brazil, 2006).



Geographical Coordinates		
Point	Latitude (south)	Longitude (west)
01	20° 31' 47.28526"	51° 14' 41.77204"
02	20° 31' 50.17819"	51° 14' 38.38312"
03	20° 31' 44.71578"	51° 14' 33.12859"
04	20° 31' 40.31853"	51° 14' 38.27974"
05	20° 31' 41.98476"	51° 14' 39.88257"
06	20° 31' 39.92349"	51° 14' 42.29718"
07	20° 31' 41.46122"	51° 14' 43.77640"
08	20° 31' 45.02686"	51° 14' 39.59955"

A.4.2. Category(ies) of project activity:

Type: Energy and Power.

Sectoral Scope 1: Energy industries (renewable/non-renewable sources) Category: Renewable electricity generation for a grid (energy generation, supply, transmission and distribution).

A.4.3. Technology to be employed by the project activity:

Biomass power conversion technologies for power production can be classified into one of the three following categories: direct combustion technologies, gasification technologies, and pyrolysis. Direct combustion technologies, such as the used in Usina Interlagos, are probably the most widely known option for simultaneous power and heat generation from biomass. It involves the oxidation of biomass with excess air in a process that yields hot gases that are used to produce steam in boilers.

The steam is used to produce electricity in a Rankine cycle turbine (Figure 3). Rankine cycle configurations could also be classified into two: condensing and backpressure, depending on the proportion of the steam used for industrial processes and where in the turbine that steam is obtained. Typically, electricity only is produced in a "condensing" steam cycle, while electricity and steam are co-generated in an "extracting" steam cycle.

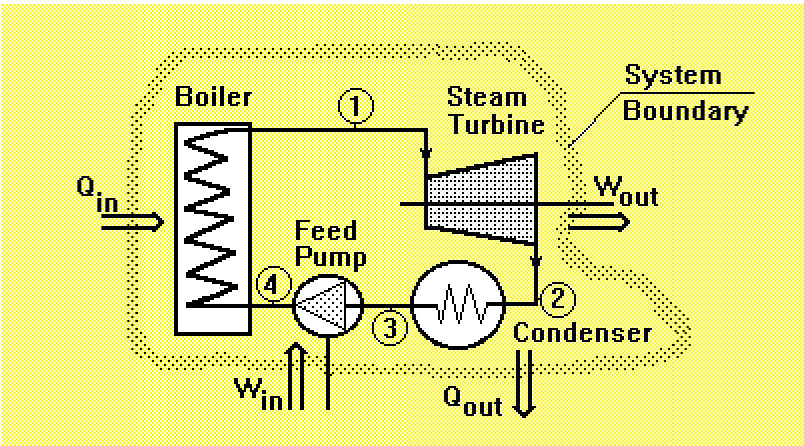


Figure 3 - Rankine Cycle

The project will start operating with a configuration using 1 boiler, 1 generator and 1 turbo-generator. And in 2010 when sugarcane production will increase more than the generator capacity, it is planned the installation of another generation plant of the same capacity. Usina Interlagos is expected to generate an annual average of 127,000 MWh power surplus at the end of the first crediting period. It will displace energy from the grid by both avoiding the consumption of power from the grid in the project and by delivering clean energy to the grid.

Table 2 - Technical Description of Energy Generation Equipments

	Boiler	***Turbo-reductor***	***Generator***
Quantity	1	1	1
Manufacturer	Caldema	TGM	WEG
Type	AMD-73-7GI	TME 35000 A	SPW 1250
Manufactured Year	2005	2006	2006
Pressure	67 bar abs	16 kgf/cm^2	
Temperature	480° C	320ºC	
Capacity	220 ton steam/h	40 MW	50 MVA

Frequency			1,800 rpm
Nominal Tension			13,8 kV
Lifetime	25 years (by regulation – ABNT NR13)	30 years	30 years
Efficiency	88.6 %	76 to 86 % Depending on steam flow	Power Factor = 0,8: Load – Efficiency(%) 125 – 98.0 100 – 98.0 75 – 97.9 50 – 97.4 Power Factor =1.0 Load – Efficiency(%) 100 – 98.6

A.4.4 Estimated amount of emission reductions over the chosen crediting period:

The chosen crediting period for this project is the renewable crediting period of 7 years. The estimated amount of emission reductions of the project can be seen at Table 3. There are no emissions reductions in 2015 until April 14th as is the off-harvest period, thus no electricity generation.

Table 3 – Estimated emission reductions for the first crediting period

Years	**Annual estimation of emission reductions in tonnes of CO_2**
2008 (from April 15th)	33,194
2009	40,471
2010	49,043
2011	55,689
2012	64,711
2013	68,139
2014	78,630
2015 (until April 14th)	0
Total Estimated Reductions (tonnes of CO_2e)	389,877
Total number of crediting years	7

Annual average over the crediting period of estimated reductions (tonnes of CO_2e)	55,697

A.4.5. Public funding of the project activity:

There is no public funding involved on the Usina Interlagos Cogeneration Project. This project does not receive any public funding and it is not a diversion of ODA.

SECTION B. Application of a baseline and monitoring methodology

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

ACM0006 - "Consolidated baseline methodology for grid-connected electricity generation from biomass residues" (version 04, November 02nd, 2006)

ACM0002 - "Consolidated baseline methodology for grid-connected electricity generation from renewable sources" (version 6, May 19th,2006).

Version 3 of the tool for demonstration and assessment of additionality.

B.2 Justification of the choice of the methodology and why it is applicable to the project activity:

The ACM0006 methodology is applied to this project because it is a **greenfield power project**: a new biomass power generation plant at a site where currently no power generation occurs.

It uses one type of biomass: bagasse, a byproduct of the production of sugar. The power generated by the project plant would in the absence of the project activity be purchased from the grid.

Applicability conditions of the methodology are as follows:

(i) No other biomass types than biomass residues are used in the project plant and these biomass residues are the predominant fuel used in the project plant. Biomass is defined as a by-product, residue or waste stream from agriculture, forestry and related industries.

The primary fuel in the project plant is a biomass consisting of sugar cane bagasse. The bagasse used in Usina Interlagos comes from the production of sugar carried in the same facility where the project is located.

(ii) The implementation of the project shall not result in an increase of the processing capacity of raw input or other substantial changes in the process:

Any increase in the bagasse production will be due to *Usina Interlagos* natural expanding business and can not be attributed to the implementation of the cogeneration project. Usina Interlagos's main activity of Usina Interlagos is the alcohol production from sugarcane. The implantation of the sugarcane plantation was planned in 2003 to attend increasing market demand for alcohol. In February 2006 started the sugarcane seedling planting in an 8.2 km^e area and will be gradually increased each year, up to 210 km^2 until 2010 for the first phase implementation. In a second phase plantation area will be expanded until reach 3.6 million ton of sugarcane.

As this is a Greenfield project, i.e., sugarcane plantation area is been prepared and developed, thus will be increased annually. Consequently the quantity of bagasse will also increase gradually.

Project Owner could fire all the exceed bagasse in the same boiler with very low efficiency, however, project owner decide to increase energy generation installing a new boiler-generator equipment.

To supply internal electricity consumption, a lower 15MW generation capacity, a lower pressure boiler (27 kgf/cm^2), and consequently lower efficiency is sufficient.

The Table below shows the classification of boilers accordingly to operation pressure.

Table 4 - Classification of boilers accordingly to operation pressure

Classification	**Pressure (bar)**	**Steam Temperature**
Very low pressure	under 6.9	1 bar – 100o C
Low pressure	6.9 to 13.8	13.8 bar - 187^{o}C
Medium pressure	13.8 to 48.3	41.4 bar - 399^{o}C
High pressure	48.3 to 103.4	103 bar - 510^{o}C
Very high pressure	103.4 to 221.2	124 bar - 538^{o}C
Supercritical	above 221.2	

References: Brazilian Service of Technical Answers, SENAI. 09 nov. 2006 (*in Portuguese*).
Perry's Chemical Engineer's Handbook, 7th edition

However, if there is no CDM project registration, Usina Interlagos will not implement the power plant expansion as there is no need to meet internal energy demand. The total generation capacity of one 40MW power plant in 203 days of harvest is around 194,000 MWh, which is 30% greater then the energy demand of the project in 2013, when the sugarcane production almost reach the planned expansion of 3,600,000 ton.

Any fluctuation of the amount of sugarcane produced and, consequently the bagasse will be due to climate, crop and market conditions that could vary from year to year.

Table 5 – Amount of sugar cane processed/bagasse consumption/ internal energy consumption in Usina Interlagos

Harvest	Installed Capacity	Sugar cane processing (tonnes)	Bagasse Consumption (wet tones)	Internal Consumption (MWh)
2007	40 MW	963,000	239,845	35,019
2008	40 MW	1,720,000	428,383	56,793
2009	40 MW	2,070,000	515,554	68,160
2010	80 MW	2,372,000	590,770	80,697
2011	80 MW	2,613,000	650,794	88,730
2012	80 MW	2,789,000	694,628	95,229
2013	80 MW	3,000,000	747,180	105,452
2014	80 MW	3,600,000	896,616	123,442

Interlagos Project will generate approximately 90,000 to 102,000 MWh yearly (for sale and internal use) per million tonnes of sugar cane processed.

(iii) The biomass used by the project facility should not be stored for more than one year:

The sugar mills, generally, store a small amount of bagasse for the next season in order to start plant operations when the new crop season/ harvest begins. In Usina Interlagos, the bagasse will be stored from the end of the harvest season in the Brazilian Shoutheast region, in November, until the beginning of the following harvest season, in April. The volume of bagasse stored between seasons is foreseen to be insignificant, 10,000 ton - less than 4% of the total amount of bagasse generated during the year or during the harvest period.

(iv) No significant energy quantities, except for transportation of the biomass, are required to prepare the biomass residues for fuel consumption:

The biomass used in this project is not transformed in any way before being used as a fuel.

Project boundaries
The project boundaries are defined by the emissions targeted or directly affected by the project activities, construction and operation.

The **spatial extent** of the project boundary encompasses the bagasse stocking area, the means for transportation of biomass from stock to power plant, the bagasse power plant at the project site and all power plants connected physically to the electricity system (interconnected grid) that the CDM project power plant is connected to. Please refer to Figure 4 to understand the project boundary and the activities included in it.

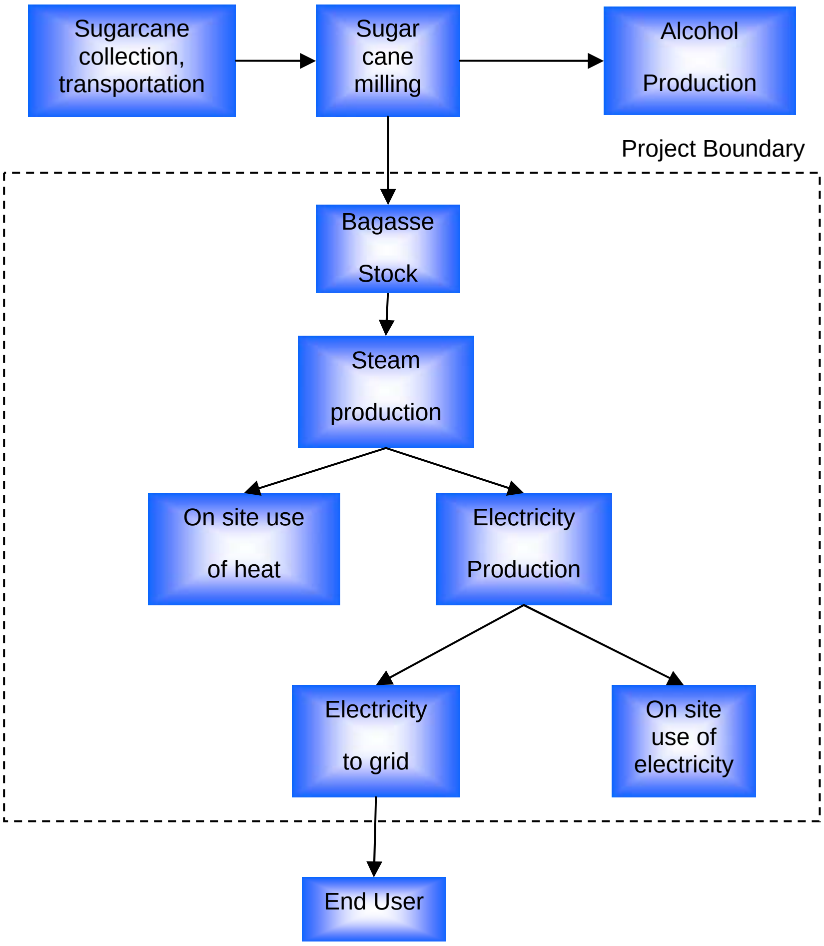


Figure 4 – Usina Interlagos Cogeneration Project Boundary

The spatial extent of the project electricity system, including issues related to the calculation of the build margin (BM) and operating margin (OM), is further defined in the "Consolidated baseline methodology for grid-connected electricity generation from renewable sources" (ACM0002).

According to the approved methodology (ACM0002, version 6, 2006), the baseline emission factor is defined as EF_y and is calculated as a combined margin (*CM*), consisting of the combination of operating margin (OM) and build margin (BM) factors. For the purpose of determining the build margin and the operating margin emission factors, a project electricity system is defined by the spatial extent of the power plants that can be dispatched without significant transmission constraints. Similarly a connected electricity system is defined as an electricity system that is connected by transmission lines to the project electricity system and in which power plants can be dispatched without significant transmission constraints.

As Brazil is a large country with layered dispatch systems, the regional grid definition will be used. Brazil is divided in five macro-geographical regions, North, Northeast, Southeast, South and Midwest. The majority of the population is concentrated in the regions South, Southeast and Northeast regions. Thus the energy generation and, consequently, the transmission are concentrated in two subsystems. The energy expansion has concentrated in two specific areas:

- North-Northeast: The electricity for this region is basically supplied by the São Francisco River. There are seven hydro power plants on the river with total installed capacity of approximately 10.5 GW. 80% of the Northern region is supplied by diesel. However, in the city of Belém, capital of the state of Pará where the mining and aluminum industries are located, electricity is supplied by Tucuruí, the second biggest hydro plant in Brazil;
- South/Southeast/Midwest: The majority of the electricity generated in the country is concentrated in this subsystem. These regions also concentrate 70% of the GDP generation in Brazil. There are more than 50 hydro power plants generating electricity for this subsystem.

The boundaries of the subsystems are defined by the capacity of transmission. The transmission lines between the subsystems have a limited capacity and the exchange of electricity between those subsystems is difficult. The lack of transmission lines forces the concentration of the electricity generated in each own subsystem. Thus the South-Southeast-Midwest interconnected subsystem of the Brazilian grid where the project activity is located is considered as a boundary.

Part of the electricity consumed in the country is imported from other countries. Argentina, Uruguay and Paraguay supply a very small amount of the electricity consumed in Brazil. In 2003 around 0.1% of the electricity was imported from these countries. In 2004 Brazil exported electricity to Argentina which was experiencing a shortage period. The energy imported from other countries does not affect the boundary of the project and the baseline calculation.

An extensive discussion of the baseline for electricity generation for the Brazilian interconnected grid can be seen in *Esparta & Martins Jr. (2001)*[1]. Its baseline for large scale projects is 261.1 Kg CO_2/MWh. This project baseline methodology/approach has been validated for a similar CDM activity consisting of power capacity expansion of biomass to energy power plant in Brazil.

B.3. Description of the sources and gases included in the project boundary

	Source	Gas	Included?	Justification/Explanation
Baseline	Grid Electricity generation	**CO_2**	**Included**	Main emission source. Fossil Fuel fired power generation, or from grid.
		CH_4	Excluded	Excluded for simplification. This is conservative.
		N_2O	Excluded	Excluded for simplification. This is conservative.
	Heat generation	CO2	Excluded	Main emission source. Not accounted. It is conservative.
		CH4	Excluded	Excluded for simplification. This is conservative.
		N2O	Excluded	Excluded for simplification. This is conservative.

[1] Esparta, A. R. J. & C. M. Martins Jr. (2002). *Brazilian Greenhouse Gases Emission Baselines from Electricity Generation,* RIO 02 - World Climate & Energy Event, Rio de Janeiro-Brazil, January 6-11.

	Uncontrolled burning or decay of surplus biomass	CO_2	Excluded	It is assumed that CO2 emissions from surplus biomass residues do not lead to changes of carbon pools in the LULUCF sector.
		CH_4	Excluded	Excluded for simplification. This is conservative.
		N_2O	Excluded	Excluded for simplification. This is conservative. Note also that emissions from natural decay of biomass are not included in GHG inventories as anthropogenic sources.[a]

Project Activity	On-site fossil fuel consumption due to the project activity	CO_2	Excluded	There is no co-fired fossil fuel in the biomass power plant.
		CH_4	Excluded	Excluded for simplification. This emission source is assumed to be very small.[c]
		N_2O	Excluded	Excluded for simplification. This emission source is assumed to be very small.[c]
	Off-site transportation of biomass	CO_2	Excluded	There is no off-site transportation of biomass
		CH_4	Excluded	Excluded for simplification. This emission source is assumed to be very small.[c]
		N_2O	Excluded	Excluded for simplification. This emission source is assumed to be very small.[c]
	Combustion of biomass for electricity and/or heat generation	CO_2	Excluded	It is assumed that CO2 emissions from surplus biomass do not lead to changes of carbon pools in the LULUCF sector.
		CH_4	Excluded	Excluded for simplification. This is conservative.
		N_2O	Excluded	Excluded for simplification. This emission source is assumed to be very small.[c]
	Biomass storage	CO_2	Excluded	It is assumed that CO2 emissions from surplus biomass residues do not lead to changes of carbon pools in the LULUCF sector.
		CH_4	Excluded	Excluded for simplification. Since biomass is stored for not longer than one year, this emission source is assumed to be small.
		N_2O	Excluded	Excluded for simplification. This emission source is assumed to be very small.[c]

Notes to table:

a. Note that the emission factors for CH_4 and N_2O emissions from uncontrolled burning or decay of dumped biomass are highly uncertain and depend on many site-specific factors. Quantification is difficult and may increase transaction costs significantly. Note also that CH_4 and N_2O emissions from the natural decay or uncontrolled burning are in some cases (e.g. natural decay of forest residues) not anthropogenic sources of emissions included in Annex A of the Kyoto Protocol and should not be included in the calculation of baseline emissions pursuant to paragraph 44 of the modalities and procedures for the CDM.

c. CH_4 and N_2O emission factors depend significantly on the technology (e.g. vehicle type) and may be difficult to determine for project participants. Exclusion of this emission source is not a conservative assumption; however, it appears reasonable, since CH_4 and N_2O from on-site use of fossil fuels and transportation are expected to be very small compared to overall emission reductions, and since it simplifies the determination of emission reductions significantly.

B.4. Description of how the baseline scenario is identified and description of the identified baseline scenario:

Usina Interlagos Cogeneration Project uses bagasse for the generation of heat and electricity. The project activity is a new biomass power generation plant at a site where currently no power generation occurs.

This corresponds to baseline scenario 4:

- In the absence of the project activity, a new biomass power plant ("reference plant") would be installed instead of the project activity at the same site and with the same thermal firing capacity, but with a lower electric efficiency than the project plant. The **generation of power** would continue in existing power plants (P2).To complete the energy demand of sugar mill, there would be imported from existing grid-connected power plants (P4).
- The **heat** generated by the project plant would, in the absence of the project activity, be generated by the reference plant, with a lower efficiency (common practice in the sugar cane sector in Brazil) (H2)
- In the absence of the project activity, the same quantity and type of **biomass** would be used in the reference plant. (B4)

According to the methodology applied, the project activity involves the installation of a new power plant at a site where currently no power generation occurs. In the absence of the project activity, a new biomass power plant (in the following referred to as "reference plant") would be installed instead of the project activity at the same site and with the same thermal firing capacity but with a lower electric efficiency as the project plant (e.g. by using a low-pressure boiler instead of a high-pressure boiler). The same type and quantity of biomass as in the project plant would be used in the reference plant. Consequently, the power generated by the project plant would in the absence of the project activity be generated (a) in the reference plant and – since power generation is larger in the project plant than in the reference plant – (b) partly in power plants in the grid. The heat generated by the project plant would in the absence of the project activity be generated in the reference plant (the heat generated per biomass input in the project plant is smaller or the same compared to the reference plant).

Baseline scenario 4 is identified for Interlagos project.

B.5. Description of how the anthropogenic emissions of GHG by sources are reduced below those that would have occurred in the absence of the registered CDM project activity (assessment and demonstration of additionality): >>

In order to determine if the project activity is additional, the additionality tool version 03 approved by the Executive Board is applied. The following steps are applied:

Step 1. Identification of alternatives to the project activity consistent with the current laws and regulations

Sub-step 1a. Define alternatives to the project activity

To define the alternatives to the project activity, there are two-sided analysis, taking into consideration the perspective of the project owner and the perspective of the country.

From the project owner's perspective, the cogeneration project allows the company to export electricity to the grid. Without the project, the plant would operate with low energy efficiency and could not export electricity to the grid.

From the country's perspective, the alternative for producing a similar amount of energy, as the one Usina Interlagos is to provide, would be to use current generation system, which is electricity supplied by large hydro and thermal power stations. Brazil is increasingly depending on thermal plants (mainly natural gas fired).

During a period of restructuring the entire electricity market, as is the current Brazilian situation, investment uncertainty is the main barrier for small renewable energy power projects. In this scenario, these projects compete with existing plants (operating margin) and with new projects (build margin), in which thermal plants usually attract the attention of financial investors.

Sub-step 1b. Consistency with mandatory laws and regulations

The usage of electricity from the grid is in complete compliance with all applicable legal and regulatory requirements. The use of thermal electricity in the generation system is not only in compliance with regulations but also of increasing importance. The proposed project activity is not the only alternative in compliance with regulations.

Step 2. Investment analysis

Sub-step 2a. Determine appropriate analysis method

Additionality is demonstrated through an investment benchmark analysis (option III)

Sub-step 2b and 2c– Option III - benchmark analysis

Financial indicator identified for cogeneration project as the case of Interlagos is the project IRR, and the benchmark is derived from the company internal benchmark (weighted average capital cost of the company - WACC). A second third-party benchmark identified is the minimum return considered by Brazilian Federal Government at the decision of Proinfa program launch.

Calculation of the Weighted Average Cost of Capital (WACC)

The rate used to discount the business cash flow is also known as the weighted-average cost of capital (WACC) and converts the future cash flow into a present value to all investors, considering that both creditors and shareholders expect compensation towards the opportunity cost of investing resources in an specific business instead of investing such resources in another business of equivalent risk.

The basic principle to be followed when calculating the WACC is consistency with the valuation method and with the definition of the discounted cash flow. The formula used to estimate the company's WACC after taxes is:

$WACC = [(Kd \times (1-t) \times Pd)+(Ke \times (1-Pd))]$ Equation A

Where:

WACC= Weighted-average cost of capital

Kd= Cost of Debt (third-party capital)
t = Marginal corporate income tax
Pd= Debt as a percentage of total capitalization
Ke= Cost of Equity (own capital)

Considering that Interlagos is being financed with their own capital and with other debitors, we have adopted the case of a leveraged company to calculate the firm's WACC.

Cost of debt (Kd) is 15% per year. It is the financing line of BNDES offered to Interlagos (10% TJLP + 5% risk spread).

BNDES financing covers 90% (ninety percent) of the thermo power project. Therefore, *Debt as a percentage of total capitalization* (Pd) is 90%. Interlagos provided the other 10% (ten percent). The average of the *marginal corporate income tax* (t) is 25% per year.

Estimating the *Cost of Equity* (Ke) was possible by using the parameters observed in global financial markets, allowing the application of the CAPM (Capital Asset Pricing Model) model. Given these assumptions, the cost of capital in Brazil should be close to a global cost of capital adjusted for local inflation and capital structure. It should be noted that as far as calculating the inflation differential we have used an estimate of the compounded difference between the local inflation rate and the US inflation rate over ten years. Also, for calculation purposes, we have used a Beta, which measures systemic equity risk within the company's industry, typical of the environmental services sector. Thus, in order to calculate Interlagos' cost of equity we have used the following parameters[2]:

Cost of Equity(Ke) – Interlagos		
Yield of Sovereign 20-year BB Debt	**Plus**	10%p.a.
10-year BB Credit risk premium over US Treasuries[3]	**Minus**	1.65%p.a.
10-year US/Brazil inflation differential	**Plus**	5%p.a.
International Market Equity Risk Premium	**Plus**	5%p.a.
Adjustment of Market Equity Risk with Beta of 0.795[4]	**Minus**	3.9%p.a.
Interlagos Cost of Equity with Brazilian Country Risk		14.45%p.a.

Applying Ke=14.45% to the Equation A above:

WACC = [(15% x (1 - 25%) x 90% + (14.45%p.a. x 10%)] = 11.57%p.a.

Thus, Interlagos' Weighted Average Cost of Capital is equal to 11.57%p.a., and this figure will be used to discount the company's cash flow throughout this study.

Financial Indicator, Internal rate of return (IRR)

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[2] Copeland et al.; Measuring and Managing the Value of Companies; Third Edition.

[3] Source: Bloomberg

[4] Considering that Interlagos is not listed in their stock exchanges, PPs decided to use similar sugar mills as the benchmark. Therefore PPs took the weighted average of the Beta of the two sugar mills listed in the Bovespa (Cosan and São Martinho).

Interlagos' cash flow (see annexed spreadsheet "FCF_Termoeletrica_Interlagos (CER) 2007.05.28.xls") shows that the IRR of the project without CERs, 8.92%, is lower than the WACC 11.57%. This evidences that project activity is not financially attractive to investor.

The cash flow revenues and costs future increase estimation are not linear because are directly linked with the plantation area, which in time are based on the sugarcane plantation area expansion, which is not linear, but depends on the negotiation of the area with the property owners.

Sub-step 2d: Sensitivity analysis

A sensitivity analysis was conducted by altering the following parameters:

- Increase in project revenue
- Reduction in running costs

Those parameters were selected as being the most likely to fluctuate over time. Financial analyses were performed altering each of these parameters by 5%, and assessing what the impact on the project IRR would be See results in the Table below. The 5% variation was chosen from the average annual Brazilian inflation.

For the calculation, see annexed spreadsheet "FCF_Termoeletrica_Interlagos (CER) 2007.05.28.xls"). As it can be seen, the project IRR remains lower than the benchmark even in the case where these parameters change in favor of the project.

Table: Sensitivity analysis

Scenario	**% change**	**IRR (%)**
Original	-	8.92
Increase in project revenue	5%	10.23
Reduction in project costs	5%	9.15

Outcome: The IRR of the project activity without being registered as a CDM project is below the WACC benchmark, evidencing that project activity is not financially attractive to investor. The IRR with CERs will be 11.28%, similar to the WACC. CERs were considered also after 2012, as PPs believe Kyoto Protocol will be extended. Although IRR is not higher than the WACC, PPs know about the CDM registering benefits, as Interlagos owner has another plant operating, registered as CDM project and with issued CERs. The fact that IRR with CERs will be almost the benchmark, and the knowledge of the CDM registering benefits were the key points to decision-making to implement the project activity.

Step 3. Barrier Analysis:

Sub-step 3a. Identify barriers that would prevent the implementation of the proposed CDM project activity

Investment Barrier

Financing Environment in Brazil

As a consequence of the long period of inflation, the Brazilian currency experienced a strong devaluation, effectively precluding commercial banks from providing any long-term debt financing. The lack of a long-term debt market has caused a severe negative impact on the financing of energy projects in Brazil.

Interest rates for local currency financing are significantly higher than for US Dollar financing. The National Development Bank – BNDES is the only supplier of long-term loans. Debt financing from BNDES are made primarily through commercial banks. The credit market is dominated by shorter maturities (90-days to 1-year) and long-term credit lines are available only to the strongest corporate borrowers and for special government initiatives. Credit is restricted to the short-term in Brazil or the long-term in dollars offshore.

Financial domestic markets with a maturity of greater than 1 year are practically non-existent in Brazil. Experience has shown that in moments of financial stress the duration of savings instruments have contracted to levels close to one day with a massive concentration in overnight banking deposits. Savers do not hold long-term financial contracts due to the inability to price-in the uncertainty involved in the preservation of purchasing power value (Arida et al., 2005).

The lack of a local long-term market results not from a disinterest of financial investment opportunities, but from the reluctance of creditors and savers to lengthen the term of their placements. It has made savers opt for the most liquid investments and to place their money in short-term government bonds instead of investing in long-term opportunities that could finance infrastructure projects.

Moreover, the high level of guarantees required to finance an energy project in Brazil is a barrier for developing new projects. Insurance, financial guarantees, financial advisories are requirements which increase the cost of the project and are barriers to project achievability.

The law nº 10,438, enacted in April 2002, created the Proinfa - *Programa de Incentivo às Fontes Alternativas de Energia Elétrica* (Program of Incentives to Alternative Energy Sources). Among others, one of this initiative's goals is to increase the renewable energy sources share in the Brazilian electricity market, thus contributing to a greater environmental sustainability. In order to achieve such goals, the Brazilian government has designated the federal state-owned power utility Eletrobras - *Centrais Elétricas Brasileiras S/A* to act as the primary offtaker of electric energy generated by alternative energy facilities in Brazil, by entering into long-term PPAs (Power Purchase Agreements) with alternative energy producers, at a guaranteed price of at least 80% of the average energy supply tariff charged to ultimate consumers. The creation of Proinfa indicates that, without specific support, the renewable sources and the small projects would hardly be implemented otherwise.

The existence of Proinfa is a proof that a sound incentive is necessary to promote the construction of renewable energy projects in Brazil and there is room for CDM projects. Proinfa legislation proposed to increase the capacity of renewable energy power generation to about 3,300 MW by 2006, but from the 1,100 MW it reserved to biomass energy sources, only 685.24 MW have been contracted so far. According to a Brazilian energy magazine[5], there are two main reasons for this: 1) the average IRR for the investment in the production of sugar cane/ethanol is 3% higher than the average IRR for the investment in cogeneration; 2) entrepreneurs have considered the tariff of R$ 97.24/MWh (as of June 2004) not profitable. In 2005, BNDES

[5] Brasil Energia, n. 299, October, 2005. P.83

presented the last final version of its financing incentive line to Proinfa, which is different from the one first considered for the program, that was considered insufficient. It means that for the last 5 years, the government had to present a new proposition (or incentive) per year, in order to convince the developers to invest in renewable energy projects.

Usina Interlagos did not apply for Proinfa, because there was not enough time to fulfill to all the application requirements and, for this reason, does not count with the benefits of the program and has more difficulties in competing in the Brazilian electricity market.

BNDES Barriers

The Interlagos Project is being developed on a project finance basis. To finance construction, project sponsor took advantage of the financing lines of BNDES. The offered rate to Interlagos was TJLP (BNDES Long Term Interest Rate) of 10% plus a 5% risk spread for a tenor of 8-year and grace period of 1-year. BNDES financing covers 80% of engineering, construction and equipment costs and is limited to local vendors.

Financing form BNDES is only available to companies willing to offer corporate or real guarantees in excess of total amount borrowed. In other words, Interlagos had to use its own balance sheet and capital to raise funds from BNDES. In case projects underperform or become unfeasible, BNDES will call Interlagos's guarantees and real assets up to their initial credit exposure. In addition to leveraging their balance sheet sizeable borrowings, Interlagos faces completion risk of the projects and credit risk of the utility. Completion risk is mitigated by guarantees pledged by the construction company, which are however, of limited recourse. The credit risk of the utility though is difficult to hedge. Once the Power Purchase Agreements are signed, Interlagos is immediately exposed to the utility's long term credit risk.

Power Purchase Agreement (PPA) Barriers

Other financial barriers are related to the power purchase agreement (PPA). The PPA is required in order to obtain long-term financing from a bank and the lack of adequate commercial agreements from the energy buyers may influence directly the negotiation between the bank and the project developer. The actual legislation for electricity generation and distribution is arranged to attend hydro, gas and oil power generation plants. Therefore is not appropriate to generation from biomass which has peculiarities as season and biological changes. Bagasse cogeneration plant owners are talking to government to adept the legislation to biomass generated electricity.

Both processes of negotiating a PPA with utility companies and obtaining funding from BNDES have been very cumbersome. The developers perceive BNDES requiring excessive guarantees in order to provide financing. Although this might be the Bank role as a financing institution to mitigate risk, it is understood as a market barrier. Other risks and barriers are related to the operational and technical issues associated with small cogeneration projects, including their capability to comply with the PPA contract and the potential non-performance penalties. Moreover, traditional sugar producers would prefer concentrating investments on their traditional business (sugar and ethanol) than venturing in new projects with new risks and low returns (see Investment Barrier) where they have little or no know-how.

Conclusion

CDM offered Interlagos project an additional source of revenue that could mitigate the projects' exposure to currency devaluation, interest rate increases, and credit risk. The pro-forma income statement analysis of the projects shows that investor's internal return could increase by as much as 240 basis points when revenues from CERs are considered and thus render projects marginally attractive when compared to risk free bond rates. In sum, in the absence of CDM, Interlagos would be a riskier, less attractive and ultimately unfeasible projects.

Institutional Barrier

As described above, since 1995 government electricity market policies have been continuously changing in Brazil. Too many laws and regulations were created to try to organize and to provide incentives for new investments in the energy sector. The results of such regulatory instability were the contrary to what was trying to be achieved. During the rationing period electricity prices surpassed BRL 600/MWh (around USD 200/MWh) and the forecasted marginal price of the new energy reached levels of BRL 120 – 150/MWh (around USD 45). In the middle of 2004 the average price was bellow BRL 50/MWh (less than USD 20/MWh). The volatility of the electricity price in Brazil has a correlation with the instability in government policies in the period, with 3 different regulatory environments in a 10 year period (from 1995 to 2004). In theory the new regulatory framework has the potential to reduce market risk considerably. Nevertheless only time will prove the efficiency of the new model in relation to market risks reduction and private investment attraction[6]. In that sense, it will interesting to evaluate the results of the first auction of licenses for the construction of new power plants in order to correctly assess the success of the implementation of the new regulatory framework

Cultural Barrier

The history of the sugarcane industry has demonstrated that the industry is a traditional stable business and has consistently helped to support the country's economy. It has historically enjoyed governmental support such as fixed prices and subsidies. Another characteristic of this sector is the specialization in commodity (sugar and ethanol) transactions. In addition to all those barriers mentioned above, it is important to understand that the sale of electricity from cogeneration represents only a small share of total annual revenues of sugar mills. As a consequence, sugar mills prefer investing in equipment related to their core business, the production of sugar and molasses. In general, the revenues of selling electricity in a cogeneration project does not represent more than 5 % of total revenues of a sugar mill. For the Interlagos cogeneration project, the sale of electricity represents less than 10% of the total annual revenues. Therefore, the cultural barrier is a considerable obstacle.

Sub-step 3b. Show that the identified barriers would not prevent the implementation of at least one of the alternatives (except the proposed activity):

As described above, the main alternative to the project activity is to continue the status quo, the sugarcane mills only concentrating their investments on sugar and ethanol. Therefore the barriers above have not affected the investment in other opportunities

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[6] The reform of the legal framework of the Brazilian electricity sector started with Provisional Measure No. 144, later converted into Law No. 10,848, of 15 March 2004 - was unveiled with the publication of Decree No. 5,163, of 30 July 2004.

Both sub-steps 3a-3b are satisfied, proceed to Step 4.

Step 4. Common practice analysis

Sub-step 4a. Analyze other activities similar to the proposed project activity:

Some sugar mills have optimized their power plants in order to export electricity; numerous risks and barriers have prevented the implementation of the proposed project activity among the majority of the sugar mills. In the Centre-South Region, there are more than 250 sugar mills producing sugar, ethanol and electricity for their self-consumption but less than 30 mills have developed expansion programs for their power plants.

Currently in Brazil, there are more than 5 million hectares of land producing sugarcane and there are more than 320 sugar mills producing sugar, ethanol and electricity to supply their own energy consumption. Consequently the potential to generate electricity for commercialization (exporting to the grid), is estimated at around 12 GW. This potential has always existed and has grown as the sugarcane industry has grown. However the investments to expand the sugar mills' power plants have only occurred since 2000. Although a flexible legislation allowing independent energy producers has existed since 1995, it was only after 2000 that sugar producers started to study this proposed project activity as an investment alternative for their power plants in conjunction with the introduction of the CDM.

Sub-step 4b. Discuss any similar options that are occurring:

Both processes of negotiating a PPA with utility companies and obtaining funding from BNDES have been very cumbersome. . The developers perceive BNDES requiring excessive guarantees in order to provide financing. Although this might be the Bank role as a financing institution to mitigate risk, it is understood as a market barrier. Other risks and barriers are related to the operational and technical issues associated with small cogeneration projects, including their capability to comply with the PPA contract and the potential non-performance penalties. Moreover, traditional sugar producers would prefer concentrating investments on their traditional business (sugar and ethanol) than venturing in new projects with new risks and low returns (see Investment Barrier) where they have little or no know-how.

Regardless of the risks and barriers mentioned above, the main reason for the reduced number of similar project activities is the economic cost. Project feasibility requires a PPA contract with a utility company, but the utilities do not have the incentives or motivation to buy electricity generated by small cogeneration projects. The marginal cost for electricity expansion is US$ 33/MWh[7] and the cost of cogeneration electricity ranges from US$ 35 to US$ 50.

Because of reasons mentioned above, no more than 10% of the sugar mills in the Centre-South region have developed similar activities to that of Termoeletrica Interlagos and the majority of these project developers have taken into consideration CDM in their decision to expand their cogeneration plant.

The intention of Interlagos mill to diversify its revenues and hedge against the volatility of sugar and ethanol prices was fundamental for the company to set up this pioneer project and create the Termoeletrica Interlagos. The company has also been a pioneer in looking for CER revenues to increase the project IRR and consequently making it economically feasible.

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[7] MME – Ministério de Minas e Energia (Ministry of Mines and Energy)

The CDM has made it possible for the mills set up their cogeneration plants and export excess electricity to the grid by helping to overcome financial barriers through the financial benefits obtained from CDM revenues. Additionally, CDM has helped to overcome institutional and cultural barriers since the CDM has made the project sponsors take more seriously into consideration the generation of renewable electricity.

Outcome: Only a small part of the sugar mills in the region, and also in national market had expanded the electricity production without some incentive as CDM revenues.

Sub-steps 4a and 4b are satisfied, then the proposed project activity is additional.

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

The project activity mainly reduces CO_2 emissions through substitution of power and heat generation with fossil fuels by energy generation with biomass. The emission reduction ER_y by the project activity during a given year y is the difference between the emission reductions through substitution of heat generation with fossil fuels ($ER_{heat,y}$), the emission reductions through substitution of electricity generation with fossil fuels ($ER_{electricity,y}$), and project emissions (PE_y), emissions due to leakage (L_y) and, where this emission source is included in the project boundary and relevant, baseline emissions due to the natural decay or burning of anthropogenic sources of biomass ($BE_{biomass,y}$), as follows:

$$ER_y = ER_{heat,y} + ER_{electricity,y} + BE_{biomass,y} - PE_y - L_y \quad \textbf{Equation 1}$$

where:

ERy: are the emissions reductions of the project activity during the year y in tons of CO_2,
$ERheat,y$: are the emission reductions due to displacement of heat during the year y in tons of CO_2,
$ERelectricity,y$: are the emission reductions due to displacement of electricity during the year y in tons of CO_2,
$BEbiomass,y$: are the baseline emissions due to natural decay or burning of anthropogenic sources of biomass during the year y in tons of CO_2 equivalents,
PEy: are the project emissions during the year y in tons of CO_2, and
Ly: are the leakage emissions during the year y in tons of CO_2.

Emission reductions from heat are not considered because the thermal efficiency of the project plant is larger than the heat efficiency of the reference plant. For conservativeness reasons, they are excluded, i.e., $ER_{heat,y}=0$.

Baseline emissions from uncontrolled burning or decay of biomass in the baseline scenario are not included, i.e. $BE_{biomass,y}=0$ (Scenario B4).

Project emissions include CO_2 emissions from transportation of biomass to the project site (PET_y),CO_2 emissions from on-site consumption of fossil fuels due to the project activity ($PEFF_y$), CO_2 emissions due to electricity consumption/importation from grid at the project site ($PE_{EC,y}$) and, where this emission source is included in the project boundary and relevant, CH_4 emissions from the combustion of biomass ($PE_{Biomass,CH4,y}$).

$$PE_y = PET_y + PEFF_y + PE_{EC,y} + GWP_{CH4}.PE_{Biomass,CH4,y} \quad \textbf{Equation 2}$$

There is no transportation of biomass, once bagasse is produced inside project site. Also, there is no fossil fuel consumption, as all energy necessary on-site is provided by the project activity. And decay of biomass is not considered to conservative way. The only project grid electricity consumption is during the out of season, from middle of November to middle of April next year, to supply energy for maintenance works. In this way project emissions are given by the following equation:

$$PE_y = PE_{EC,y} = EC_{PJ,y} \times EF_{grid,y} \quad \textbf{Equation 3}$$

where:

$EC_{PJ,y}$: On-site electricity consumption attributable to the project activity during the year y(tCO_2/year)
$EF_{grid,y}$: CO2 emission factor for grid electricity during the year y (tCO_2/MWh)

The main emissions giving rise due to leakage in the context of electric sector projects are emissions arising due to activities such as power plant construction, fuel handling (extraction, processing and transport), and increase in emissions from fossil fuel combustion due to diversion of biomass from other uses to the project plant as a result of the project activity.

Project participants do not need to consider these emissions sources as leakage in applying this methodology in the scenario 4, because the diversion of biomass to the project activity is already considered in the calculation of baseline reductions. Therefore:

$$L_y = 0$$ **Equation 4**

Emission reduction due to displacement of electricity are calculated by multiplying the net quantity of increased electricity generated with biomass as a result of the project activity (EG_y) with the CO_2 baseline emission factor for the electricity displaced due to the project ($EF_{electricity,y}$), as follows:

$$ER_{electricity,y} = EG_y \cdot EF_{electricity,y}$$ **Equation 5**

For the scenario 4, EGy is determined as the difference between the electricity generation in the project plant and the quantity of electricity that would be generated by other power plant(s) using the same quantity of biomass residues that is fired in the project plant, as follows:

$$EG_y = EG_{project\_plant,y} - \varepsilon_{el,other\_plant} \cdot \frac{1}{3.6} \cdot \sum_k BF_{k,y} \cdot NCV_k$$ **Equation 6**

Where:

$EG_{project\ plant,y}$: net quantity of electricity generated in the project plant during year y (MWh)

$\varepsilon_{el,\ other\ plant}$: average net energy efficiency of electricity generation in (the) other plant that would use the biomass residues fired in the project plant in absence of the project activity ($MWh_{el}/MWh_{biomass}$)

$BF_{k,y}$: quantity of biomass residue type k combusted in the project plant during year y (tons of dry matter)

NCV_k: net calorific value of the biomass residue type k (GJ/ton of dry matter)

From the explanations above, we have the emissions reductions of the project activity calculated as:

$$ER = ER_{electricity,y} - PE_y = EG_y \cdot EF_{electricity,y} - EC_{PJ,y} \cdot EF_{grid,y}$$ **Equation 7**

As $EF_{electricity,y}$ and $EF_{grid,y}$ corresponds to the same parameter in this project activity, the emissions reductions are calculated as:

$$ER = (EG_y - EC_{PJ,y}) \cdot EF_{grid}$$ **Equation 8**

Calculation of the Emission Factor for the electricity displaced ($EF_{electricity,y}$) and Emission Factor for grid electricity (EF_{grid})

According to the selected approved methodology ACM0002, version 6, 2006, the baseline emission factor is calculated as a combined margin (*CM*), consisting of the combination of operating margin (*OM*) and build margin (*BM*) factors according to the following three steps:

- **STEP 1 -** Calculate the operating margin emission factor(s), based on one of the following methods:
  - (1) Simple operating margin
  - (2) Simple adjusted operating margin
  - (3) Dispatch data analysis operating margin
  - (4) Average operating margin.

Dispatch data analysis operating margin (3) should be the first methodological choice. Since not enough data was supplied by the Brazilian national dispatch center, the choice is not currently available. The simple operating margin (1) can only be used where low-cost/must-run resources[8] constitute less than 50% of total grid generation in: 1) average of 5 most recent years, or 2) based on long-term normals for hydroelectricity production. The share of hydroelectricity in the total electricity production for the Brazilian South-Southeast-Midwest interconnected system is much higher than 50% (see table 6 below), resulting in the non-applicability of the simple operating margin to the project.

Table 6 – Share of hydroelectricity production in the Brazilian S-SE-CO interconnected system from 1999 to 2003 (ONS, 2004).

Year	Share of hydroelectricity (%)
1999	94.0
2000	90.1
2001	86.2
2002	90.0
2003	92.9

The average operating margin alternative (4), is an oversimplification and, due to the high share of a low operating cost/must run resource (hydro), does not reflect at all the impact of the project activity in the operating margin.

Therefore, the simple adjusted operating margin (2) will be used here.

The simple adjusted operating margin emission factor (EFOM,adjusted,y in tCO2/MWh) is a variation on the simple operating margin, where the power sources (including imports) are separated in low-cost/must-run power sources (*k*) and other power sources (*j*):

$$EF_{OM,simple-adjusted,y} = (1-\lambda_y)\frac{\sum_{i,j} F_{i,j,y} \cdot COEF_{i,j}}{\sum_j GEN_{j,y}} + \lambda_y \cdot \frac{\sum F_{i,k,y} \cdot COEF_{i,k}}{\sum_k GEN_{k,y}}$$ **Equation 9**

Where:

- λ_y is the share of hours in year *y* (in %) for which low-cost/must-run sources are on the margin.
- $\sum_{i,j} F_{i,j,y}$ is the amount of fuel *i* (in mass or volume unit) consumed by relevant power sources *j* (analogous for sources *k*) in year(s) *y*,
- $COEF_{i,j}$ is the CO_2e coefficient of fuel *i* (tCO_2e/mass or volume unit of the fuel), taking into account the carbon dioxide equivalent emission potential of the fuels used by relevant power sources *j* (analogous for sources *k*) and the percent oxidation of the fuel in year(s) *y* and,
- $\sum_j GEN_{j,y}$ is the electricity (MWh) delivered to the grid by source *j* (analogous for sources *k*).

The most recent numbers for the interconnected S-SE-CO system were obtained from the Brazilian national dispatch center, ONS (from the Portuguese *Operador Nacional do Sistema Elétrico)* in the form of daily consolidated reports (ONS-ADO, 2004). Data from 126 power plants, comprising 66 GW installed capacity and around 828 TWh electricity generation over the 3-year period were considered.

Low-cost/must-run resources in Brazilian S-SE-CO interconnected system are hydro and thermonuclear power plants, considered free of greenhouse gases emissions, i.e., $COEF_{i,k}$ for these plants is zero. Hence, the low-cost/must-run part of the Equation 2 is null, so this equation turns to the following:

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[8] Low operating cost and must run resources typically include hydro, geothermal, wind, low-cost biomass, nuclear and solar generation (AM0015, 2004).

$$EF_{OM,simple-adjusted,y} = (1-\lambda_y).EF_{OM-non,y} = (1-\lambda_y).\frac{\sum_{i,j} F_{i,j,y} \cdot COEF_{i,j}}{\sum_j GEN_{j,y}}$$ **Equation 10**

where: $EF_{OM-non,y}$ is emission factor for **non**-low-cost/must-run resources(in tCO_2/MWh) by relevant power sources j in year(s) y.

Non-low-cost/must-run resources in Brazilian S-SE-CO interconnected system are thermopower plants burning coal, fuel oil, natural gas and diesel oil. These plants result in non-balanced emissions of greenhouse gases, calculated as follows:

The product $\sum_{i,j} F_{i,j,y} \cdot COEF_{i,j}$ for each one of the plants was obtained from the following formulae:

$$F_{i,j,y} = \frac{GEN_{i,j,y} \cdot 3{,}6 \times 10^{-6}}{\eta_{i,j,y} \cdot NCV_i}$$ **Equation 11**

$$COEF_{i,j} = NCV_i \cdot EF_{CO2,i} \cdot 44/12 \cdot OXID_i$$ **Equation 12**

$$Hence,\ F_{i,j,y} \cdot COEF_{i,j} = \frac{GEN_{i,j,y} \cdot EF_{CO2,i} \cdot OXID_i \cdot 44/12 \cdot 3{,}6 \times 10^{-6}}{\eta_{i,j,y}}$$ **Equation 13**

where variable and parameters used are:

- $\sum_{i,j} F_{i,j,y}$ is given in [kg], $COEF_{i,j}$ in [tCO_2e/kg] and $F_{i,j,y} \cdot COEF_{i,j}$ in [tCO_2e]
- $GEN_{i,j,y}$ is the electricity generation for plant j, with fuel i, in year y, obtained from the ONS database, in MWh
- $EF_{CO2,i}$ is the emission factor for fuel i, obtained from the Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories, in tC/TJ.
- $OXID_i$ is the oxidization factor for fuel i, obtained from the Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories, in %.
- 44/12 is the carbon conversion factor, from tC to tCO_2.
- 3.6×10^{-6} is the energy conversion factor, from MWh to TJ.
- $\eta_{i,j,y}$ is the thermal efficiency of plant j, operating with fuel i, in year y, obtained from Bosi et al. (2002).
- NCV_i is the net calorific value of fuel i [TJ/kg].

$\sum_{j,y} GEN_{j,y}$ is obtained from the ONS database, as the summation of non-low-cost/must-run resources electricity generation, in MWh.

- **STEP 2** – Calculate the build margin mission factor ($EF_{BM,y}$) as the generation weighted average emission factor (tCO_2e/MWh) of a sample of power plants m, as follows:

$$EF_{BM,y} = \frac{\sum_{i,m} F_{i,m,y} \cdot COEF_{i,m}}{\sum_{m} GEN_{m,y}}$$ **Equation 14**

where $F_{i,m,y}$, $COEF_{i,m}$ and $GEN_{m,y}$ are analogous to the variables described for the simple OM method (ACM0002, version 6, 2006) for plants *m*, based on the most recent information available on plants already built. The sample group *m* consists of either:

- The five power plants that have been built most recently, or
- The power plants 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.

- **STEP 3** – Calculate the baseline emission factor EF_y, as the weighted average of the operating margin factor ($EF_{OM,y}$) and the build margin factor ($EF_{BM,y}$):

$$EF_y = w_{OM} \cdot EF_{OM,y} + w_{BM} \cdot EF_{BM,y}$$ **Equation 15**

where the weights w_{OM} and w_{BM}, by default, are 50% (i.e., $w_{OM} = w_{OM} = 0.5$).

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

Project participants decided to determine emission factor for interconnected grid *ex-ante*, without annual revision. Emission factor is calculated with data for the last available 3 years: 2003, 2004, 2005.

Data / Parameter:	$EF_{grid,y}$ *and* $EF_{electricity,y}$
Data unit:	tCO_2/MWh
Description:	CO2 emission factor for the Brazilian South-Southeast-Midwest interconnected grid
Source of data used:	Data provided by ONS (National dispatch center). Calculated according to the approved methodology – ACM0002, version 6, 2006
Value applied:	0.2611
Justification of the choice of data or description of measurement methods and procedures actually applied :	Factor was calculated according to the approved monitoring methodology ACM0002-ver06. Calculated as a weighted sum of the OM and BM emission factors.
Any comment:	

Data / Parameter:	$EF_{OM,y}$
Data unit:	tCO_2/MWh
Description:	CO_2 Operating Margin emission factor of the grid in a year *y*
Source of data used:	Data provided by ONS (National dispatch center). Calculated according to the

	approved methodology – ACM0002, version 6, 2006
Value applied:	0.4349
Justification of the choice of data or description of measurement methods and procedures actually applied :	According to ACM0002, version 6, May 19, 2006, the option chosen for the calculation of the emission factor in this project is option (a): simple adjusted operating margin factor. This choice is due to the fact that, in Brazil, even though most of the energy produced in the country comes from hydroelectric power, most of these low costs investments in hydro electrics are exhausted. Therefore, the possibility of investments in non-renewable sources arises, such as thermoelectric power plants. As thermal plants use fossil, these companies end up having higher operational costs than hydro plants. As a result, they are likely to be displaced by any hydro added to the grid. See more details in Annex 3
Any comment:	

Data / Parameter:	$EF_{BM,y}$
Data unit:	tCO_2/MWh
Description:	CO_2 Build Margin emission factor of the grid in a year *y*
Source of data used:	Data provided by ONS (National dispatch center). Calculated according to the approved methodology – ACM0002, version 6, 2006
Value applied:	0.0872
Justification of the choice of data or description of measurement methods and procedures actually applied :	*ex-ante* calculation 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.
Any comment:	

Data / Parameter:	λ_y
Data unit:	No unit
Description:	Fraction of time during which low-cost/must-run sources are on the margin
Source of data used:	Data provided by ONS.
Value applied:	λ_{2003}=0.5312, λ_{2004}=0.5055, λ_{2005}=0.5130
Justification of the choice of data or description of measurement methods and procedures actually applied :	Calculated according the approved methodology – ACM0002
Any comment:	

Data / Parameter:	$Fi_{,y}$
Data unit:	Mass or volume
Description:	Amount of each fossil fuel consumed by each power source/plant
Source of data used:	Data provided by ONS

Value applied:	Please see table below for data $\frac{\sum_{i,j} F_{i,j,y} \cdot COEF_{i,j}}{\sum_{j} GEN_{j,y}}$
Justification of the choice of data or description of measurement methods and procedures actually applied :	. Calculated according the approved methodology – ACM0002
Any comment:	As the amount of values/data is extraordinary large, it will be omitted here. Data is available under request, together with the emission factor for grid calculations.

Data / Parameter:	**COEFi**
Data unit:	tCO_2/mass or volume
Description:	CO_2 emission coefficient of each fuel type i
Source of data used:	Data provided by ONS.
Value applied:	Please see table below for data $\frac{\sum_{i,j} F_{i,j,y} \cdot COEF_{i,j}}{\sum_{j} GEN_{j,y}}$
Justification of the choice of data or description of measurement methods and procedures actually applied :	Calculated according the approved methodology – ACM0002
Any comment:	As the amount of values/data is extraordinary large, it will be omitted here. Data is available under request, together with the emission factor for grid calculations.

Data / Parameter:	**$GEN_{j/k/n,y}$**
Data unit:	MWh/year
Description:	Electricity generation of each power source/plant *j*, *k*, or n in year *y*
Source of data used:	Data provided by ONS.
Value applied:	Please see table below for data $\frac{\sum_{i,j} F_{i,j,y} \cdot COEF_{i,j}}{\sum_{j} GEN_{j,y}}$
Justification of the choice of data or description of measurement methods and procedures actually applied :	Calculated according the approved methodology – ACM0002
Any comment:	As the amount of values/data is extraordinary large, it will be omitted here. Data is available under request, together with the emission factor for grid

	calculations.

Data / Parameter:	**$GEN_{j/k/ll,y,\ Imports}$**
Data unit:	MWh
Description:	Electricity imports to the project electricity system
Source of data used:	Data provided by ONS.
Value applied:	Please see table below for data $\frac{\sum_{i,j} F_{i,j,y} \cdot COEF_{i,j}}{\sum_{j} GEN_{j,y}}$
Justification of the choice of data or description of measurement methods and procedures actually applied :	Calculated according the approved methodology – ACM0002
Any comment:	As the amount of values/data is extraordinary large, it will be omitted here. Data is available under request, together with the emission factor for grid calculations.

Data / Parameter:	**COEF i/j,y, imports**
Data unit:	tCO2/mass or volume unit
Description:	CO2 emission coefficient of fuels used in connected electricity systems (if imports occur)
Source of data used:	Data provided by ONS.
Value applied:	Please see table below for data $\frac{\sum_{i,j} F_{i,j,y} \cdot COEF_{i,j}}{\sum_{j} GEN_{j,y}}$
Justification of the choice of data or description of measurement methods and procedures actually applied :	Calculated according the approved methodology – ACM0002
Any comment:	As the amount of values/data is extraordinary large, it will be omitted here. Data is available under request, together with the emission factor for grid calculations.

Data / Parameter:	$\frac{\sum_{i,j} F_{i,j,y} \cdot COEF_{i,j}}{\sum_{j} GEN_{j,y}}$
Data unit:	tCO2/MWh
Description:	Operating Margin for non low-cost/must run power sources *j*
Source of data used:	Data provided by ONS. Calculated according the approved methodology –

	ACM0002
Value applied:	2003: 0.9823 2004: 0.9163 2005: 0.8086
Justification of the choice of data or description of measurement methods and procedures actually applied :	Both electricity generated from power plants in the grid and electricity imported are included.
Any comment:	

Data / Parameter:	**εel, reference plant**
Data unit:	MWh_{el} / $MWh_{biomass}$
Description:	Average net energy efficiency of power generation in the reference power/cogeneration plant that would use the biomass residues fired in the project plant in the absence of the project activity.
Source of data used:	Regional sugar and alcohol producers cooperative – Copersucar
Value applied:	0.022
Justification of the choice of data or description of measurement methods and procedures actually applied :	Data available from Copersucar were analyzed excluding plants that are CDM registered or in process for registration. See Annex 3 to details.
Any comment:	

B.6.3 Ex-ante calculation of emission reductions:

Bagasse amount is estimated from the planned sugarcane production, using regional statistical values for bagasse per sugarcane ratio and bagasse humidity. From the bagasse amount, a third part engineering company designed the power plant capacity, also using statistical value for net calorific value of the bagasse.

As described in section B.6.1, emission reductions (*ER*) in this project are calculated directly from electricity supplied by the project to the grid (*EG*) multiplied by the emission factor (*EF*). Detailed information of emission factor calculation is described in Annex 3.

For EF_{OM} calculation, first the λ_y factors are calculated as indicated in methodology ACM0002, version 6, 2006, with date obtained from the ONS database. Figure 13, Figure 14 and Figure 15 in Annex3 present the load duration curves and λ_y calculations for years 2003, 2004 and 2005, respectively.

The results for years 2003, 2004 and 2005 are presented in Table 7.

Table 7 - Share of hours in year *y* (in %) for which low-cost/must-run sources are on the margin in the S-SE-CO system for the period 2003-2005 (ONS-ADO, 2006).

Year	$\frac{\sum_{i,k} F_{i,k,y} \cdot COEF_{i,k}}{\sum_k GEN_{k,y}}$ [tCO2/MWh]	λ_y [%]
2003	0.9823	0.5312
2004	0.9163	0.5055
2005	0.8086	0.5130

Finally, applying the obtained numbers to calculate $EF_{OM,simple-adjusted,2003-2005}$ as the weighted by generation capacity average *of* $EF_{OM,simple-adjusted\ 2003}$, $EF_{OM\ simple-\ adjusted,2004}$ *and* $EF_{OM,simple-adjusted,2005}$ and λ_y to Equation 2:

$EF_{OM,simple-adjusted,2003-2005}$ = 0.4349 tCO_2e/MWh.

Applying the data from the Brazilian national dispatch center to Equation 6, the 20% of the system generation from most recently build has larger annual generation, giving:

- $EF_{BM,2005}$ = 0.0872 tCO_2e/MWh.

With these numbers, applying in Equation 7, we have:

$$EF_{grid,y} = 0.5 \times 0.4349 + 0.5 \times 0.0872$$

- $EF_{grid,y}$ = 0.2611 tCO_2e/MWh.

Future electricity supplied by the project to the grid is estimated based from bagasse production described in Table 4.

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

Table 8 – Ex-ante Estimation of Emissions Reductions

Year	Estimation of project activity emissions (tonnes of CO_2e)	Estimation of baseline emissions (tonnes of CO_2e)	Estimation of leakage (tonnes of CO_2e)	Estimation of overall emission reductions (tonnes of CO_2e)
2008 (from April 15th)	444	33,637	0	33,194
2009	444	40,915	0	40,471
2010	666	49,709	0	49,043
2011	666	56,354	0	55,689
2012	666	65,377	0	64,711

2013	666	68,805	0	68,139
2014	666	79,296	0	78,630
2015 (until April 14th)	0 †	0	0	0
Total (tonnes of CO_2e)	4,217	394,094	0	389,877

Note: Baseline emissions values in this project is the Emission Reductions due to displacement of electricity ($ER_{electricity,y}$)

† Project activity emission is due to importation of grid electricity during of-harvest from end November to end of April. This consumption is included as the year before consumption, i.e., the consumption from January 2015 to the beginning of the harvest in included in 2014 emissions.

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

B.7.1 Data and parameters monitored:

The project owner will continuously measure the energy generated, delivered to the grid and consumed internally.

Data / Parameter:	BFk,y
Data unit:	Tons of dry matter
Description:	Quantity of biomass residue type k combusted in the project plant during the year y
Source of data to be used:	On-site measurement
Value of data applied for the purpose of calculating expected emission reductions in section B.5	2008 (from April 15th) 214,192 2009 257,777 2010 295,385 2011 325,397 2012 347,314 2013 373,590 2014 448,308 2015 (until April 14th) 0
Description of measurement methods and procedures to be applied:	Weight meters by truck. Adjusted by moisture content in order to determine the quantity of dry biomass.
QA/QC procedures to be applied:	Measurements are crosschecked with an annual energy balance.
Any comment:	

Data / Parameter:	*Moisture content of the biomass residues*
Data unit:	% water content
Description:	Moisture content of each biomass residue type *k*
Source of data to be used:	On-site measurements
Value of data applied	50

for the purpose of calculating expected emission reductions in section B.5	
Description of measurement methods and procedures to be applied:	Samples are collected each 2 hours and analysis is made each 4 hours in a composted sample. Mean value calculated annually.
QA/QC procedures to be applied:	
Any comment:	

Data / Parameter:	NCV_k
Data unit:	GJ/ton of dry matter
Description:	Net calorific value of biomass residue type *k*
Source of data to be used:	Measurement by laboratory on-site
Value of data applied for the purpose of calculating expected emission reductions in section B.5	8.888
Description of measurement methods and procedures to be applied:	At least 3 samples collection each 6 months.
QA/QC procedures to be applied:	Data will be cross-checked with local statistical values.
Any comment:	

Data / Parameter:	$EG_{project\ plant,y}$
Data unit:	MWh/year
Description:	Net quantity of electricity generated in the project plant during year y
Source of data to be used:	On-site measurement
Value of data applied for the purpose of calculating expected emission reductions in section B.5	2008 (from April 15): 140,464 2009: 170,705 2010: 206,427 2011: 233,509 2012: 269,255 2013: 283,813 2014: 328,051 2015 (until April 14): 0
Description of measurement methods and procedures to be applied:	Measured and calculated. Continuously electronic measurement of the total generated amount and the energy consumed in the auxiliary system of cogeneration plant. Net quantity is calculated subtracting the auxiliary consumption from the total generated.

QA/QC procedures to be applied:	Consistency of metered net electricity generation will be cross-checked with receipts from electricity sales and quantity of bagasse fired. Data is being monitored by the Usina Interlagos as explained in Annex 4
Any comment:	

Data / Parameter:	$EC_{PJ,y}$
Data unit:	MWh
Description:	On-site electricity consumption imported from the grid, attributable to the project activity during the year *y*
Source of data to be used:	On-site measurements.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	2008 (from April 15) 1,700 2009 1,700 2010 2,550 2011 2,550 2012 2,550 2013 2,550 2014 2.550 2015 (until April 14) 0* * 2015 electricity consumption before the crop start is included in 2014 consumption.
Description of measurement methods and procedures to be applied:	Continuously by electricity meters. The same meter used in energy exportation.
QA/QC procedures to be applied:	Values will be cross-checked with purchase invoices.
Any comment:	

B.7.2 Description of the monitoring plan:

As per the procedures set by the Approved monitoring methodology ACM0006 - Monitoring methodology for emissions reductions from grid connected bagasse cogeneration projects, the data that have to be monitored going forward during the life of the contract are the electricity related ones.

This data is monitored through a spreadsheet that has to collect by meters installed in the exit of the mill and entrance of the transmission lines and by the sales receipts/invoices issued by the electricity utility to the mill.

All operators, quality control analysts, managers, etc. were contracted 1 year before the start of Usina Interlagos operation and received on-site training at the Usina Santa Adélia plant, which is a plant of the same group.

Usina Interlagos is constructing an analytical laboratory to analyze all parameters concerned to alcohol and energy production.

See Annex 4 for details.

B.8 Date of completion of the application of the baseline study and monitoring methodology and

the name of the responsible person(s)/entity(ies)

Date of completing the final draft of this baseline section (DD/MM/YYYY): 30/10/2006.

Name of person/entity determining the baseline of ACM0002-ver06:

Company:	Ecoinvest Carbon Brasil Ltda. (Project participant)
Address:	Rua Padre João Manoel, 222
Zip code + city address:	01411-000 São Paulo, SP
Country:	Brazil
Contact person:	Ricardo Esparta
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Fax number:	+55 (11) 3063-9069
E-mail:	esparta@ecoinvestcarbon.com

Name of person/entity determining the baseline of ACM0006-ver04:

Company:	Ecoinvest Carbon Brasil Ltda. (Project participant)
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Country:	Brazil
Contact person:	Jenny Sayaka Komatsu
Telephone number:	+55 (11) 3063-9068
Fax number:	+55 (11) 3063-9069
E-mail:	jennyk@ecoinvestcarbon.com

Ecoinvest is the Project Advisor and also a Project Participant.

SECTION C. Duration of the project activity / crediting period

C.1 Duration of the project activity:

C.1.1. Starting date of the project activity:

(DD/MM/YYYY): 04/09/2006

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

25y-0m

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

C.2.1. Renewable crediting period

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

(DD/MM/YYYY): 15/04/2008

C.2.1.2. Length of the first crediting period:

7y-0m.

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

Not applicable.

C.2.2.2. Length:

Not applicable.

SECTION D. Environmental impacts

>>

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

The growing global concern on sustainable use of resources is driving a requirement for more sensitive environmental management practices. Increasingly this is being reflected in government policy and legislation. In Brazil the situation is not different. Environmental rules and licensing policies are very demanding in line with the best international practices.

As the Usina Interlagos project is a power plant construction based on energy efficiency, the fast-track procedure can be used (Preparation of a Preliminary Environmental Report – "Relatório Ambiental Preliminar," RAP). The process has been completed and a report containing an investigation of the following aspects has been produced:

- Resources usage
- Legislation to be observed
- Impacts to climate and air quality
- Geological and soil impacts
- Hydrological impacts (surface and groundwater)
- Impacts to the flora and animal life
- Socio-economical (necessary infra-structure, legal and institutional, etc.)
- Local stakeholders comments
- Mitigation measures and Monitoring plan

In Brazil, the sponsor of a project that involves construction, installation, expansion or operation, even with no new significant environmental impact, must obtain new licenses. The licenses required by the Brazilian environmental regulation are (Resolution n. 237/97):

- The preliminary license ("*Licença Prévia*" or L.P.),
- The construction license ("*Licença de Instalação*" or L.I.); and
- The operating license ("*Licença de Operação*" or L.O.).

Usina Interlagos has the authorization issued by ANEEL to operate as an independent power producer (*ANEEL Decree 219 of 03/08/2006)*. Moreover, the power plant has the licenses emitted by *Companhia de Tecnologia de Saneamento Ambiental (CETESB)*, the environmental agency of the state of São Paulo (*Construction License – nº 13001412*).

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

After the assessment of the preliminary environmental report by the state environmental authority some minor requirements were made in order to issue the licenses. The project sponsors are fulfilling all the requirements. In conclusion, the environmental impact of the project activity is not considered significant and no full environmental impact assessment, as EIA/RIMA, was required.

Moreover, the project activity does not imply transboundary environmental impacts.

SECTION E. Stakeholders' comments

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

Public discussion with local stakeholders is compulsory for obtaining the environmental construction and operating licenses, and once the project already received the licenses, the project has consequently gone through a stakeholder comments process. The legislation also requests the announcement of the issuance of the licenses (LP, LI and LO) in the official journal (*Diário Oficial da União*) and in the regional newspaper to make the process public and allow public information and opinion.

Additionally, the Brazilian Designated National Authority for the CDM, *Comissão Interministerial de Mudanças Globais do Clima*, requires the compulsory invitation of selected stakeholders (copies of these invitations under request) to comment the PDD sent to validation in order to provide the letter of approval.

Letters inviting for comments on the project were sent on October 2006 to the following organizations and entities:

- *Pereira Barreto City Hall;*
- *Municipal Assembly of Pereira Barreto;*
- *Environmental Agency of the State of São Paulo;*
- *State Attorney for the Rights of Citizens of the State of São Paulo;*
- *Fórum Brasileiro de ONGs e Movimentos Sociais para o Desenvolvimento e Meio Ambiente ;*
- *Environmental Agency of Pereira Barreto;*
- *Associação Brasileira de Ecologia e de Prevenção à Poluição das Águas e do Ar – ABEPPOLAR.*

Copies of the invitation letters and receipts (*ARs – Avisos de Recebimento*) are available with project proponents. No concerns were raised in the public calls regarding the project.

E.2. Summary of the comments received:

FBOMS sent a letter suggesting the use of Gold Standard or similar tools.

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

The project participants consider that requests made by the Brazilian Government are sufficient to be used as sustainable indicators which are attended by this CDM project activity.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Organization:	Usina Santa Adélia S/A
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FAX:	+ 55 (16) 3209-2074
URL:	www.usinainterlagos.com.br
Represented by:	
Title:	
Salutation:	Mr
Last Name:	Braido
Middle Name:	Roberto
First Name:	José
Department:	
Mobile:	
Direct FAX:	
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Organization:	Ecoinvest Carbon Brasil Ltda.
Street/P.O.Box:	Rua Padre João Manoel 222
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City:	São Paulo
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Represented by:	
Title:	Director
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Personal E-Mail:	cmm@ecoinvestcarbon.com

Annex 2

INFORMATION REGARDING PUBLIC FUNDING

No public funding is involved in the present project.

Annex 3

BASELINE INFORMATION

Grid Baseline Emission Factor Calculation

The Brazilian electricity system (figure below) has been historically divided into two subsystems: the North-Northeast (N-NE) and the South-Southeast-Midwest (S-SE-CO, From the Portuguese *Sul-SudEste-Centro-Oeste*). This is due mainly to the historical evolution of the physical system, which was naturally developed nearby the biggest consuming centers of the country.

The natural evolution of both systems is increasingly showing that integration is to happen in the future. In 1998, the Brazilian government was announcing the first leg of the interconnection line between S-SE-CO and N-NE. With investments of around US$ 700 million, the connection had the main purpose, in the government's view, at least, to help solve energy imbalances in the country: the S-SE-CO region could supply the N-NE in case it was necessary and vice-versa.

Nevertheless, even after the interconnection had been established, technical papers still divided the Brazilian system in two (Bosi, 2000):

"… where the Brazilian Electricity System is divided into three separate subsystems:

i) The South/Southeast/Midwest Interconnected System;
ii) The North/Northeast Interconnected System; and
iii) The Isolated Systems (which represent 300 locations that are electrically isolated from the interconnected systems)"

Moreover, Bosi (2000) gives a strong argumentation in favor of having so-called *multi-project baselines*:

"For large countries with different circumstances within their borders and different power grids based in these different regions, multi-project baselines in the electricity sector may need to be disaggregated below the country-level in order to provide a credible representation of 'what would have happened otherwise."

Finally, one has to take into account that even though the systems today are connected, the energy flow between N-NE and S-SE-CO is heavily limited by the transmission lines capacity. Therefore, only a fraction of the total energy generated in both subsystems is sent one way or another. It is natural that this fraction may change its direction and magnitude (up to the transmission line's capacity) depending on the hydrological patterns, climate and other uncontrolled factors. But it is not supposed to represent a significant amount of each subsystem's electricity demand. It has also to be considered that only in 2004 the interconnection between SE and NE was concluded, i.e., if project proponents are to be coherent with the generation database they have

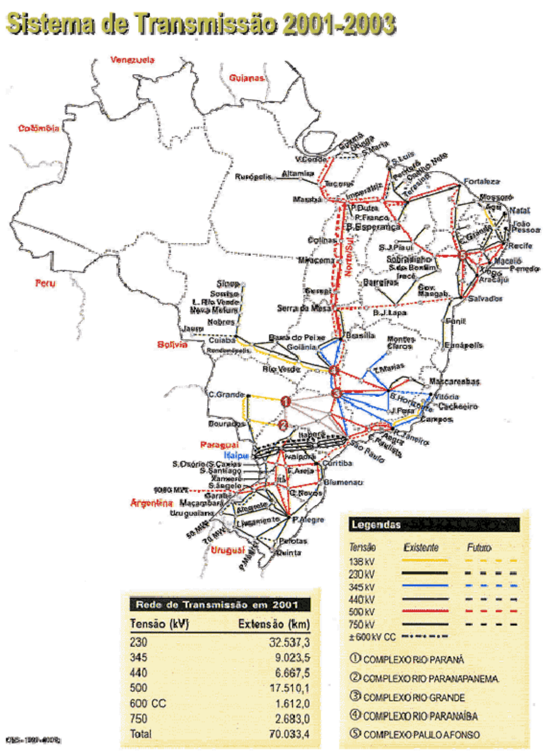

Figure 5 – Brazilian Interconnected System (ONS)

available as of the time of the PDD submission for validation, a situation where the electricity flow between the subsystems was even more restricted is to be considered.

The Brazilian electricity system nowadays comprises of around 91.3 GW of installed capacity, in a total of 1,420 electricity generation enterprises. From those, nearly 70% are hydropower plants, around 10% are natural gas-fired power plants, 5.3% are diesel and fuel oil plants, 3.1% are biomass sources (sugarcane bagasse, black liquor, wood, rice straw and biogas), 2% are nuclear plants, 1.4% are coal plants, and there are also 8.1 GW of installed capacity in neighboring countries (Argentina, Uruguay, Venezuela and Paraguay) that may dispatch electricity to the Brazilian grid. (http://www.aneel.gov.br/aplicacoes/capacidadebrasil/OperacaoCapacidadeBrasil.asp). This latter capacity is in fact comprised by mainly 6.3 GW of the Paraguayan part of *Itaipu Binacional*, a hydropower plant operated by both Brazil and Paraguay, but whose energy almost entirely is sent to the Brazilian grid.

Approved methodologies ACM0002, version 6, 2006, asks project proponents to account for "all generating sources serving the system". In that way, when applying the methodology, project proponents in Brazil should search for, and research, all power plants serving the Brazilian system.

In fact, information on such generating sources is not publicly available in Brazil. The national dispatch center, ONS – *Operador Nacional do Sistema* – argues that dispatching information is strategic to the power agents and therefore cannot be made available. On the other hand, ANEEL, the electricity agency, provides information on power capacity and other legal matters on the electricity sector, but no dispatch information can be got through this entity.

In that regard, project proponents looked for a plausible solution in order to be able to calculate the emission factor in Brazil in the most accurate way. Since real dispatch data is necessary after all, the ONS was contacted, in order to let participants know until which degree of detail information could be provided. After several months of talks, plants' daily dispatch information was made available for years 2002, 2003 and 2004.

Project proponents, discussing the feasibility of using such data, concluded it was the most proper information to be considered when determining the emission factor for the Brazilian grid. According to ANEEL, in fact, ONS centralized dispatched plants accounted for 75,547 MW of installed capacity by 31/12/2004, out of the total 98,848.5 MW installed in Brazil by the same date (http://www.aneel.gov.br/arquivos/PDF/Resumo_Gráficos_mai_2005.pdf), which includes capacity available in neighboring countries to export to Brazil and emergency plants, that are dispatched only during times of electricity constraints in the system. Therefore, even though the emission factor calculation is carried out without considering all generating sources serving the system, about 76.4% of the installed capacity serving Brazil is taken into account, which is a fair amount if one looks at the difficulty in getting dispatch information in Brazil. Moreover, the remaining 23.6% are plants that do not have their dispatch coordinated by ONS, since: either they operate based on power purchase agreements which are not under control of the dispatch authority; or they are located in non-interconnected systems to which ONS has no access. In that way, this portion is not likely to be affected by the CDM projects, and this is another reason for not taking them into account when determining the emission factor.

In an attempt to include all generating sources, project developers considered the option to research for available, but non-official data, to supply the existing gap. The solution found was the International Energy Agency database built when carrying out the study from Bosi *et al.* (2002). Merging ONS data with the IEA data in a spreadsheet, project proponents have been able to consider all generating sources connected to the relevant grids in order to determine the emission factor. The emission factor calculated was found more conservative when considering ONS data only.

Tabela 1 – Ex ante and ex-post operating and build margin emission factors

(ONS-ADO, 2004; Bosi *et al.*, 2002)

Year	$EF_{OM\ non-low-cost/must-run}$ [tCO_2/MWh]		EF_{BM} [tCO_2/MWh]	
	Ex-ante	Ex-post	Ex-ante	Ex-post
2001-2003	0.719	0.950	0.569	0.096

Therefore, considering all the rationale explained, project developers decided for the database considering ONS information only, as it was capable of properly addressing the issue of determining the emission factor and doing it in the most conservative way.

The aggregated hourly dispatch data got from ONS was used to determine the lambda factor for each of the years with data available (2003, 2004 and 2005). The Low-cost/Must-run generation was determined as the total generation minus fossil-fuelled thermal plants generation, this one determined through daily dispatch data provided by ONS. All this information has been provided to the validators, and extensively discussed with them, in order to make all points crystal clear. The figures below show the load duration curves for the three considered years, as well as the lambda calculated.

Table 9- Emission Factors for the Brazilian South-Southeast-Midwest interconnected grid (simple adjusted operating margin factor)

Emission factors for the Brazilian South-Southeast-Midwest interconnected grid				
Baseline (including imports)	EF_{OM} [tCO2/MWh]	Load [MWh]	LCMR [MWh]	Imports [MWh]
2003	0,9823	288.933.290	274.670.644	459.586
2004	0,9163	302.906.198	284.748.295	1.468.275
2005	0,8086	314.533.592	296.690.687	3.535.252
	Total (2003-2005) =	**906.373.081**	**856.109.626**	**5.463.113**
	$EF_{OM,\ simple\text{-}adjusted}$ [tCO2/MWh]	$EF_{BM,2005}$	**Lambda**	
	0,4349	0,0872	λ_{2003}	
	Alternative weights	**Default weights**	0,5312	
	w_{OM} = 0,75	w_{OM} = 0,5	λ_{2004}	
	$w_{BM=}$ 0,25	$w_{BM=}$ 0,5	0,5055	
	Alternative EF_y [tCO2/MWh]	**Default EF_y [tCO2/MWh]**	λ_{2005}	
	0,3480	**0,2611**	0,5130	

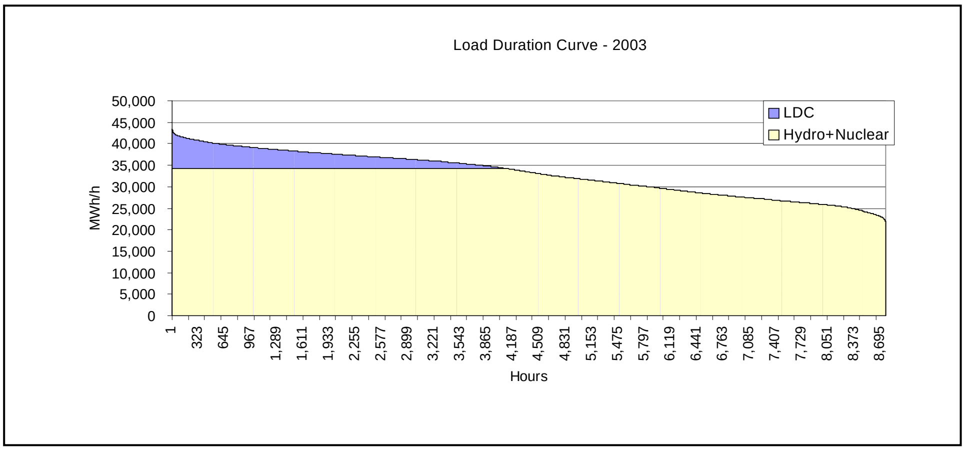

Figure 6- Load duration curve for the S-SE-CO system, 2003

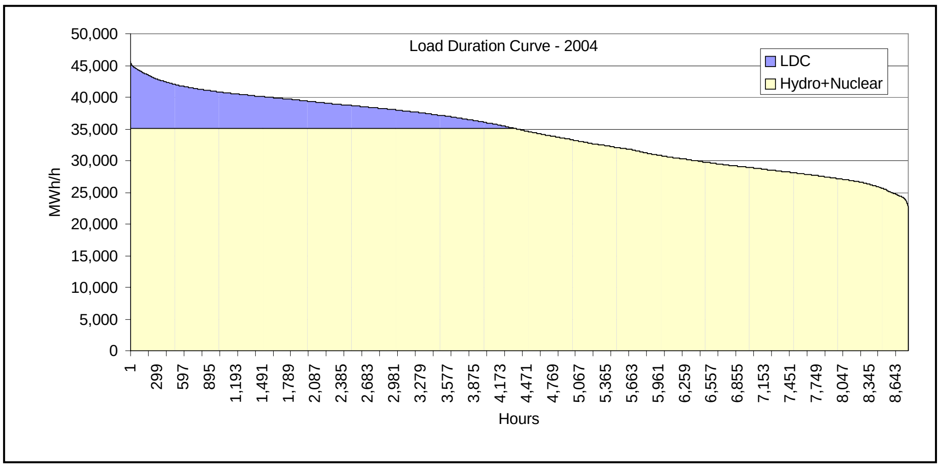

Figure 7 - Load duration curve for the S-SE-CO system, 2004

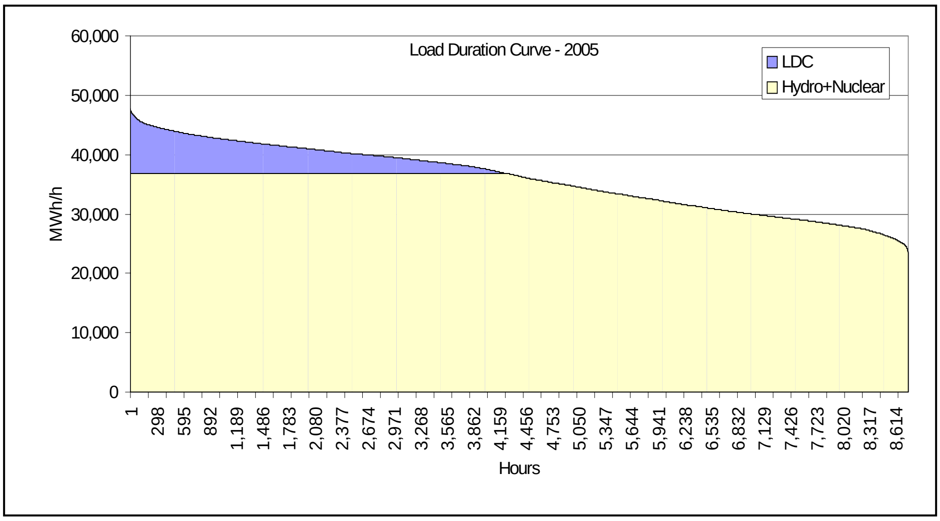

Figure 8 – Load duration curve for the S-SE-CO system, 2005

Table 10 – Power plants database for the Brazilian South-Southeast-Midwest interconnected grid, part 1

	Power plant name	Subsystem	Fuel source	Operation start	Installed capacity	Fossil fuel conversion efficiency	Fraction carbon oxidized	Baseline
					[MW]	[%]	[%]	[tCO_2/MWh]
1	TermoRio	SE-CO	natural gas	Nov-2004	423.3	50%	99.5%	0.402
2	Candonga	SE-CO	hydro	Sep-2004	140.0	100%	-	-
3	Queimado	SE-CO	hydro	May-2004	105.0	100%	-	-
4	Norte Fluminense	SE-CO	natural gas	Feb-2004	860.2	50%	99.5%	0.402
5	Jauru	SE-CO	hydro	Sep-2003	121.5	100%	-	-
6	Guaporé	SE-CO	hydro	Sep-2003	120.0	100%	-	-
7	Três Lagoas	SE-CO	natural gas	Aug-2003	306.0	32%	99.5%	0.628
8	Funil (MG)	SE-CO	hydro	Jan-2003	180.0	100%	-	-
9	Itiquira I	SE-CO	hydro	Sep-2002	156.1	100%	-	-
10	Araucária	S	natural gas	Sep-2002	484.5	32%	99.5%	0.628
11	Canoas	S	natural gas	Sep-2002	160.6	32%	99.5%	0.628
12	Piraju	SE-CO	hydro	Sep-2002	81.0	100%	-	-
13	N. Piratininga	SE-CO	natural gas	Jun-2002	384.9	32%	99.5%	0.628
14	PCT CGTEE	S	fuel oil	Jun-2002	5.0	33%	99.0%	0.902
15	Rosal	SE-CO	hydro	Jun-2002	55.0	100%	-	-
16	Ibirité	SE-CO	natural gas	May-2002	226.0	32%	99.5%	0.628
17	Cana Brava	SE-CO	hydro	May-2002	465.9	100%	-	-
18	Sta Clara	SE-CO	hydro	Jan-2002	60.0	100%	-	-
19	Machadinho	S	hydro	Jan-2002	1,140.0	100%	-	-
20	Juiz de Fora	SE-CO	natural gas	Nov-2001	87.0	32%	99.5%	0.628
21	Macaé Merchant	SE-CO	natural gas	Nov-2001	922.6	32%	99.5%	0.628
22	Lajeado	SE-CO	hydro	Nov-2001	902.5	100%	-	-
23	Eletrobolt	SE-CO	natural gas	Oct-2001	379.0	32%	99.5%	0.628
24	Porto Estrela	SE-CO	hydro	Sep-2001	112.0	100%	-	-
25	Cuiaba (Mario Covas)	SE-CO	natural gas	Aug-2001	529.2	32%	99.5%	0.628
26	W. Arjona	SE-CO	natural gas	Jan-2001	194.0	32%	99.5%	0.628
27	Uruguaiana	S	natural gas	Jan-2000	639.9	50%	99.5%	0.402
28	S. Caxias	S	hydro	Jan-1999	1,240.0	100%	-	-
29	Canoas I	SE-CO	hydro	Jan-1999	82.5	100%	-	-
30	Canoas II	SE-CO	hydro	Jan-1999	72.0	100%	-	-
31	Igarapava	SE-CO	hydro	Jan-1999	210.0	100%	-	-
32	P. Primavera	SE-CO	hydro	Jan-1999	1,540.0	100%	-	-
33	Cuiaba (Mario Covas)	SE-CO	diesel oil	Oct-1998	529.2	33%	99.0%	0.800
34	Sobragi	SE-CO	hydro	Sep-1998	60.0	100%	-	-
35	PCH EMAE	SE-CO	hydro	Jan-1998	26.0	100%	-	-
36	PCH CEEE	S	hydro	Jan-1998	25.0	100%	-	-
37	PCH Enersul	S	hydro	Jan-1998	43.0	100%	-	-
38	PCH CEB	SE-CO	hydro	Jan-1998	15.0	100%	-	-
39	PCH Escelsa	SE-CO	hydro	Jan-1998	62.0	100%	-	-
40	PCH Celesc	S	hydro	Jan-1998	50.0	100%	-	-
41	PCH CEMAT	SE-CO	hydro	Jan-1998	145.0	100%	-	-
42	PCH CELG	SE-CO	hydro	Jan-1998	15.0	100%	-	-
43	PCH CERJ	SE-CO	hydro	Jan-1998	59.0	100%	-	-
44	PCH Copel	S	hydro	Jan-1998	70.0	100%	-	-
45	PCH CEMIG	SE-CO	hydro	Jan-1998	84.0	100%	-	-
46	PCH CPFL	SE-CO	hydro	Jan-1998	55.0	100%	-	-
47	S. Mesa	SE-CO	hydro	Jan-1998	1,275.0	100%	-	-
48	PCH Eletropaulo	SE-CO	hydro	Jan-1998	26.0	100%	-	-
49	Guilmam Amorim	SE-CO	hydro	Jan-1997	140.0	100%	-	-
50	Corumbá	SE-CO	hydro	Jan-1997	375.0	100%	-	-
51	Miranda	SE-CO	hydro	Jan-1997	408.0	100%	-	-
52	Nova Ponte	SE-CO	hydro	Jan-1994	510.0	100%	-	-
53	Segredo	S	hydro	Jan-1992	1,260.0	100%	-	-
54	Taquaruçu	SE-CO	hydro	Jan-1989	554.0	100%	-	-
55	Manso	SE-CO	hydro	Jan-1988	210.0	100%	-	-
56	D. Francisca	S	hydro	Jan-1987	125.0	100%	-	-
57	Itá	S	hydro	Jan-1987	1,450.0	100%	-	-
58	Rosana	SE-CO	hydro	Jan-1987	369.2	100%	-	-
59	Angra	SE-CO	nuclear	Jan-1985	1,874.0	100%	-	-
60	T. Irmãos	SE-CO	hydro	Jan-1985	807.5	100%	-	-
61	Itaipú 60 Hz	SE-CO	hydro	Jan-1983	6,300.0	100%	-	-
62	Itaipú 50 Hz	SE-CO	hydro	Jan-1983	5,375.0	100%	-	-
63	Emborcação	SE-CO	hydro	Jan-1982	1,192.0	100%	-	-
64	Nova Avanhandava	SE-CO	hydro	Jan-1982	347.4	100%	-	-

[1] Agência Nacional de Energia Elétrica. *Banco de Informações da Geração* (http://www.aneel.gov.br/, data collected in november 2004).
[2] Bosi, M., A. Laurence, P. Maldonado, R. Schaeffer, A. F. Simoes, H. Winkler and J.-M. Lukamba. *Road testing baselines for greenhouse gas*
[3] Intergovernamental Panel on Climate Change. *Revised 1996 Guidelines for National Greenhouse Gas Inventories.*
[4] Operador Nacional do Sistema Elétrico. Centro Nacional de Operação do Sistema. *Acompanhamento Diário da Operação do SIN* (daily reports
[5] Agência Nacional de Energia Elétrica. Superintendência de Fiscalização dos Serviços de Geração. *Resumo Geral dos Novos Empreendimentos de*
[6] Centrais Elétricas Brasileiras S/A. Plano anual de combustíveis - Sistema interligado S/SE/CO 2005 (released December 2004).

Table 10 – Power plants database for the Brazilian South-Southeast-Midwest interconnected grid, part 2

65	Gov. Bento Munhoz	S	hydro	Jan-1980	1,676.0	100%	-	-
66	S. Santiago	S	hydro	Jan-1980	1,420.0	100%	-	-
67	Itumbiara	SE-CO	hydro	Jan-1980	2,280.0	100%	-	-
68	Igarapé	SE-CO	fuel oil	Jan-1978	131.0	33%	99.0%	0.820
69	Itauba	S	hydro	Jan-1978	512.4	100%	-	-
70	A. Vermelha	SE-CO	hydro	Jan-1978	1,396.2	100%	-	-
71	S. Simão	SE-CO	hydro	Jan-1978	1,710.0	100%	-	-
72	Capivara	SE-CO	hydro	Jan-1977	640.0	100%	-	-
73	S. Osório	S	hydro	Jan-1975	1,078.0	100%	-	-
74	Marimbondo	SE-CO	hydro	Jan-1975	1,440.0	100%	-	-
75	Promissão	SE-CO	hydro	Jan-1975	264.0	100%	-	-
76	Pres. Medici	S	coal	Jan-1974	446.0	33%	98.0%	1.019
77	Volta Grande	SE-CO	hydro	Jan-1974	380.0	100%	-	-
78	Porto Colombia	SE-CO	hydro	Jun-1973	320.0	100%	-	-
79	Passo Fundo	S	hydro	Jan-1973	220.0	100%	-	-
80	Passo Real	S	hydro	Jan-1973	158.0	100%	-	-
81	Ilha Solteira	SE-CO	hydro	Jan-1973	3,444.0	100%	-	-
82	Mascarenhas	SE-CO	hydro	Jan-1973	131.0	100%	-	-
83	Gov. Parigot de Souza	S	hydro	Jan-1971	252.0	100%	-	-
84	Chavantes	SE-CO	hydro	Jan-1971	414.0	100%	-	-
85	Jaguara	SE-CO	hydro	Jan-1971	424.0	100%	-	-
86	Sá Carvalho	SE-CO	hydro	Apr-1970	78.0	100%	-	-
87	Estreito	SE-CO	hydro	Jan-1969	1,050.0	100%	-	-
88	Ibitinga	SE-CO	hydro	Jan-1969	131.5	100%	-	-
89	Jupiá	SE-CO	hydro	Jan-1969	1,551.2	100%	-	-
90	Alegrete	S	fuel oil	Jan-1968	66.0	33%	99.0%	0.820
91	Campos	SE-CO	natural gas	Jan-1968	30.0	32%	99.5%	0.628
92	Santa Cruz (RJ)	SE-CO	natural gas	Jan-68	766.0	32%	99.5%	0.628
93	Paraibuna	SE-CO	hydro	Jan-1968	85.0	100%	-	-
94	Limoeiro	SE-CO	hydro	Jan-1967	32.0	100%	-	-
95	Cacaonde	SE-CO	hydro	Jan-1966	80.4	100%	-	-
96	J. Lacerda C	S	coal	Jan-1965	363.0	33%	98.0%	1.019
97	J. Lacerda B	S	coal	Jan-1965	262.0	33%	98.0%	1.019
98	J. Lacerda A	S	coal	Jan-1965	232.0	33%	98.0%	1.019
99	Bariri	SE-CO	hydro	Jan-1965	143.1	100%	-	-
100	Funil (RJ)	SE-CO	hydro	Jan-1965	216.0	100%	-	-
101	Figueira	S	coal	Jan-1963	20.0	33%	98.0%	1.019
102	Furnas	SE-CO	hydro	Jan-1963	1,216.0	100%	-	-
103	Barra Bonita	SE-CO	hydro	Jan-1963	140.8	100%	-	-
104	Charqueadas	S	coal	Jan-1962	72.0	33%	98.0%	1.019
105	Jurumirim	SE-CO	hydro	Jan-1962	97.7	100%	-	-
106	Jacui	S	hydro	Jan-1962	180.0	100%	-	-
107	Pereira Passos	SE-CO	hydro	Jan-1962	99.1	100%	-	-
108	Tres Marias	SE-CO	hydro	Jan-1962	396.0	100%	-	-
109	Euclides da Cunha	SE-CO	hydro	Jan-1960	108.8	100%	-	-
110	Camargos	SE-CO	hydro	Jan-1960	46.0	100%	-	-
111	Santa Branca	SE-CO	hydro	Jan-1960	56.1	100%	-	-
112	Cachoeira Dourada	SE-CO	hydro	Jan-1959	658.0	100%	-	-
113	Salto Grande, SP	SE-CO	hydro	Jan-1958	70.0	100%	-	-
114	Salto Grande (MG)	SE-CO	hydro	Jan-1956	102.0	100%	-	-
115	Mascarenhas de Moraes	SE-CO	hydro	Jan-1956	478.0	100%	-	-
116	Itutinga	SE-CO	hydro	Jan-1955	52.0	100%	-	-
117	S. Jerônimo	S	coal	Jan-1954	20.0	33%	98.0%	1.019
118	Carioba	SE-CO	fuel oil	Jan-1954	36.2	33%	99.0%	0.820
119	Piratininga	SE-CO	fuel oil	Jan-1954	472.0	33%	99.0%	0.820
120	Canastra	S	hydro	Jan-1953	42.5	100%	-	-
121	Nilo Peçanha	SE-CO	hydro	Jan-1953	378.4	100%	-	-
122	Fontes Nova	SE-CO	hydro	Jan-1940	130.3	100%	-	-
123	H. Borden Sub.	SE-CO	hydro	Jan-1926	420.0	100%	-	-
124	H. Borden Ext	SE-CO	hydro	Jan-1926	469.0	100%	-	-
125	I. Pombos	SE-CO	hydro	Jan-1924	189.7	100%	-	-
126	Jaguari	SE-CO	hydro	Jan-1917	11.8	100%	-	-

[1] Agência Nacional de Energia Elétrica. *Banco de Informações da Geração* (http://www.aneel.gov.br/, data collected in november 2004).
[2] Bosi, M., A. Laurence, P. Maldonado, R. Schaeffer, A. F. Simoes, H. Winkler and J.-M. Lukamba. *Road testing baselines for greenhouse gas*
[3] Intergovernamental Panel on Climate Change. *Revised 1996 Guidelines for National Greenhouse Gas Inventories.*
[4] Operador Nacional do Sistema Elétrico. Centro Nacional de Operação do Sistema. *Acompanhamento Diário da Operação do SIN* (daily reports
[5] Agência Nacional de Energia Elétrica. Superintendência de Fiscalização dos Serviços de Geração. *Resumo Geral dos Novos Empreendimentos de*
[6] Centrais Elétricas Brasileiras S/A. Plano anual de combustíveis - Sistema interligado S/SE/CO 2005 (released December 2004).

Reference Plant energy efficiency ($\varepsilon_{el,\ reference\ plant}$)

Data of bagasse and generated electricity by bagasse power plants were acquired from Copersucar (Cooperativa Produtores de Cana-de-açúcar, Açúcar e Álcool do Estado de São Paulo) a sugarcane, sugar and alcohol producers cooperatives. Founded in 1959, today it has 87 associates, which among them 29 sugar and alcohol producers located in São Paulo, Minas Gerais and Paraná states. The sugar and alcohol producers are made public by the Copersucar website at: http://www.copersucar.com.br/

Fig.16 below shows the electrical energy efficiency in kWh generated electricity per tonne of processed sugarcane in 2006. The 34.12 line is to limit the power plants that have more than 50% excess electricity of the generated amount. These plants are showed separately in Fig.17. All them are registered or in process of CDM registration.

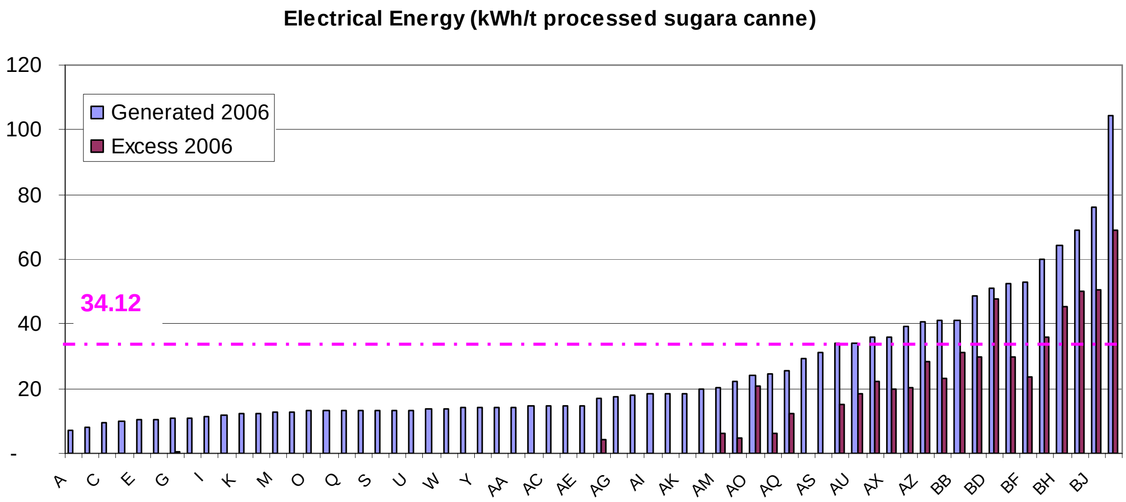

Figure 9 – All Copersucar Bagasse Power Plant in 2006

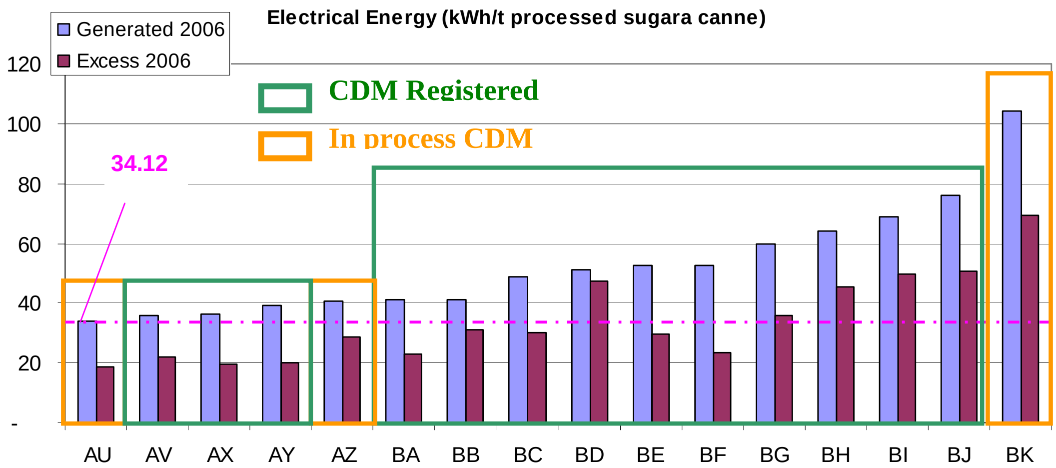

Figure 10 – Sugarcane Bagasse Power Plants with Excess per Generated Energy greater than 50% in 2006

The business-as-usual energy generation efficiency was calculated excluding all CDM registered or in process for, power plants. Fig.18 shows the efficiency distribution of these power plants in years 2005 and 2006.

The average generated energy per bagasse for power plants excluding CDM registered or under implementation in 2006 was 53.55 kWh/ton bagasse, and in 2005 was 40.63 kWh/ton bagasse. Efficiency in Usina Santa Adélia, a sugarcane sugar and alcohol producer of the same group of here Usina Interlagos, used to operate a 57 kWh/ton bagasse generation equipments before substituting to a more efficient equipment to claim for CO2 credits under CDM.

Project participant will use 2006 value, with regional statistical net calorific value (dry base) of 2123 kcal/kg leading to a net energy efficiency of 0.022 $MWh_{el}/MWh_{biomass}$.

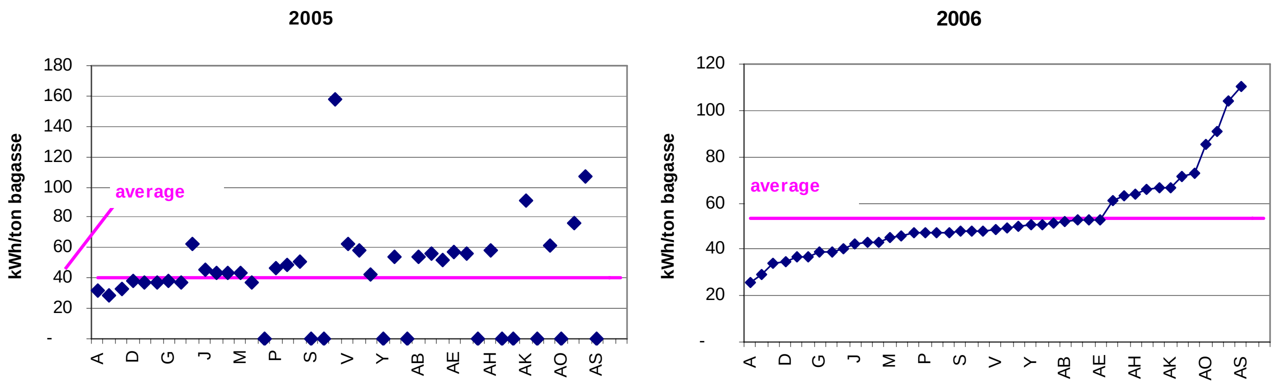

Figure 11 – Efficiency of Bagasse Cogeneration Power Plants in years 2005 and 2006

Annex 4

MONITORING INFORMATION

All Monitoring Procedures and Manuals will be prepared during the test operation that will be held in March 2007, before the harvest start.

Energy Generation Monitoring

The electricity baseline emission factor is determined ex-ante and will only be updated at renewal of the crediting period. The recording frequency of the data is appropriate for the project.

The project sponsor will proceed with the necessary measures for the power control and monitoring. Together with the information produced by both ANEEL and ONS, it will be possible to monitor the power generation of the project and the grid power mix.

Usina Interlagos is responsible for the project management, monitoring and reporting as well as for organising and training of the staff in the appropriate monitoring, measurement and reporting techniques.

The monitoring plan is straightforward and no specific procedures beyond the established QA/QC procedures will be necessary. The established procedures reflect good monitoring and reporting practices. The maintenance and installation of monitoring equipment will be done according to the internal procedures of Usina Interlagos.

The methodology considers monitoring emissions reductions generated from cogeneration projects using sugarcane bagasse. The monitoring plan, for emissions reductions occurring within the project boundary, is based on monitoring the amount of electricity generated subtracted by the amount that would be generated in a business-as-usual reference plant.

Energy generated in project activity ($EG_{project\ plant,y}$)

Generated energy is read once a day by the cogeneration plant operator and duty electrician. Data will be cross-checked with energy sale receipt added by internal consumption monitored by process control software and energy balance from the quantity of bagasse fired. Exported energy is also read monthly by an operator from the energy company.

Generated Energy meter is under Usina Interlagos responsibility using a relay Schweitzer, model SEL 300G, accuracy 0.5%.

Exported Energy meter is under Energy Company Elektro responsibility using *Power Measurement Ltd* multifunctional meter, ELEKTRO Standard, Model ION 8300, socket type, accuracy Class 0,2S (<0.3%). There will be a back-up energy meter of the same manufacturer and model.

Energy consumed in the auxiliary system (consumed by cogeneration plant itself) is calculated by summing all consumption in the subsystems of the cogeneration plant. Each subsystem has a meter with the following description: Relay SEL- Schweitzer Electric Laboratories, Model SEL-351-A, manufactured in 2006, accuracy 0.5%.

On-site Energy consumption imported from the grid ($EC_{PJ,y}$)

The only import of energy from the grid, is during off-harvest, when electricity is consumed in the offices and for equipments maintenance works. This amount will be monitored through electricity meter and cross-checked with the purchase invoice from Electricity Service Company *ELEKTRO Eletricidade e Serviços S.A.* Energy meter is the same used to measure exported energy under Elektro responsibility.

Energy meters under Usina Interlagos responsibility will be calibrated each 5 years as set by manufacturer.
Energy meter under Elektro - electricity company responsibility will be calibrated each 1 year.

As there is no back-up energy meter for the generated electricity, when this meter goes down, it will be calculated from the sum of exported energy and internal consumed amount, checking with energy balance and past historical data.

Bagasse analysis

Bagasse amount ($BF_{k,y}$) is weighted on truck electronic.

Humidity is analyzed each 4 hours with composite sample collect each 2 hours in the Interlagos own laboratory, and cross-checked with regional statistical data.

Net Calorific value of biomass (NCV_k) will be analysed each 6 months collecting at least 3 samples in the Interlagos own laboratory.

All data monitored will be stored accordingly to Interlagos quality control management system.

Amount of energy generated, internally consumed, exported and the quantity of bagasse fired data will be archived in the document FO.ID.01.26.0020 of the Usina Interlagos quality control management system. Energy amounts are also digitally archived automatically through the process control software.

Bagasse humidity data will be archived in the document FO.ID.01.27.0003 of the Usina Interlagos quality control management system.

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BIBLIOGRAPHY REFERENCES

ACM0002 (2006). Approved Consolidated Baseline Methodology 0002 – Consolidated Methodology for grid-connected electricity generation from renewable sources. Version 6; 19th May 2006. Web-site: http://cdm.unfccc.int/.

ACM0006 (2006) Approved Consolidated Baseline Methodology 0006 - "Consolidated baseline methodology for grid-connected electricity generation from biomass residues". Version 04, 2nd May 2006. Web-site: http://cdm.unfccc.int/.

ANEEL (2006), *Resumo Geral dos Novos Empreendimento de Geração*, Superintendência de Fiscalização dos Serviços de Geração –SFG, Agência Nacional de Energia Elétrica, 15th November 2006. Web-site**:** **http://www.aneel.gov.br/area.cfm?idArea=37** (Resumo Geral)

Arida, P. E. L. Bacha, and A. L. Resende (2005). *Credit, Interest, and Jurisdictional Uncertainty: Conjectures on the Case of Brazil."* In F. Giavazzi, I. Goldfajn e S. Herrera (orgs.), Inflation Targeting, Debt, and the Brazilian Experience, 1999 to 2003. Cambridge, MA: MIT Press.

Bosi, M., A. Laurence, P. Maldonado, R. Schaeffer, A. F. Simoes, H. Winkler and J.-M. Lukamba (2002). Road testing baselines for greenhouse gas mitigation projects in the electric power sector. OECD and IEA information paper.

BNDES (2000). O setor elétrico – Desempenho 1993/1999. Banco Nacional de Desenvolvimento Econômico e Social. Informe Infra-estrutura, nº 53. http://www.bndes.gov.br/.

CGE/CBEE (2002). Programa de Energia Emergencial. Câmara de Gestão da Crise de Energia Elétrica – Comercializadora Brasileira de Energia Emergencial.

Eletrobrás (1999). Diretrizes para estudos e projetos de pequenas centrais hidrelétricas. Centrais Elétricas Brasileiras S/A Web-site: http://www.eletrobras.gov.br/.

Elliot, D. (2000). Renewable Energy and Sustainable Futures. Futures 32 CTS Special 'Sustainable Futures' Issue, pp261-274, April/May 2000.

Esparta, A. R. J. (2005) Orientation for study and project of Small Hydro Powers (in Portuguese). Document presented to Doctor qualification. Escola Politécnica da Universidade de São Paulo.

IBGE (2006). Banco de dados Cidades@,. Instituto Brasileiro de Geografia e Estatística (http://www.ibge.gov.br/).

Kartha, S., M. Lazarus and M. Bosi (2002). Practical baseline recommendations for greenhouse gas mitigation projects in the electric power sector. OECD and IEA information Paper.

OECD (2001). OECD Economic Surveys: Brazil. Organization for Economic Co-Operation and Development, Paris, France.

OECD (2004). Environmental Outlook. Organization for Economic Cooperation and Development. Web-site: http://www.oecd.org/env/

OECD (2005). OECD Economic Survey of Brazil 2005: Regulation of the electricity sector. Organization for Economic Co-Operation and Development, Paris, France

ONS (2004). De olho na energia: Histórico da energia, carga própria de energia 1999-2003. Operador Nacional do Sistema Elétrico Brasileiro. Web-site: http://www.ons.gov.br/.

ONS-ADO (2004). Acompanhamento Diário da Operação do Sistema Iterligado Nacional. ONS-CNOS, Centro Nacional de Operação do Sistema. Daily reports on the whole interconnected electricity system from Jan. 1, 2001 to Dec. 31, 2003. Web-site: http://www.ons.gov.br/.

Pinto Júnior, H. (2003). Les problèmes des réformes structurelles et institutionnelles inachevées: le cas de l'industrie éléctrique au Brésil. Révue de l'Energie **544**, 103-111.

Schaeffer, R., J. Logan, A. S. Szklo, W. Chandler and J. C. de Souza (2000). Electric Power Options in Brazil. Pew Center on Global Climate Change.

SIESE (2002). Sistema de Informações Empresariais do Setor de Energia Elétrica: Boletim Anual. Eletrobrás (Centrais Elétricas Brasileiras S/A) - MME (Ministério de Minas e Energia do Brasil). Web-site: http://www.eletrobras.gov.br/IN_Informe_SIESE/

Tolmasquim, M.T. (2003) [Ed.]. Fontes Renováveis de Energia no Brasil. Editora Interciência.

WCED (1987). Our Common Future. The World Commission on Environment and Development. Oxford University Press.