CLEAN DEVELOPMENT MECHANISM
PROJECT DESIGN DOCUMENT FORM (CDM-PDD)
Version 02 - in effect as of: 1 July 2004)

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SECTION A. General description of project activity

A.1. Title of the project activity

Usinas Itamarati cogeneration project (hereafter referred to simply as "**PROJECT"**).

PDD version number: 2

Date: November 16, 2005.

A.2. Description of the project activity

Usinas Itamarati is one of the Brazilian largest sugar mills. It started its operation in 1980 in the Midwest of the country, in the city of Nova Olímpia, 200 km far from the capital of the state of Mato Grosso, Cuiabá.

Usinas Itamarati has been implementing quality programs in its businesses based on the triple bottom line approach. These programs encompass workers' health, quality in its products and services, and conservation, mitigation, and preservation of natural resources.

Usinas Itamarati has also implemented an environmental management system called "Sistema de Gestão Ambiental" (SGA), which continuously contributes to a better environmental commitment and concern from workers, directors, clients, suppliers, and community. In addition to that, Usinas Itamarati was the first sugar and ethanol mill to obtain the ISO 9000/2000 version, in 2001. In 2002, the energy area of the group was also awarded with the ISO certification.

"Fundação Abrinq" has certified the company since 2001 too. This is an important Brazilian non-governmental organization that supports child rights. Master Cana has also granted the company in 2001 and 2003 as the mill of the year in the total quality category. Master Cana is an award delivered by ProCana, which has as mission to promote the sustainable development in the sugarcane agribusiness.

During the last crop season, Usinas Itamarati processed 6,574,350 tonnes of sugarcane, produced, 6,409,420 sugar sacks (50Kg each), 230,193,594 liters of anhydrous alcohol, and 92,157,175 liters of hydrated alcohol as well as generates its own electricity.

In 08/2001, the PROJECT sold its first MWh to the local power utility CEMAT-REDE. There is a PPA (Power Purchase Agreement) signed with CEMAT-REDE during the period from 07/2001 to 07/2011, to commercialize 31,800 MW during the season.

In 2001, Usinas Itamarati S.A. upgraded its equipment with the objective of using bagasse more efficiently to cogenerate electricity (see Figure 1~~Figure 1~~). A more efficient cogeneration of this renewable fuel allows the PROJECT to sell a surplus of electricity to the grid and creates a competitive advantage.

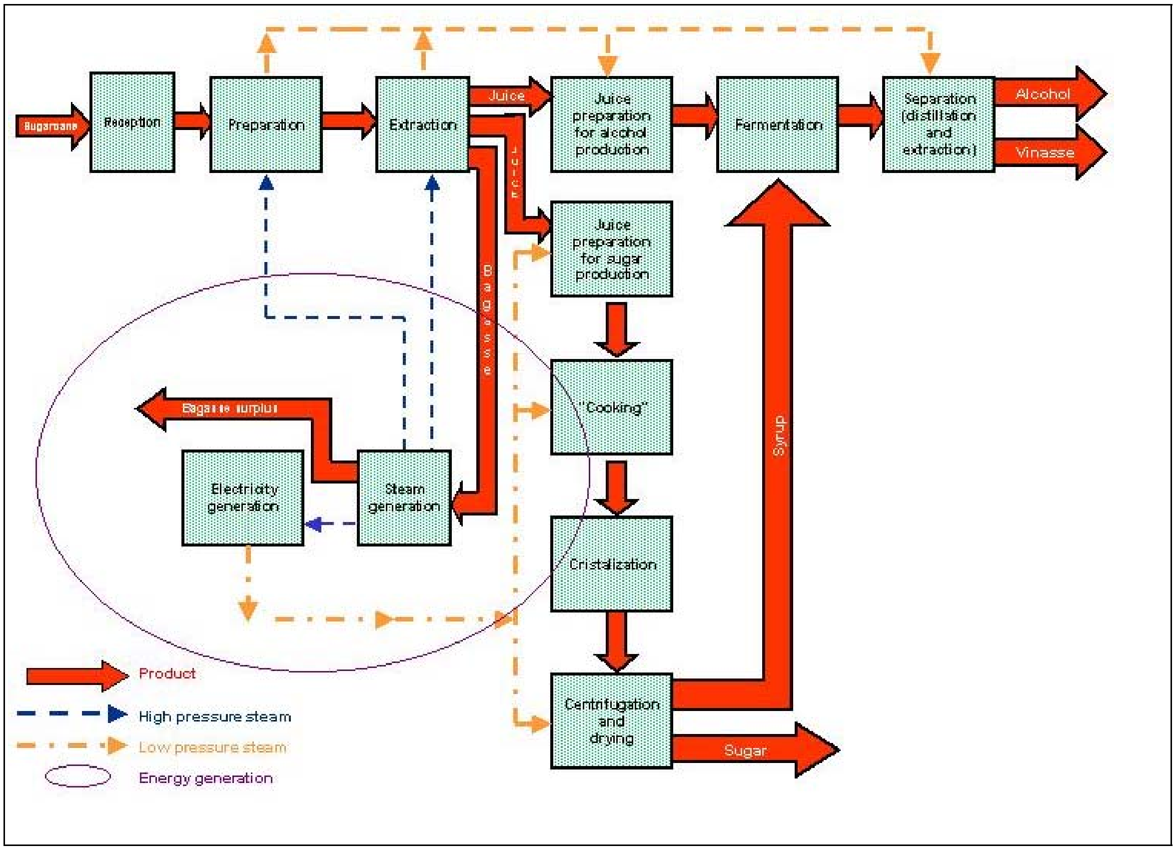

Figure 1 – Flowchart of the electricity generation inside a Sugar and Alcohol Production (Source: Codistil)

The electricity sold to the grid diversifies income to the mill and help meet 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 the total Brazilian region's electricity consumption.

This indigenous and cleaner source of electricity also have an important contribution to environmental sustainability by reducing carbon dioxide emissions that would have occurred otherwise in the absence of the project. The project activity reduces emissions of greenhouse gas (GHG) by avoiding electricity generation by fossil fuel sources (and CO_2 emissions), which would be generating (and emitting) in the absence of the project.

Projects of this type typically incur extra expenditures and require employment demand. The PROJECT directly employed several workers and it indirectly provided work for some other employees during the year of retrofitting the thermo. The PROJECT annually employs seven workers to operate the plant.

The PROJECT also contributes to a larger income distribution of the region since it plays an important role for the entire Usinas Itamarati complex, which directly employees about 3,861 workers.

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. 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.

In addition, the project sponsor is 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.

A.3. Project participants

Detailed contact information on parties and private/public entities involved in the project activity listed in Annex 1.

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)	Usinas Itamarati S.A.	No
(*) In accordance with the CDM modalities and procedures, at the time of making the CDM-PDD public at the stage of validation, a Party involved may or may not have provided its approval. At the time of requesting registration, the approval by the Party(ies) involved is required.		

Table 1 – Parties and private/public entities involved in the project activity

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.

Midwest Region / State of Mato Grosso

A.4.1.3. City/Town/Community etc

Nova Olímpia

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

The PROJECT is located on the Usinas Itamarati in the Midwest of Brazil, state of Mato Grosso, town of Nova Olímpia of around 17,917 inhabitants, according to IBGE, 2004, (coordinates South Latitude 14º49'; West Longitude 57º19'60"; altitude 644 ft). See Figure 3~~Figure 3~~, Figure 5~~Figure 5~~, and Figure 7~~Figure 7~~.

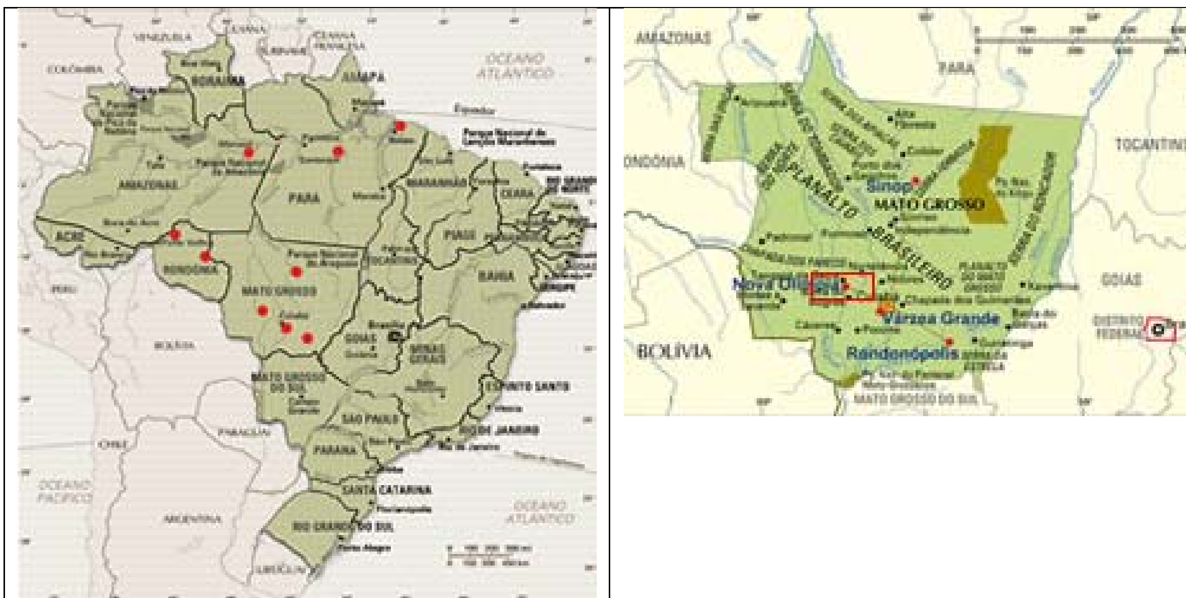

Figure 3 – Geographical Position of the City of Nova Olimpia (Source: Usinas Itamarati, 2005 http://www.usinasitamarati.com.br)

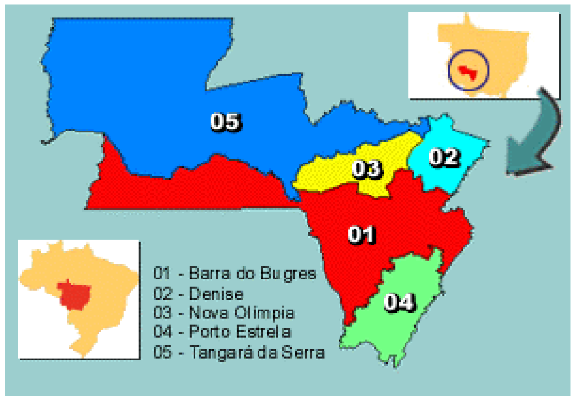

Figure 5 – Political division of Brazil showing the state of Mato Grosso and the city of Nova Olímpia (Source: City Brazil, 2005 http://www.citybrazil.com.br)

Figure 7 – General view of Usinas Itamarati (Source: Usinas Itamarati http://www.uisanet.com.br)

A.4.2. Category(ies) of project activity

Type: Energy and Power.

Sectoral Scope: 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 electricity production can be broadly categorized as one of three technologies: direct combustion technology, gasification technology, and pyrolysis. Direct combustion technology, like the one used in the PROJECT, is the most widely used for simultaneous power generation and heat production from biomass. It involves the oxidation of biomass with excess air in a process that yields hot flue gases that are used to produce steam in boilers. The steam is used to produce electricity in a Rankine cycle engine.

The Rankine cycle is a heat engine with a vapor power cycle, as can be seen in Figure 9~~Figure 9~~. The working fluid is water. Typically, electricity is produced in a "condensing" steam cycle, while electricity and steam are co-generated in an "extracting" steam cycle.

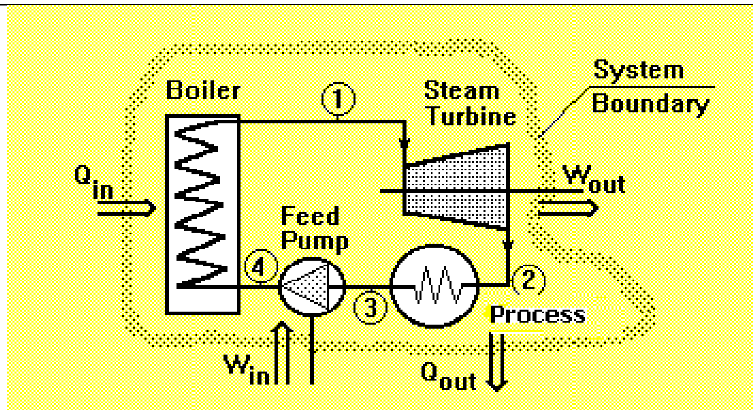

Figure 9 – Rankine Cycle (Source: Taftan Data, 1998)

- The project operates with a configuration using a high-pressure boiler and a multiple stage backpressure turbine coupled with a new generator. There are 31,800 MW power surplus, operating at full capacity during the season (March to December) and the plant exports approximately from 14,800 MWh to 31,800 MWh every year since 2001, considering 60% of capacity factor in the crop season.

Itamarati power plant uses the following equipment, which was upgraded in 2001:

	Turbo Generators	Boilers

Previous situation Previous 2001	*4 MW 21kgf/cm^2 (deactivated)* 12 MW 42kgf/cm^2 12 MW 42kgf/cm^2	**03 boilers 21kgf/cm^2** 21kgf/cm^2 95t/h 21kgf/cm^2 80t/h 21kgf/cm^2 80t/h **02 boilers 42kgf/cm^2** 42kgf/cm^2 100t/h 42kgf/cm^2 170t/h
Current situation Post 2001	12 MW 42kgf/cm^2 12 MW 42kgf/cm^2 *18 MW 42kgf/cm^2 (new turbo generator)*	**03 boilers 21kgf/cm^2** 21kgf/cm^2 95t/h 21kgf/cm^2 80t/h 21kgf/cm^2 80t/h **03 boilers 42kgf/cm^2** 42kgf/cm^2 100t/h 42kgf/cm^2 170t/h *42kgf/cm^2 150t/h (new boiler)*

- Sub-station: 15,000/20,000 KV
- Transmission Line: 13,8 KV

Usinas Itaramati trains the local staff yearly focusing on the following issues:

- NR 10[1]: Technical instruction for electric installation and services;
- NR 13: Technical instruction for boilers and pressure vessels;

A.4.4. Brief explanation of how the anthropogenic emissions of anthropogenic greenhouse gas (GHGs) by sources are to be reduced by the proposed CDM project activity, including why the emission reductions would not occur in the absence of the proposed project activity, taking into account national and/or sector policies and circumstances

The PROJECT, a greenhouse (GHG) gas-free power generation plant, will result in GHG emissions reductions as the result of the displacement of generation from fossil-fuel thermal plants that would have otherwise been delivered to the interconnected grid.

[1] Ministério do Trabalho e Emprego (www.mte.gov.br). Federal Labour Department

As Kartha et al. (2002) stated, “The crux of the baseline challenge for electricity projects clearly resides in determining the ‘avoided generation’, or what would have happened without the CDM or other GHG-mitigation project. The fundamental question is whether the avoided generation is on the ‘build margin’ (i.e. replacing a facility that would have otherwise been built) and/or ‘operating margin’ (i.e. affecting the operation of current and/or future power plants).”

The baseline emission factor is calculated as a combined margin consisting of the combination of operating margin and build margin 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 one which is connected by transmission lines to the project electricity system and in which power plants can dispatch without significant transmission constraints.

A.4.4.1. Estimated amount of emission reductions over the chosen crediting period

The PROJECT estimation of emission reduction calculates GHG diminutions derived from renewable electricity sold to the grid, which would have otherwise been generated by the operation of

Years	Annual estimation of emission reductions in tonnes of CO_{2e}
Year 1_2001	**4,136**
Year 2_2002	**8,799**
Year 3_2003	**9,872**
Year 4_2004	**8,790**
Year 5_2005	**8,850**
Year 6_2006	**8,850**
Year 7_2007	**8,850**
Total estimated reductions (tonnes of CO_{2e})	**58,147**
Total number of crediting years	**7**
Annual average over the crediting period of estimated reductions (tonnes of CO_{2e})	**8,307**

grid-connected power plants (Table 2~~Table 2~~).

Table 2– Estimated Emission Reductions of the PROJECT

With a baseline of 278 $kgCO_2$/MWh, the implementation of the PROJECT connected to the Brazilian interconnected power grid will generate an estimated annual reduction of 8,307 tCO_2 during the whole period, and a total reduction of 58,147 tCO_2 over the first crediting period.

A.4.5. Public funding of the project activity

There is no public funding involved for this Project.

SECTION B. Application of a baseline methodology

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

AM0015 – "Bagasse-based cogeneration connected to an electricity grid".

B.1.1. Justification of the choice of the methodology and why it is applicable to the project activity

The chosen methodology provides a procedures / conditions to determine if the referred methodology is applicable to the PROJECT activity.

The bagasse to be used as the feedstock for cogeneration shall be supplied from the same facility where the project is implemented;

The PROJECT is installed inside the Usinas Itamarati. The sugar mill retrofitted the power plant in order to generate excess electricity to export to the grid and use in electric irrigation equipments by using the same quantity of bagasse as before the retrofitting. The bagasse is entirely supplied by Usinas Itamarati.

Documentation is available supporting the project activity would not be implemented by the public sector, project participants or other relevant potential developers, notwithstanding of the government policies/ programs to promote renewables if any, in the absence of the CDM;

The PROJECT is located within the Usinas Itamarati premises, by using the bagasse produced from the sugarcane milling process; therefore, no other entity could develop this project. The government does not control sugar mills in Brazil therefore projects such as the Itamarati could only be set up by the private sector.

The implementation of the project shall not increase the bagasse production in the facility;

The Usinas Itamarati produces the same amount of sugarcane and bagasse as before the project activity was implemented. The fluctuation of the amount of sugarcane produced and, consequently the bagasse is due to climate, crop and market conditions that could vary from year to year. Additionally, the percentage of fibre present in the sugarcane could influence in the amount of bagasse (see Table 4~~Table 4~~).

Season	Sugarcane Produced	Bagasse Produced
2001/2002	5,270,109	1,422,929
2002/2003	5,774,292	1,559,059
2003/2004	7,034,356	1,899,276
2004/2005	6,574,350	1,775,075

Table 4- Historical Bagasse Generation in tons at Usinas Itamarati

The bagasse at 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. The bagasse is stored from the end of the harvest season in December in the Midwest region, until the beginning of the following harvest season in March. The volume of bagasse stored between seasons is insignificant, less than 2% of the total amount of bagasse generated during the year or during the harvest period.

B.2. Description of how the methodology is applied in the context of the project activity

The PROJECT fulfils all the "additionality" requisites (see application of the "additionality tool[2]" below) and demonstrates why the project would not occur in the absence of the CDM.

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), which usually attract the attention of financial investors. Operating and Build Margins have been used to calculate the emission factor for the connected grid.

The methodology AM0015, for cogeneration projects, uses derived margins, which have been applied in the context of the project activity through the determination of the emissions factor for the South-Southeast-Midwest subsystem of the interconnected Brazilian grid (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).

Years	Total installed capacity (MW)	Installed Capacity (MW) to internal use	Installed Capacity (MW) to export to the grid	Capacity Factor %	Hours of operation during the year	MWh year exported to the grid
Year 1_2001	38	18	7	90%	2,359	14,862
Year 2_2002	38	18	7	90%	5,018	31,616
Year 3_2003	38	18	7	90%	5,631	35,474
Year 4_2004	38	18	7	90%	5,014	31,586
Year 5_2005	38	18	7	90%	5,048	31,800
Year 6_2006	38	18	7	90%	5,048	31,800
Year 7_2007	38	18	7	90%	5,048	31,800

[2] Tool for the demonstration and assessment of additionality. UNFCCC, CDM Executive Board 16th Meeting Report, 22 October 2004, Annex 1. Web-site: http://cdm.unfccc.int/

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

The proposed baseline methodology includes an Additionality Tool approved by the Executive Board. This tool considers some important steps that are necessary in order to determine if the project activity is additional and also demonstrates the importance that emissions reductions would not occur in the absence of the Itamarati activity.

Following are the steps necessary for the demonstrations and assessment of Itamarati additionality:

Step 0. Preliminary screening based on the starting date of the project activity:

a) **Project Start date:** 08/2001.

b) Evidence demonstrates that CDM incentives were seriously considered in the development of the PROJECT.

The sugarcane industry sector has been informed about the Clean Development Mechanism and has been proactive in participating in the CDM since last years. Therefore, the sugarcane sector and the PROJECT are assuming a protagonist role under the CDM.

In May 2000, a consultant developed a critical analysis of the Itamarati's thermo plant. This study and consequently the CER revenues were seriously considered in the PROJECT's business plan. An evidence of this study prior to the PROJECT implementation regarding the potential to develop the project as CDM project is shown in Figure 11~~Figure 11~~.

Figure 11 – Evidence of CER studies prior to the PROJECT implementation

CTEQ	ANÁLISE CRÍTICA INICIAL	USINAS ITAMARATI Unidade: **Planta térmica** Área: **Industrial**

Atividade	Aspecto	Impacto	B / A
Geração e Co-geração de energia	A geração e co-geração de energia elétrica é realizada	Por se tratar de energia produzida a partir de bio-	B
	a partir da biomassa de bagaço de cana de açúcar.	massa, é renovável, não causando poluição atmos-	
		férica a partir do carbono. Com a expansão da plan-	
		Ta termoelétrica, objetivando a venda de energia	
		a concessionária CEMAT, poderão ser gerados	
		Créditos de Carbono após a ratificação do Protoco-	
		lo de KIOTO.	

Consultor: Aramis Mendonça	Resp. Pelas informações: Lécio Koike	Data: maio/2000	Fl.: 1/1

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

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

1. The alternative to the project activity for the investors is the continuation of the current (previous) situation, with the investment of surplus capital in the financial market. The main project sponsor had no previous experience with the power market.

Sub-step 1b. Enforcement of applicable laws and regulations:

2. The alternative is in compliance with all applicable legal and regulatory requirements.

3. Non-applicable.

4. The project activity and the alternative scenario are in compliance with the legal and regulatory requirements.

Step 2. Investment Analysis:

Non applicable.

Step 3. Barrier Analysis:

To substantiate the barrier analysis, a brief overview of the Brazilian electricity market in the last years is first presented.

Until the beginning of the 1990's, the energy sector was composed almost exclusively of state-owned companies. From 1995 on due to the increase of international interest rates and the lack of investment capacity of the State, the government was forced to look for alternatives. The solution recommended was to initiate a privatization process and the deregulation of the market.

The four pillars of the privatization process initiated in 1995 were:

Building a competition friendly environment, with the gradual elimination of the captive consumer. The option to choose an electricity services supplier, which began in 1998 for the largest consumers, and should be available to the entire market in 2006;

Dismantling of the state monopolies, separating and privatizing the activities of generation, transmission and distribution;

Allowing free access to the transmission lines, and

Placing the operation and planning responsibilities to the private sector.

Three governmental entities were created, the Electricity Regulatory Agency, ANEEL set up to develop the legislation and to regulate the market; the National Electric System Operator, ONS, to supervise and control the generation, transmission and operation; and the Wholesale Electricity Market, MAE, to define rules and commercial procedures of the short-term market.

At the end of 2000, after five years of privatization, the results were modest (Figure 13~~Figure 13~~). Despite high expectations, investments in new generation did not follow the increase in consumption.

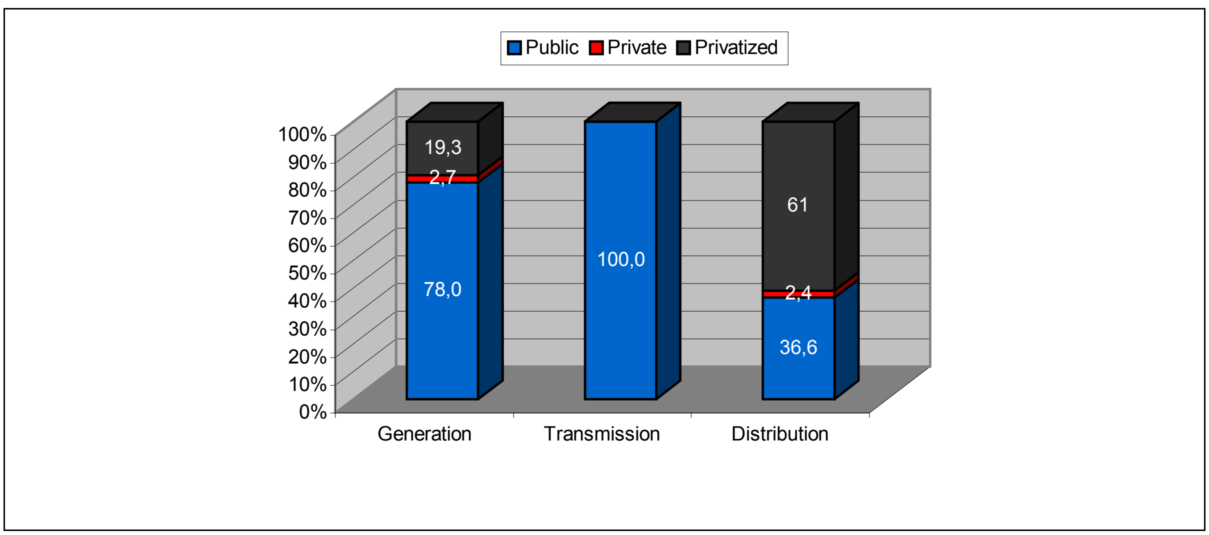

Figure 13 – Participation of private capital in the Brazilian electricity market in December 2000 (Source: BNDES, 2000).

The decoupling of GDP (average of 2% increase in the period of 1980 to 2000) from electricity consumption increase (average of 5% increase in the same period) is well known in developing countries, mainly due to the expansion of the supply services to new areas and the growing infra-structure. The necessary measures to prevent bottlenecks in services were taken. These include an increase of generation capacity higher than the GDP growth rate and strong investments in energy efficiency. In the Brazilian case, the increase in the installed generation capacity (average of 4% in the same period) did not follow the growth of consumption as can be seen in Figure 15~~Figure 15~~.

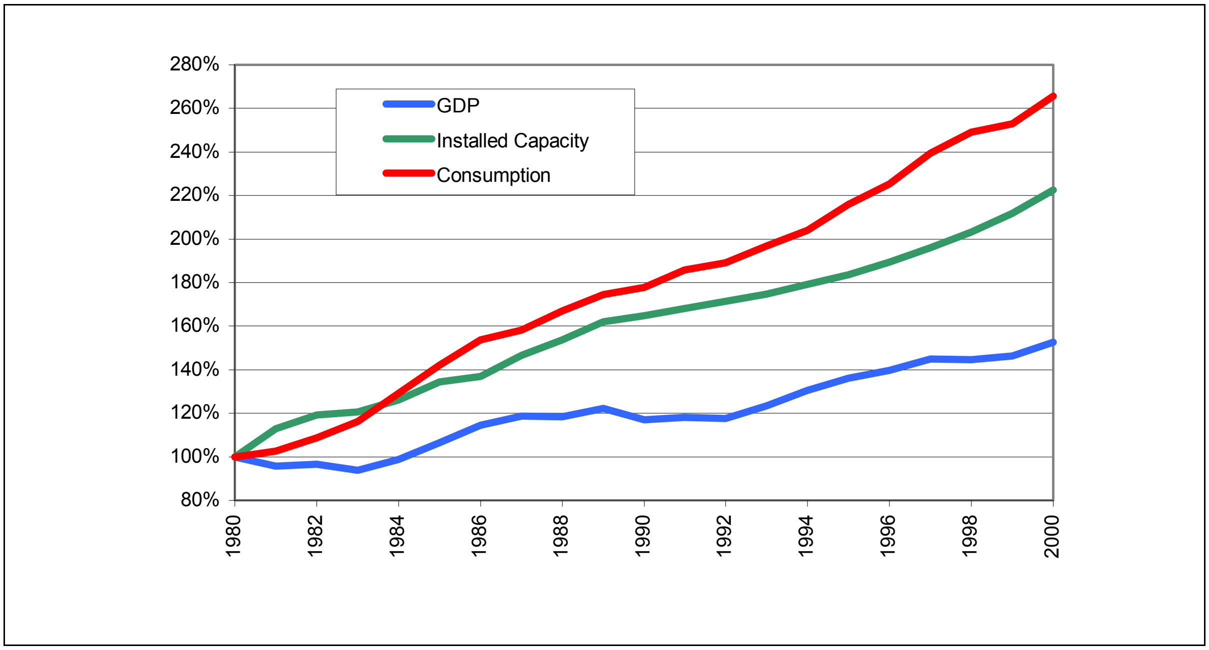

Figure 15 – Cumulated variation of GDP, electricity supply (installed capacity) and demand (consumption). Source: Eletrobrás, IBGE.

Without new installed capacity, the only alternatives were energy efficiency improvements or higher capacity utilization (capacity factor). Regarding energy efficiency, the government established in 1985 PROCEL (the National Electricity Conservation Program). Although the results of the program were remarkable, the efficiency achievement was not big enough to cover the mentioned gap between the need of new generation capacity and consumption growth.

The remaining alternative, to increase the capacity factor of the old plants, was actually the most widely used, as can be seen in Figure 17~~Figure 17~~. To understand if such increase in capacity factor brought positive or negative consequences one needs to analyze the availability and price of fuel. In the Brazilian electricity model the primary energy source is the water accumulated in the reservoirs. Figure 19~~Figure 19~~ shows what happened to the levels of "stored energy" in the reservoirs from January 1997 to January 2002. It can be seen that reservoirs which were planned to withstand 5 years of less-than-average rainy seasons, almost collapsed after a single season of low rainfall 2000/2001 experienced 74% of the historical average rain. This situation depicts a very intensive use of the country's hydro resources to support the increase in demand without increase of installed capacity. Under the situation described there was still no long-term solution for the problems that finally caused shortage and rationing in 2001.

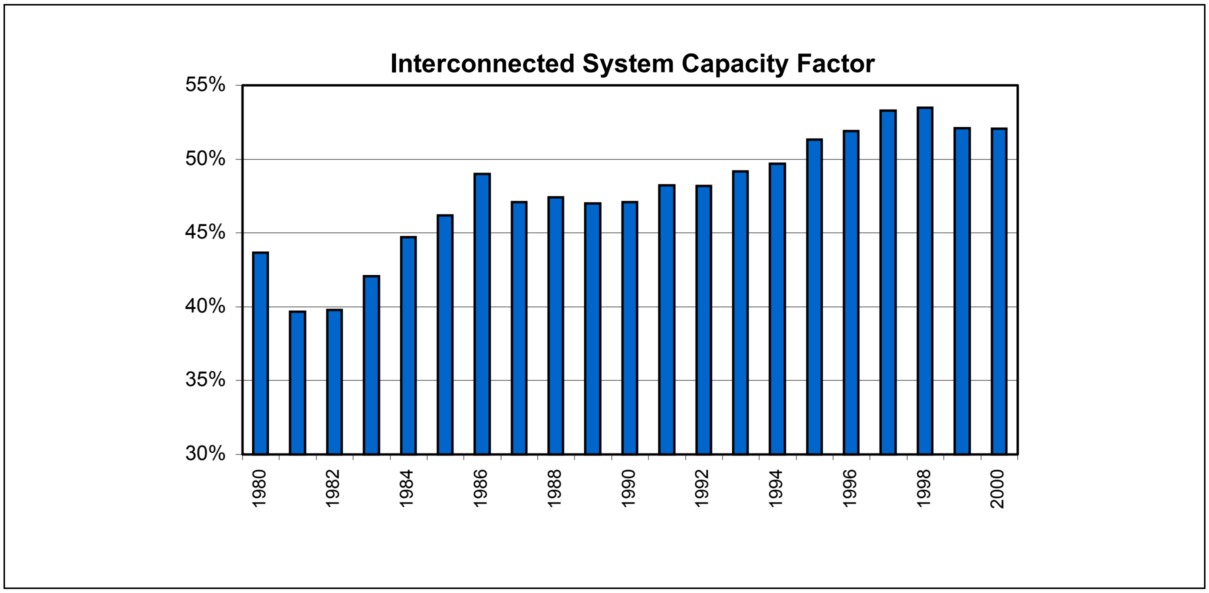

Figure 17 – Evolution of the rate of generated energy to installed capacity (Source: Eletrobrás).

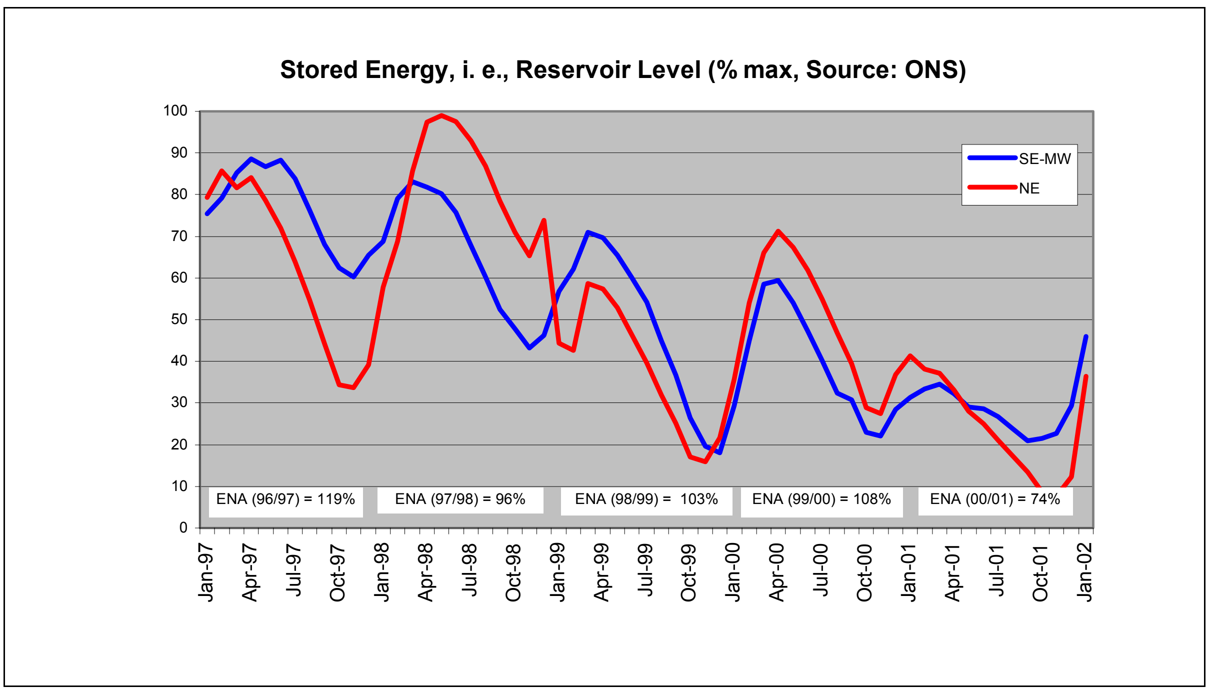

Figure 19 – Evolution of the water stored capacity for the Southeast/Midwest (SE-MW) and Northeast (NE) interconnected subsystems and intensity of precipitation in the rainy season (ENA) in the southeast region compared to the historic average (Source: ONS).

Aware of the difficulties since the end of the 1990's, the Brazilian government signalized that it was strategically important for the country to increase thermoelectric generation and consequently be less dependent of hydropower. With that in mind the federal government launched in the beginning of the year of 2000 the *Thermoelectric Priority Plan* (*PPT*, "*Plano Prioritário de Termelétricas*", Federal Decree 3,371 of February 24th, 2000, and Ministry of Mines and Energy Directive 43 of February 25th, 2000), originally planning the construction of 47 thermo plants using Bolivian natural gas, totalizing 17,500 MW new installed capacity until December of 2003. During 2001 and the beginning of 2002 the plan was rearranged to 40 plants and 13,637 MW to be installed until December 2004 (Federal Law 10,438 of April 26th, 2002, Article 29). As of today, December 2004, 20 plants totalizing around 9,700 MW are operational.

During the rationing of 2001 the government also launched the *Emergency Energy Program* with the short-term goal of building 58 small to medium thermal power plants until the end of 2002 (using mainly diesel oil, 76,9 %, and residual fuel oil, 21.1 %), totalizing 2,150 MW power capacity (CGE-CBEE, 2002).

It is clear though that hydroelectricity is and will continue as the main source responsible for the electricity base load in Brazil. However, most if not all-hydro resources in the South and Southeast of the country have been exploited, and most of the remaining reserves are located in the Amazon basin, far from the industrial and population centers (OECD, 2001). Clearly, new additions to Brazil's electric power sector are shifting from hydroelectricity to natural gas plants (Schaeffer *et al.,* 2000). With discoveries of vast reserves of natural gas in the Santos Basin in 2003 (Figure 21~~Figure 21~~) the policy of using natural gas to generate electricity remains a possibility and it still will continue to have interest from private-sector investments in the Brazilian energy sector.

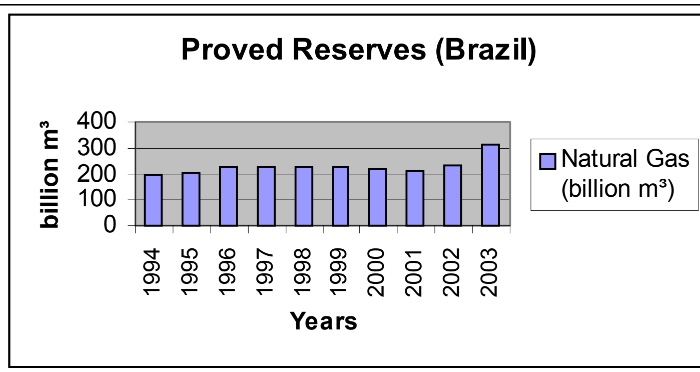

Figure 21 – National Historical Proved Reserves of Natural Gas (Source: Petrobras)

In power since January 2003, the new elected government decided to fully review the electricity market institutional framework. Congress approved a new model for the electricity sector in March 2004. The new regulatory framework for the electricity sector has the following key features (OECD, 2005):

- Electricity demand and supply will be coordinated through a "Pool" Demand will be estimated by the distribution companies, which will have to contract 100 per cent of their projected electricity demand over the following 3 to 5 years. These projections will be submitted to a new institution (*Empresa de Planejamento Energético*, EPE), which will estimate the required expansion in supply capacity to be sold to the distribution companies through the Pool. The price at which electricity will be traded through the Pool is an average of all long-term contracted prices and will be the same for all distribution companies.

- In parallel to the "regulated" long-term Pool contracts, there will be a "free" market. Although in the future, large consumers (above 10 MW) will be required to give distribution companies a 3-year notice if they wish to switch from the Pool to the free market and a 5-year notice for those moving in the opposite direction a transition period is envisaged during which these conditions will be made more flexible. These measures have the potential to reduce market volatility and allow distribution companies to better estimate market size. If actual demand turns out to be higher than projected, distribution companies will have to buy electricity in the free market. In the opposite case, they will sell the excess supply in the free market. Distribution companies will be able to pass on to end consumers the difference between the costs of electricity purchased in the free market and through the Pool if the discrepancy between projected and actual demand is below 5 per cent. If it is above this threshold, the distribution company will bear the excess costs.
- The government opted for a more centralized institutional set-up, reinforcing the role of the Ministry of Mines and Energy in long-term planning. EPE will submit to the Ministry its desired technological portfolio and a list of strategic and non-strategic projects. In turn, the Ministry will submit this list of projects to the National Energy Policy Council (*Conselho Nacional de Política Energética*, CNPE). Once approved by CNPE, the strategic projects will be auctioned on a priority basis through the Pool. Companies can replace the non-strategic projects proposed by EPE, if their proposal offers the same capacity for a lower tariff. Another new institution is a committee (*Comitê de Monitoramento do Setor Elétrico,* CMSE), which will monitor trends in power supply and demand. If any problem is identified, CMSE will propose corrective measures to avoid energy shortages, such as special price conditions for new projects and reserve of generation capacity. The Ministry of Mines and Energy will host and chair this committee. No major further privatizations are expected in the sector.

Although one of the new model biggest aims is to reduce market risk, its ability to encourage private investment will depend on how the new regulatory framework is implemented. Several challenges are noteworthy in this regard. *First,* the risk of regulatory failure that might arise due to the fact that the government will have a considerable bigger role to play in long-term planning should be avoided by close monitoring of new rules applicability. *Second,* rules will need to be designed for the transition from the current to the new model to allow current investments to be rewarded adequately. *Third,* because of its small size, price volatility may increase in the short-term electricity market, in turn bringing about higher investment risk, albeit this risk will be attenuated by the role of large consumers. The high share of hydropower in Brazil's energy mix and uncertainty over rainfall also contribute to higher volatility of the short-term electricity market. *Fourth,* although the new model will require total separation between generation and distribution, regulations for the unbundling of vertically integrated companies still have to be defined. Distribution companies are currently allowed to buy up to 30 per cent of their electricity from their own subsidiaries (self-dealing). *Finally,* the government's policy for the natural gas sector needs to be defined within a specific sectoral framework.

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

Investment Barrier

In order to analyse accurately the investment environment in Brazil, the Brazilian Prime Rate, known, as SELIC rate, as well as the CDI – Interbank Deposit Certificate, which is the measure of value of value in the short-term credit market, need to be taken into account. Real interest rates have been extraordinarily high since the Real plan stabilized inflation in 1994.

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.

The most liquid government bond is the LFT (floating rate bonds based on the daily Central Bank reference rate). As of January 2004, 51.1% of the domestic federal debt was in LFTs and had duration of one day. This bond rate is almost the same as the CDI - Interbank Deposit Certificate rate that is influenced by the SELIC rate, defined by COPOM[3].

The SELIC Rate has been oscillating since 1996 from a minimum of 15% p.a. in January 2001 to a maximum of 45% p.a. in March 1999, as it is possible to see in Figure 23~~Figure 23~~.

3 COPOM – Comitê de Politica Monetária (Monetary Policy Committee).

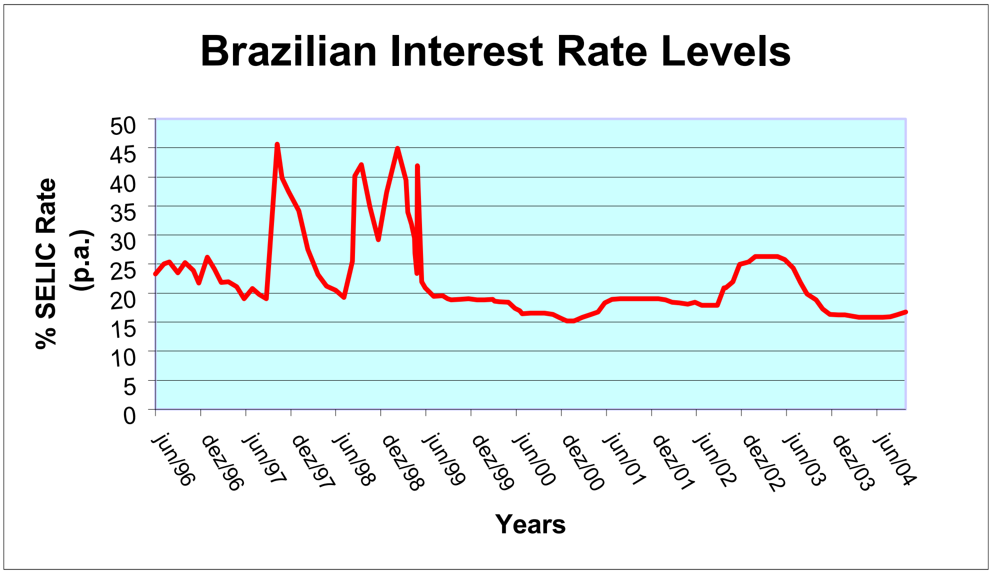

Figure 23 – SELIC rate (source: Banco Central do Brasil)

The project was developed on an equity basis and it was set up with an expected financial IRR – Internal Rate of Return of the approximately 17% per year (Table 6~~Table 6~~). The project's IRR is very similar to the SELIC rate in effect at the time of financing although the project is a riskier investment as compared to Brazilian government bonds. The inclusion of the revenues from CERs makes the project's IRR increase basis point from 15.2% to 17.8%. Such increase in return would compensate for the additional risk investor would take with this project.

Financial Sensitivity Analysis - BK Itamarati			
SELIC rate* (1996 - 2004)	**%**	**Project NPV**	**Project NPV with CER**
Maximum Level	45.00%	(R$ 5,540,994)	(R$ 4,982,525)
Average	22.36%	(R$ 3,437,089)	(R$ 2,127,957)
Minimum Level	15.25%	(R$ 75,909)	R$ 1,877,283
Current Discount Rate	**17.00%**	**(R$ 1,212,853)**	**R$ 540,976**
Project IRR		**15.15%**	**17.84%**

Table 6 – Financial Sensitivity Analysis

In addition to the increase of basis points, CER revenues would bring the project additional benefits due to the fact that they are generated in hard currencies (USD or EUR). The CDM incentive allows Itamarati to hedge its debt cash flow against currency devaluation. Moreover, the CER Free Cash Flow, in US dollars or EURO, could be discounted at an applicable discount interest rate, thus increasing the project leverage.

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.

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. Most of the utilities in Brazil do not have a satisfactory credit risk thus representing a barrier to obtain long-term funding.

Core Business Barrier

In addition to all those barriers mentioned above, the sugar mills do not have an incentive to invest in their own power plants. In general, the revenues of selling electricity in a cogeneration project represents less than 1% of the total revenues of a sugar mill. Thus, the sugar mills tend to invest in their core business, sugar and ethanol, instead of investing in electricity generation for the grid.

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[4]. In that sense, it will be 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

[4] 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.

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. Therefore, the cultural barrier is a considerable obstacle since the generation of electricity to sell to the grid and the electricity negotiation in the market is something relatively new to this industry, which can be in part overcome with the Clean Development Mechanism.

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

As described above, the main alternative to the project activity is to continue the status quo. The project sponsor could invest their resources in different financial market investments. Therefore the barriers above have not affected the investment in other opportunities. To the contrary Brazilian interest rates, which represent a barrier for the project activity, is a viable investment alternative.

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.

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

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[5] 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 sugar mills and the majority of these project developers have taken into consideration CDM in their decision to expand their cogeneration plant.

The intention of the PROJECT 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

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

PROJECT. The company has also been a pioneer in looking for CER revenues to increase the project IRR and consequently making it economically feasible.

Step 5 – Impact of CDM Registration

The sugarcane plantation is part of the country's colonization period. The commercialization of sugarcane has become part of the Brazilian culture was introduced during the XVI century when the Portuguese colonized the country. Brazil became the first producer and exporter of sugar in the world. Since then, sugarcane has been an important part of the Brazilian agricultural industry.

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.

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.

Therefore, the registration of the proposed project activity will have a strong impact in paving the way for similar projects to be implemented in Brazil, which may bring about among other things development in technologies.

This kind of activity will be encouraged once this project activity gets registered.

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

Project Boundary

The PROJECT boundaries are defined by the emissions targeted or directly affected by the project activities, construction and operation. It encompasses the physical, geographical site of the bagasse power generation source, which is represented by the sugarcane mills, the sugarcane plantation that supply biomass to the mill and the region located close to the power plants facilities and the interconnected grid.

Brazil is a large country and 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. Thus the energy generation and, consequently, the transmission are concentrated in three subsystems. The energy expansion has concentrated in three specific areas:

- Northeast: The electricity for this region is basically supplied by the São Francisco River. There are seven hydro power plants at the river with total installed capacity around 10.5 GW.

- 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.
- North : 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.

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. (please see it at Annex 4)

Part of the electricity consumed in Brazil is imported from other countries. Argentina, Uruguay and Paraguay supply a very small amount of the electricity. 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 counties does not affect the boundary of the project and the baseline calculation.

B.5. Details of baseline information, including the date of completion of the baseline study and the name of person (s)/entity (ies) determining the baseline

The date of completing the final draft of this baseline section was 30/08/2005.

Mr. Ricardo Esparta, director of Ecoinvest was responsible for its development.

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Brazil.

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

01/09/2001

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

01/09/2001

C.2.1.2. Length of the first crediting period

7 years

C.2.2. Fixed crediting period

C.2.2.1. Starting date

Not applicable

C.2.2.2. Length

Not applicable

SECTION D. Application of a monitoring methodology and plan

D.1. Name and reference of approved monitoring methodology applied to the project activity

Approved monitoring methodology AM0015: "Bagasse-based cogeneration connected to an electricity grid"

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

The chosen methodology is applicable to all bagasse-based cogeneration projects connected to the grid. The monitoring methodology and plan considers monitoring emission reductions generated from cogeneration projects using sugarcane bagasse as fuel.

The main data to be considered in determining the emissions reductions is the electricity exported to the grid. The emissions reduction is reached by applying an emissions factor through the electricity dispatched to the grid, that is verified and monitor by a two party verification: by the power plant that sells the electricity and by the utility company that buys the electricity.

D.2.1. Option 1: Monitoring of the emissions in the project scenario and the baseline scenario

The project emissions (PE_y) are zero; therefore table D.2.1.1 below is empty.

D.2.1.1. Data to be collected in order to monitor emissions from the project activity, and how this data will be archived								
ID number *(Please use numbers to ease cross-referencing to*	Data variable	Source of data	Data unit	Measured (m), calculated (c) or estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (Electronic/ paper)	Comment

D.2.1.2. Description of formulae used to estimate project emissions (for each gas, source, formulae/algorithm, emissions units of CO_{2e})

The project emissions (PE_y) are zero, therefore no formula for calculation of direct emissions are necessary.

D.2.1.3. Relevant data necessary for determining the baseline of anthropogenic emissions by sources of GHGs within the project boundary and how such data will be collected and archived								
ID number *(Please use numbers to ease cross-referencing to table D.3)*	Data variable	Source of data	Data unit	Measured (m), calculated (c), estimated (e),	Recording frequency	Proportion of data to be monitored	How will the data be archived? (Electronic/ paper)	Comment

1. EG_y	Electricity supplied to the grid by the project	Readings of the energy metering connected to the grid and Receipt of sales	MWh	(m)	15-minutes-measurement and Monthly recording	100%	Electronic and paper. Data will be archived during the crediting period and two years after.	The electricity delivered to the grid is monitored by the Project as well as by the energy buyer through a double check by receipt of sales.
2. EF_y	Emission Factor	Calculated	tCO_2/MWh	(c)	At the validation	0%	Electronic	Data is available under request. Factors were calculated according to the Approved monitoring methodology AM0015
3. $EF_{om,y}$	Emission factor	Calculated	tCO_2/MWh	(c)	At the validation	0%	Electronic	Data is available under request. Factors were calculated according to the Approved monitoring methodology AM0015
4. $EF_{BM,y}$	Emission factor	Calculated	tCO_2/MWh	(c)	At the validation	0%	Electronic	Data is available under request. Factors were calculated according to the Approved monitoring methodology AM0015
5. λ_y	Fraction of time during which low-cost/must-run sources are on the margin	Calculated	Non dimensional	(c)	At the validation	0%	Electronic	Data is available under request. Factors were calculated according to the Approved monitoring methodology AM0015

D.2.1.4. Description of formulae used to estimate baseline emissions (for each gas, source, formulae/algorithm, emissions units of CO_{2e})

From AM0015 (2004), a baseline emission factor (EF_y) 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).

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

- **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 2**

- **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 3**

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

A more detailed description of the formulae used to estimate baseline emissions can be seen in Section E below.

D.2.2.	**Option 2: Direct monitoring of emission reductions from the project activity (values should be consistent with those in section E)**

Not applicable.

D.2.2.1. Data to be collected in order to monitor emissions from the project activity, and how this data will be archived

ID number *(Please use numbers to ease cross-referencing to table D.3)*	Data variable	Source of data	Data unit	Measured (m), calculated (c), estimated (e),	Recording frequency	Proportion of data to be monitored	How will the data be archived? (Electronic/paper)	Comment

D.2.2.2. Description of formulae used to calculate project emissions (for each gas, source, formulae/algorithm, emissions units of CO_{2e})

Not applicable.

D.2.3. Treatment of leakage in the monitoring plan

D.2.3.1. If applicable, please describe the data and information that will be collected in order to monitor leakage effects of the project activity								
ID number *(Please use numbers to ease crossreferencing to table D.3)*	Data variable	Source of data	Data unit	Measured (m), calculated (c) or estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (Electronic/ paper)	Comment

No sources of emissions were identified, and therefore no data will be collected and archived. There are no entries in the table D.2.3.1 above.

D.2.3.2. Description of formulae used to estimate leakage (for each gas, source, formulae/algorithm, emissions units of CO_{2e})

Leakage is not applicable to the projects activity approved methodology

D.2.4. Description of formulae used to estimate emission reductions for the project activity (for each gas, source, formulae/algorithm, emissions units of CO_2 equivalent)

The project activity mainly reduces carbon dioxide through substitution of grid electricity generation with fossil fuel fired power plants by renewable electricity. The emission reduction by the project activity (ER_y) during a given year (y) is the difference between the baseline emissions (BE_y, in tCO_2), project emissions (PE_y, in tCO_2e) and due to leakage (L_y, in tCO_2e), as follows:

$$ER_y = BE_y - PE_y - L_y$$ **Equation 4**

Where the baseline emissions are the product of the the electricity supplied by the project to the grid (EG_y in *MWh*) times the baseline emission factor (EF_y in tCO_2e/MWh), as follows:

$$BE_y = EG_y \cdot EF_y$$ **Equation 5**

Project emissions are the sum of the fugitive carbon dioxide and methane emissions due to the release of non-condensable gases from the produced steam (PES_y, *in* tCO_2) and carbon dioxide emissions from fossil fuel combustion ($PEFF_y$, *in* tCO_2), as follows:

$$PE_y = PES_y + PEFF_y$$ **Equation 6**

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). Project participants do no need to consider these emissions these emission sources as leakage in applying this methodology. Therefore:

$$L_y = 0$$ **Equation 7**

D.3. Quality control (QC) and quality assurance (QA) procedures are being undertaken for data monitored

Data *(Indicate table and ID number e.g. 3.1; 3.2.)*	Uncertainty level of data (High/Medium/Low)	Explain QA/QC procedures planned for these data, or why such procedures are not necessary.
1	Low	Data is being monitored by Itamarati and the utility company.
2	Low	Data acquired from ONS and ANEEL and does not need to be monitored.
3	Low	Data acquired from ONS and ANEEL and does not need to be monitored.
4	Low	Data acquired from ONS and ANEEL and does not need to be monitored.
10	Low	Data acquired from ONS and ANEEL and does not need to be monitored.

D.4. Please describe the operational and management structure that the project operator will implement in order to monitor emission reductions and any leakage effects, generated by the project activity

As the project is neither associated with leakage effects nor with new emissions of pollutants and all other pertinent data is necessary to be analyzed and presented only at the validation phase of the project, the only data that has to be monitored going forward during the life of the contract is the electricity supplied to the grid by the project (EG_y).

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 issued by the electricity utility to the mill.

D.5. Name of person/entity determining the monitoring methodology

Mr. Ricardo Esparta, director of Ecoinvest.

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SECTION E. Estimation of GHG emissions by sources

E.1. Estimate of GHG emissions by sources

Based on the renewable source of technology, the project emissions (PE_y) are zero. Therefore, no calculation of estimate of GHG emissions is necessary.

$$PE_y = 0$$ **Equation 8**

E.2. Estimated leakage

No leakage was identified.

$$L_y = 0$$ **Equation 9**

E.3. The sum of E.1 and E.2 representing the project activity emissions

$$PE_y + L_y = 0 \ tCO_2e$$ **Equation 10**

E.4. Estimated anthropogenic emissions by sources of greenhouse gases of the baseline

According to the selected approved methodology (AM0015, 2004), 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.

Brazil's electric power system is geographically divided into 5 macro-regions: South (S), Southeast (SE), Midwest (CO, from the Portuguese *Centro-Oeste*), North (N) and Northeast (NE). Regarding the electricity system, three different electric systems supply the five macro-regions of the country. The largest interconnected power transmission system, which includes the Southeast, South, and Mid-West regions, accounts for more than 70% of the Brazilian total installed capacity. It includes the hydroelectric power plant of Itaipu, and the only two nuclear power plants currently in operation in Brazil: Angra I (657 MW), and Angra II (1,309 MW). The second interconnected grid system connects the north and northeast regions, accounting for almost 25% of the Brazilian total installed capacity. Finally, the third system includes small, independent grids that are isolated in terms of electric power, largely in the northern region. These isolated systems accounted for less than 5% and are based mainly on thermal power plants (SIESE, 2002).

The PROJECT are integrated to the South-Southeast-Midwest (S-SE-CO) connected electricity system.

From AM0015 (2002), a baseline emission factor (*EFy*) 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:
  - Simple operating margin
  - Simple adjusted operating margin
  - Dispatch data analysis operating margin
  - Average operating margin.

Dispatch data analysis operating margin 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 can only be used where low-cost/must-run resources 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. Table 8~~Table 8~~ shows the share of hydroelectricity in the total electricity production for the Brazilian S-SE-CO interconnected system. However the results show the non-applicability of the simple operating margin to the PROJECT.

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

Table 8 – Share of hydroelectricity production in the Brazilian S-SE-CO interconnected system from 1999 to 2003 (ONS, 2004).

The fourth alternative, an average operating margin, 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 will be used here.

The simple adjusted operating margin emission factor ($EF_{OM,adjusted,y}$ in tCO_2/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 11**

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 120 power plants, comprising 63.6 GW installed capacity and around 828 TWh electricity generation over the 3-year period were considered. With the numbers from ONS, is calculated, as described below:

$$EF_{OM,y} = \frac{\sum_{i,j} F_{i,j,y} \cdot COEF_{i,j}}{\sum_j GEN_{j,y}}$$ **Equation 12**

Where:

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

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., $COEF_{i,j}$ for these plants is zero. Hence, the emission factor for low-cost/must-run resources results, $EF_{OM,y} = 0$.

$$EF_{OM-non,y} = \frac{\sum_{i,k} F_{i,k,y} \cdot COEF_{i,k}}{\sum_{k} GEN_{j,k}}$$ **Equation 13**

Where:

- $EF_{OM-non,y}$ is emission factor for **non**-low-cost/must-run resources(in tCO_2/MWh) by relevant power sources *k* 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 $\sum_{i,k} F_{i,k,y} \cdot COEF_{i,k}$ for each one of the plants was obtained from the following formulae:

$$F_{i,k,y} = \frac{GEN_{i,k,y} \cdot 3{,}6 \times 10^{-6}}{\eta_{i,k,y} \cdot NCV_i}$$ **Equation 14**

$$COEF_{i,k} = NCV_i \cdot EF_{CO2,i} \cdot 44/12 \cdot OXID_i$$ **Equation 15**

$$Hence,\ F_{i,k,y} \cdot COEF_{i,k} = \frac{GEN_{i,k,y} \cdot EF_{CO2,i} \cdot OXID_i \cdot 44/12 \cdot 3{,}6 \times 10^{-6}}{\eta_{i,k,y}}$$ **Equation 16**

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 $F_{i,k,y} \cdot COEF_{i,k}$ in [tCO_2e]

- $GEN_{i,k,y}$ is the electricity generation for plant *k*, 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.
- $\eta_{i,k,y}$ is the thermal efficiency of plant *k*, 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].

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

The λ_y factors are calculated as indicated in methodology AM0015, with date obtained from the ONS database. Figure 25~~Figure 25~~, Figure 27~~Figure 27~~ and

Figure 29

~~Figure 29~~ present the load duration curves and λ_y calculations for years 2002, 2003 and 2004, respectively.

The results for years 2002, 2003 and 2004 are presented in Table 10~~Table 10~~.

Table 10 – 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 2002-2004 (ONS-ADO, 2005).

Year	$\frac{\sum_{i,k} F_{i,k,y} \cdot COEF_{i,k}}{\sum_{k} GEN_{k,y}}$ [tCO_2/MWh]	λ_y [%]
2002	0.850	0.505

2003	0.938	0.531
2004	0.873	0.504

With the numbers from ONS, the first step was to calculate the lambda factors and the emission factors for the simple operating margin. The obtained values can be seen in Table 10~~Table 10~~, Figure 25~~Figure 25~~, Figure 27~~Figure 27~~, and Figure 29~~Figure 29~~

Finally, applying the obtained numbers to calculate $EF_{OM,simple\text{-}adjusted,2002\text{-}2004}$ as the weighted average *of* $EF_{OM,simple\text{-}adjusted\ 2002}$, $EF_{OM\ simple\text{-}\ adjusted,2003}$ *and* $EF_{OM,simple\text{-}adjusted,2004}$ and λ_y to Equation 1~~Equation 1~~1:

- $EF_{OM,simple\text{-}adjusted,2002\text{-}2004} = 0.4310\ tCO_2e/MWh.$

- **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 17**

Where $F_{i,m,y}$, $COEF_{i,m}$ and $GEN_{m,y}$ are analogous to the variables described for the simple OM method (AM0015, 2004) 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.

Applying the data from the Brazilian national dispatch center to Equation 17:

- $EF_{BM,2004} = 0.1256\ tCO_2e/MWh.$

- **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 18**

Where the weights w_{OM} and w_{BM}, by default, are 50% (i.e., $w_{OM} = w_{OM} = 0.5$). With these numbers:

$$EF_y = 0.5 \times 0.4310 + 0.5 \times 0.1256$$

Equation 19

- *$EF_y = 0.278\ tCO_2e/MWh$.*

Baseline emissions are calculated by using the annual generation (project annual electricity dispatched to the grid) times the CO_2 average emission rate of the estimated baseline, as follows:

Monitored project power generation	(MWh)	(A)
Baseline emission rate factor	(tCO_2/MWh)	(B)
(A) x (B)	(tCO_2)	

Based on the calculation mentioned above, the following example is presented.

Example:

Total typical annual power generation of the five units:	575,803 MWh
Baseline emission rate factor:	0.278 tCO_2/MWh
Net annual reductions:	160,246 tCO_2

The baseline emissions would be then proportional to the electricity delivered to the grid throughout the project's lifetime. Baseline emissions due to displacement of electricity are calculated by multiplying the electricity baseline emissions factor ($EF_{CM,2002\text{-}2004}$) with the electricity generation of the project activity.

$$BE_{,y} = EF_{CM,2002\text{-}2004} \times EG_y$$ **Equation 19**

Therefore, for the first crediting period, the baseline emissions (BE_y in tCO_2e) will be calculated as follows:

$$BE_y = 0.278 \times EG_y$$ **Equation 20**

E.5. Difference between E.4 and E.3 representing the emission reductions of the project activity

The emission reduction by the project activity (ER_y in tCO_2e) during a given year (y) is the difference between the baseline emissions (BE_y), project emissions (PE_y) and due to leakage (L_y), as follows:

$$ER_y = BE_y - PE_y - L_y = 0.278 \times EG_y - 0 - 0$$ **Equation 21**

$$ER_y = 0.278 \times EG_y$$ **Equation 22**

E.6. Table providing values obtained when applying formulae above

Year	Estimation of project activity emission reductions (tonnes of CO_{2e})	Estimation of baseline emission reductions (tonnes of CO_{2e})	Estimation of leakage (tonnes of CO_{2e})	Estimation of emission reductions (tonnes of CO_{2e})
Year 1_2001	-	4,136	0	**4,136**
Year 2_2002	-	8,799	0	**8,799**
Year 3_2003	-	9,872	0	**9,872**
Year 4_2004	-	8,790	0	**8,790**
Year 5_2005	-	8,850	0	**8,850**
Year 6_2006	-	8,850	0	**8,850**
Year 7_2007	-	8,850	0	**8,850**
Total (tonnes of CO_{2e})	-	58,147	-	**58,147**

Table 12 – Yearly estimated emission reductions of the PROJECT

SECTION F. Environmental impacts

F.1. Documentation on the analysis of the environmental impacts, including trans-boundary impacts

By the time of building the sugar mill, environmental impact study was not necessary for obtaining operating license. Therefore, this license was issued without any environmental study.

Since the power plant expansion based on energy efficiency is part of the entire sugar mill complex, the license obtained by the sugar mill is legal for the thermo plant.

The power plant has the 2004 license # 537 (Figure 31~~Figure 31~~) by the environmental agency FEMA of the state of Mato Grosso.

F.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

Whether an environmental enhancement was needed, its compliance was necessary to be achieved in order to renovate the license.

SECTION G. Stakeholders' comments

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

Public discussion with local stakeholders is compulsory for obtaining the environmental operating licenses. The legislation also requests the announcement of the issuance of the license (LO) in the local state official newspaper (*Diário Oficial do Estado de Mato Grosso*) and in the regional newspaper to make the process public and allow public information and opinion. (Figure 33Figure 33)

Besides the public discussion for the environmental licensing, the project invited local stakeholders for comments on the CDM Itamarati Cogeneration Project. Several organizations and entities were invited for comments on the project:

- City Hall.
- City Council.
- Local Environmental and Agricultural Department.
- Environmental Department.
- Mato Grosso State Public Attorney

G.2. Summary of the comments received

The PROJECT and the sugar mills have not received any comments on the project.

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

The PROJECT and the sugar mills have not received any comments on the project.

SECTION H. Annexes

Annex 1. Contact information on participants in the project activity

Organization:	Usinas Itamarati S.A.
Street/P.O.Box:	Fazenda Guanabara, Zona Rural,
City:	Nova Olimpia
State/Region:	Mato Grosso
Postfix/ZIP:	Caixa Postal 60
Country:	Brazil
Telephone:	+55 (65) 311-1168
FAX:	+55 (65) 311-1270
Represented by:	
Title:	Sistema de Gestão Ambiental - SGA
Salutation:	Mr.
Last Name:	Grossi
First Name:	Caetano Henrique
Department:	
Direct FAX:	
Direct tel:	
Personal E-Mail:	caetano.grossi@uisanet.com.br

Annex 2. Information regarding public funding

No public funding was and will be used in the present project.

ANNEX 3 - BASELINE INFORMATION

Years	Total installed capacity (MW)	Installed Capacity (MW) to internal use	Installed Capacity (MW) to export to the grid	Capacity Factor %	Hours of operation during the year	MWh year exported to the grid
Year 1_2001	38	18	7	90%	2,359	14,862
Year 2_2002	38	18	7	90%	5,018	31,616
Year 3_2003	38	18	7	90%	5,631	35,474
Year 4_2004	38	18	7	90%	5,014	31,586
Year 5_2005	38	18	7	90%	5,048	31,800
Year 6_2006	38	18	7	90%	5,048	31,800
Year 7_2007	38	18	7	90%	5,048	31,800

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:

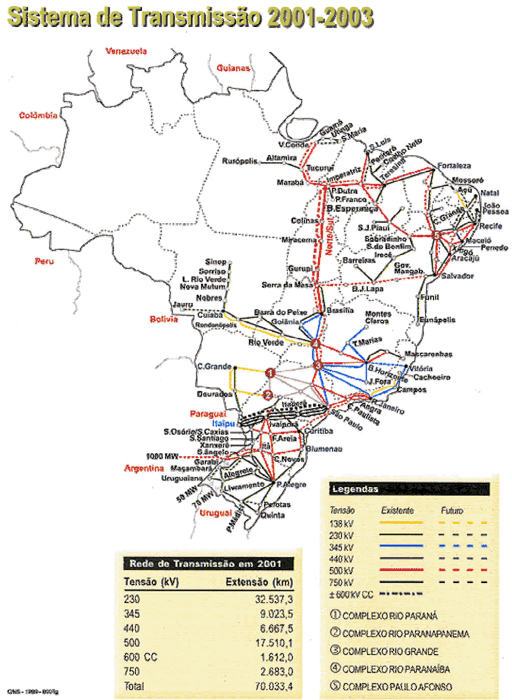
The South/Southeast/Midwest Interconnected System;

The North/Northeast Interconnected System; and

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."



Brazilian Interconnected System (Source: ONS)

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 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 AM0015 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 (Table 8).

Year	$EF_{OM\ non\text{-}low\text{-}cost/must\text{-}run}$ [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

Table 13 Ex ante and ex-post operating and build margin emission factors (ONS-ADO, 2004; Bosi et al., 2002)

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 (2002, 2003 and 2004). 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.

Emission factors for the Brazilian South-Southeast-Midwest interconnected grid				
Baseline (including imports)	EF_{OM} [tCO2/MWh]	Load [MWh]	LCMR [GWh]	Imports [MWh]
2002	0.8504	275,402,896	258,720	1,607,395
2003	0.9378	288,493,929	274,649	459,586
2004	0.8726	297,879,874	284,748	1,468,275
	Total (2001-2003) =	**861,776,699**	**818,118**	**3,535,256**
	$EF_{OM,\ simple\text{-}adjusted}$ [tCO2/MWh]	$EF_{BM,2004}$	Lambda	
	0.4310	0.1256	λ_{2002}	
	Alternative weights	**Default weights**	0.5053	
	w_{OM} = 0.75	w_{OM} = 0.5	λ_{2003}	
	w_{BM} = 0.25	w_{BM} = 0.5	0.5312	
	EF_{CM} [tCO2/MWh]	Default EF_{OM} [tCO2/MWh]	λ_{2004}	
	0.3547	0.2783	0.5041	

Table 14 – Emission factors for the Brazilian South-Southeast-Midwest interconnected grid (simple adjusted operating margin factor)

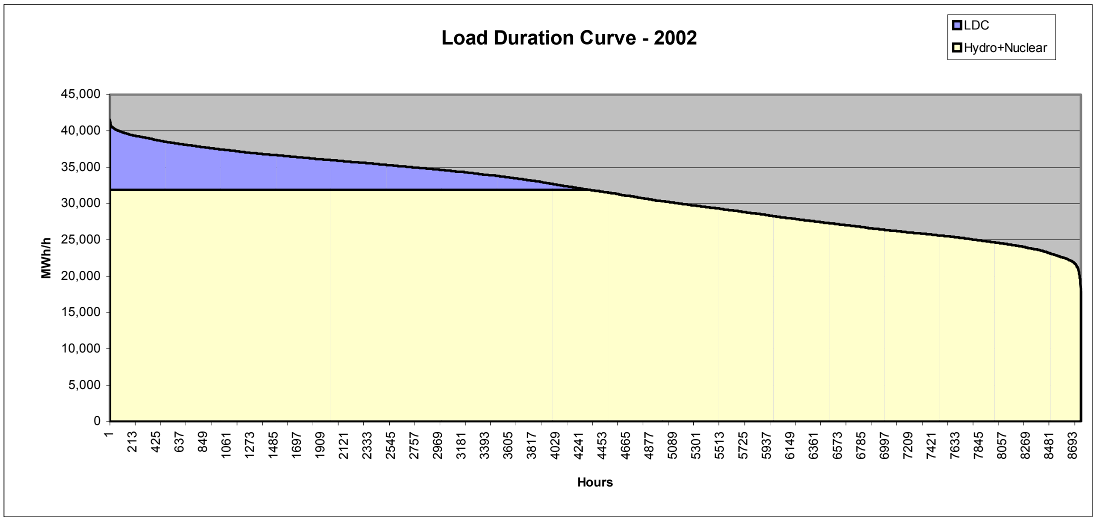


Figure 25 – Load duration curve for the S-SE-CO system, 2002

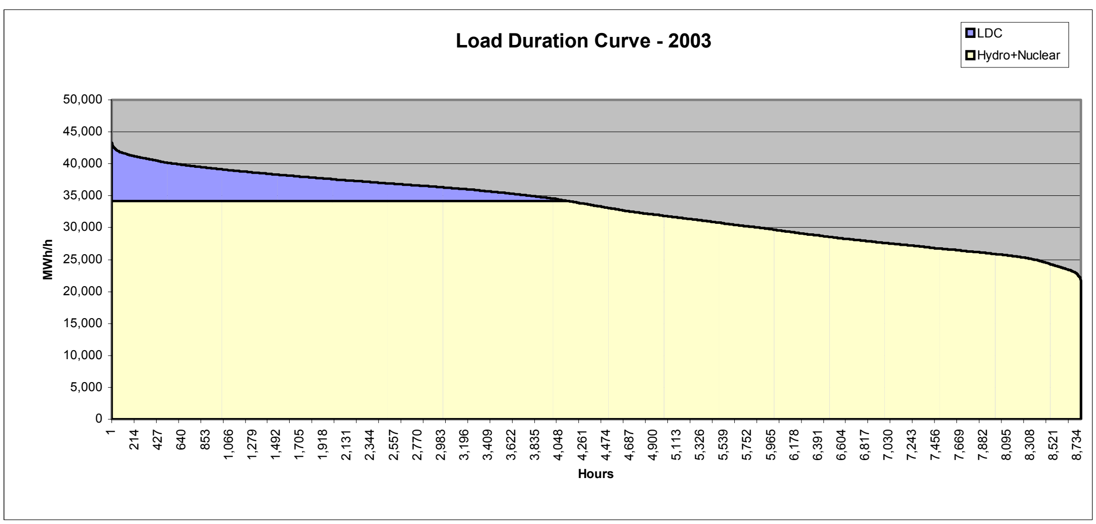


Figure 27 – Load duration curve for the S-SE-CO system, 2003

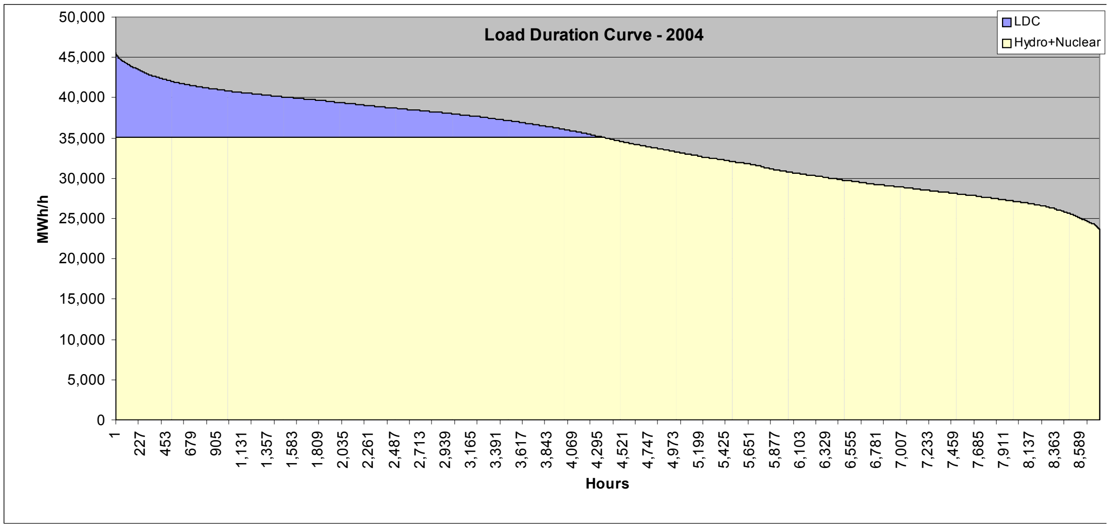


Figure 29 – Load duration curve for the S-SE-CO system, 2004

	Subsystem*	Fuel source**	Power plant	Operation start [2, 4, 5]	Installed capacity (MW) [1]	Fuel conversion efficiency (%) [2]	Carbon emission factor (tC/TJ) [3]	Fraction carbon oxidized [3]	Emission factor (tCO2/MWh)
1	S-SE-CO	H	Jauru	Sep-2003	121.5	1	0.0	0.0%	0.000
2	S-SE-CO	H	Gauporé	Sep-2003	120.0	1	0.0	0.0%	0.000
3	S-SE-CO	G	Três Lagoas	Aug-2003	306.0	0.3	15.3	99.5%	0.670
4	S-SE-CO	H	Funil (MG)	Jan-2003	180.0	1	0.0	0.0%	0.000
5	S-SE-CO	H	Itiquira I	Sep-2002	156.1	1	0.0	0.0%	0.000
6	S-SE-CO	G	Araucária	Sep-2002	484.5	0.3	15.3	99.5%	0.670
7	S-SE-CO	G	Canoas	Sep-2002	160.6	0.3	15.3	99.5%	0.670
8	S-SE-CO	H	Piraju	Sep-2002	81.0	1	0.0	0.0%	0.000
9	S-SE-CO	G	Nova Piratininga	Jun-2002	384.9	0.3	15.3	99.5%	0.670
10	S-SE-CO	O	PCT CGTEE	Jun-2002	5.0	0.3	20.7	99.0%	0.902
11	S-SE-CO	H	Rosal	Jun-2002	55.0	1	0.0	0.0%	0.000
12	S-SE-CO	G	Ibirité	May-2002	226.0	0.3	15.3	99.5%	0.670
13	S-SE-CO	H	Cana Brava	May-2002	465.9	1	0.0	0.0%	0.000
14	S-SE-CO	H	Sta. Clara	Jan-2002	60.0	1	0.0	0.0%	0.000
15	S-SE-CO	H	Machadinho	Jan-2002	1,140.0	1	0.0	0.0%	0.000
16	S-SE-CO	G	Juiz de Fora	Nov-2001	87.0	0.28	15.3	99.5%	0.718
17	S-SE-CO	G	Macaé Merchant	Nov-2001	922.6	0.24	15.3	99.5%	0.837
18	S-SE-CO	H	Lajeado (ANEEL res. 402/2001)	Nov-2001	902.5	1	0.0	0.0%	0.000
19	S-SE-CO	G	Eletrobolt	Oct-2001	379.0	0.24	15.3	99.5%	0.837
20	S-SE-CO	H	Porto Estrela	Sep-2001	112.0	1	0.0	0.0%	0.000
21	S-SE-CO	G	Cuiaba (Mario Covas)	Aug-2001	529.2	0.3	15.3	99.5%	0.670
22	S-SE-CO	G	W. Arjona	Jan-2001	194.0	0.25	15.3	99.5%	0.804
23	S-SE-CO	G	Uruguaiana	Jan-2000	639.9	0.45	15.3	99.5%	0.447
24	S-SE-CO	H	S. Caxias	Jan-1999	1,240.0	1	0.0	0.0%	0.000
25	S-SE-CO	H	Canoas I	Jan-1999	82.5	1	0.0	0.0%	0.000
26	S-SE-CO	H	Canoas II	Jan-1999	72.0	1	0.0	0.0%	0.000
27	S-SE-CO	H	Igarapava	Jan-1999	210.0	1	0.0	0.0%	0.000
28	S-SE-CO	H	Porto Primavera	Jan-1999	1,540.0	1	0.0	0.0%	0.000
29	S-SE-CO	D	Cuiaba (Mario Covas)	Oct-1998	529.2	0.27	20.2	99.0%	0.978
30	S-SE-CO	H	Sobragi	Sep-1998	60.0	1	0.0	0.0%	0.000
31	S-SE-CO	H	PCH EMAE	Jan-1998	26.0	1	0.0	0.0%	0.000
32	S-SE-CO	H	PCH CEEE	Jan-1998	25.0	1	0.0	0.0%	0.000
33	S-SE-CO	H	PCH ENERSUL	Jan-1998	43.0	1	0.0	0.0%	0.000
34	S-SE-CO	H	PCH CEB	Jan-1998	15.0	1	0.0	0.0%	0.000
35	S-SE-CO	H	PCH ESCELSA	Jan-1998	62.0	1	0.0	0.0%	0.000
36	S-SE-CO	H	PCH CELESC	Jan-1998	50.0	1	0.0	0.0%	0.000
37	S-SE-CO	H	PCH CEMAT	Jan-1998	145.0	1	0.0	0.0%	0.000
38	S-SE-CO	H	PCH CELG	Jan-1998	15.0	1	0.0	0.0%	0.000
39	S-SE-CO	H	PCH CERJ	Jan-1998	59.0	1	0.0	0.0%	0.000
40	S-SE-CO	H	PCH COPEL	Jan-1998	70.0	1	0.0	0.0%	0.000
41	S-SE-CO	H	PCH CEMIG	Jan-1998	84.0	1	0.0	0.0%	0.000
42	S-SE-CO	H	PCH CPFL	Jan-1998	55.0	1	0.0	0.0%	0.000
43	S-SE-CO	H	S. Mesa	Jan-1998	1,275.0	1	0.0	0.0%	0.000
44	S-SE-CO	H	PCH EPAULO	Jan-1998	26.0	1	0.0	0.0%	0.000
45	S-SE-CO	H	Guilmam Amorim	Jan-1997	140.0	1	0.0	0.0%	0.000
46	S-SE-CO	H	Corumbá	Jan-1997	375.0	1	0.0	0.0%	0.000
47	S-SE-CO	H	Miranda	Jan-1997	408.0	1	0.0	0.0%	0.000
48	S-SE-CO	H	Noav Ponte	Jan-1994	510.0	1	0.0	0.0%	0.000
49	S-SE-CO	H	Segredo (Gov. Ney Braga)	Jan-1992	1,260.0	1	0.0	0.0%	0.000
50	S-SE-CO	H	Taquaruçu	Jan-1989	554.0	1	0.0	0.0%	0.000
51	S-SE-CO	H	Manso	Jan-1988	210.0	1	0.0	0.0%	0.000
52	S-SE-CO	H	D. Francisca	Jan-1987	125.0	1	0.0	0.0%	0.000
53	S-SE-CO	H	Itá	Jan-1987	1,450.0	1	0.0	0.0%	0.000
54	S-SE-CO	H	Rosana	Jan-1987	369.2	1	0.0	0.0%	0.000
55	S-SE-CO	N	Angra	Jan-1985	1,874.0	1	0.0	0.0%	0.000
56	S-SE-CO	H	T. Irmãos	Jan-1985	807.5	1	0.0	0.0%	0.000
57	S-SE-CO	H	Itaipu 60 Hz	Jan-1983	6,300.0	1	0.0	0.0%	0.000
58	S-SE-CO	H	Itaipu 50 Hz	Jan-1983	5,375.0	1	0.0	0.0%	0.000
59	S-SE-CO	H	Emborcação	Jan-1982	1,192.0	1	0.0	0.0%	0.000
60	S-SE-CO	H	Nova Avanhandava	Jan-1982	347.4	1	0.0	0.0%	0.000
61	S-SE-CO	H	Gov. Bento Munhoz - GBM	Jan-1980	1,676.0	1	0.0	0.0%	0.000

* Subsystem: S - south, SE-CO - Southeast-Midwest

** Fuel source (C, bituminous coal; D, diesel oil; G, natural gas; H, hydro; N, nuclear; O, residual fuel oil).

[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 GHG mitigation projects in the electric power sector.* OECD/IEA information paper, October 2002.

[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 from Jan. 1, 2001 to Dec. 31, 2003).

[5] Agência Nacional de Energia Elétrica. Superintendência de Fiscalização dos Serviços de Geração. *Resumo Geral dos Novos Empreendimentos de Geração* (http://www.aneel.gov.br/, data collected in november 2004).

Table 15 – Power plants database for the Brazilian South-Southeast-Midwest interconnected grid, part 1

	Subsystem*	Fuel source**	Power plant	Operation start [2, 4, 5]	Installed capacity (MW) [1]	Fuel conversion efficiency (%) [2]	Carbon emission factor (tC/TJ) [3]	Fraction carbon oxidized [3]	Emission factor (tCO2/MWh)
62	S-SE-CO	H	S.Santiago	Jan-1980	1,420.0	1	0.0	0.0%	0.000
63	S-SE-CO	H	Itumbiara	Jan-1980	2,280.0	1	0.0	0.0%	0.000
64	S-SE-CO	O	Igarapé	Jan-1978	131.0	0.3	20.7	99.0%	0.902
65	S-SE-CO	H	Itauba	Jan-1978	512.4	1	0.0	0.0%	0.000
66	S-SE-CO	H	A. Vermelha (Jose E. Moraes)	Jan-1978	1,396.2	1	0.0	0.0%	0.000
67	S-SE-CO	H	S.Simão	Jan-1978	1,710.0	1	0.0	0.0%	0.000
68	S-SE-CO	H	Capivara	Jan-1977	640.0	1	0.0	0.0%	0.000
69	S-SE-CO	H	S.Osório	Jan-1975	1,078.0	1	0.0	0.0%	0.000
70	S-SE-CO	H	Marimbondo	Jan-1975	1,440.0	1	0.0	0.0%	0.000
71	S-SE-CO	H	Promissão	Jan-1975	264.0	1	0.0	0.0%	0.000
72	S-SE-CO	C	Pres. Medici	Jan-1974	446.0	0.26	26.0	98.0%	1.294
73	S-SE-CO	H	Volta Grande	Jan-1974	380.0	1	0.0	0.0%	0.000
74	S-SE-CO	H	Porto Colombia	Jun-1973	320.0	1	0.0	0.0%	0.000
75	S-SE-CO	H	Passo Fundo	Jan-1973	220.0	1	0.0	0.0%	0.000
76	S-SE-CO	H	Passo Real	Jan-1973	158.0	1	0.0	0.0%	0.000
77	S-SE-CO	H	Ilha Solteira	Jan-1973	3,444.0	1	0.0	0.0%	0.000
78	S-SE-CO	H	Mascarenhas	Jan-1973	131.0	1	0.0	0.0%	0.000
79	S-SE-CO	H	Gov. Parigot de Souza - GPS	Jan-1971	252.0	1	0.0	0.0%	0.000
80	S-SE-CO	H	Chavantes	Jan-1971	414.0	1	0.0	0.0%	0.000
81	S-SE-CO	H	Jaguara	Jan-1971	424.0	1	0.0	0.0%	0.000
82	S-SE-CO	H	Sá Carvalho	Apr-1970	78.0	1	0.0	0.0%	0.000
83	S-SE-CO	H	Estreito (Luiz Carlos Barreto)	Jan-1969	1,050.0	1	0.0	0.0%	0.000
84	S-SE-CO	H	Ibitinga	Jan-1969	131.5	1	0.0	0.0%	0.000
85	S-SE-CO	H	Jupiá	Jan-1969	1,551.2	1	0.0	0.0%	0.000
86	S-SE-CO	O	Alegrete	Jan-1968	66.0	0.26	20.7	99.0%	1.040
87	S-SE-CO	G	Campos (Roberto Silveira)	Jan-1968	30.0	0.24	15.3	99.5%	0.837
88	S-SE-CO	G	Santa Cruz (RJ)	Jan-1968	766.0	0.31	15.3	99.5%	0.648
89	S-SE-CO	H	Paraibuna	Jan-1968	85.0	1	0.0	0.0%	0.000
90	S-SE-CO	H	Limoeiro (Armando Salles de Oliviera)	Jan-1967	32.0	1	0.0	0.0%	0.000
91	S-SE-CO	H	Caconde	Jan-1966	80.4	1	0.0	0.0%	0.000
92	S-SE-CO	C	J.Lacerda C	Jan-1965	363.0	0.25	26.0	98.0%	1.345
93	S-SE-CO	C	J.Lacerda B	Jan-1965	262.0	0.21	26.0	98.0%	1.602
94	S-SE-CO	C	J.Lacerda A	Jan-1965	232.0	0.18	26.0	98.0%	1.869
95	S-SE-CO	H	Bariri (Alvaro de Souza Lima)	Jan-1965	143.1	1	0.0	0.0%	0.000
96	S-SE-CO	H	Funil (RJ)	Jan-1965	216.0	1	0.0	0.0%	0.000
97	S-SE-CO	C	Figueira	Jan-1963	20.0	0.3	26.0	98.0%	1.121
98	S-SE-CO	H	Furnas	Jan-1963	1,216.0	1	0.0	0.0%	0.000
99	S-SE-CO	H	Barra Bonita	Jan-1963	140.8	1	0.0	0.0%	0.000
100	S-SE-CO	C	Charqueadas	Jan-1962	72.0	0.23	26.0	98.0%	1.462
101	S-SE-CO	H	Jurumirim (Armando A. Laydner)	Jan-1962	97.7	1	0.0	0.0%	0.000
102	S-SE-CO	H	Jacui	Jan-1962	180.0	1	0.0	0.0%	0.000
103	S-SE-CO	H	Pereira Passos	Jan-1962	99.1	1	0.0	0.0%	0.000
104	S-SE-CO	H	Tres Marias	Jan-1962	396.0	1	0.0	0.0%	0.000
105	S-SE-CO	H	Euclides da Cunha	Jan-1960	108.8	1	0.0	0.0%	0.000
106	S-SE-CO	H	Camargos	Jan-1960	46.0	1	0.0	0.0%	0.000
107	S-SE-CO	H	Santa Branca	Jan-1960	56.1	1	0.0	0.0%	0.000
108	S-SE-CO	H	Cachoeira Dourada	Jan-1959	658.0	1	0.0	0.0%	0.000
109	S-SE-CO	H	Salto Grande (Lucas N. Garcez)	Jan-1958	70.0	1	0.0	0.0%	0.000
110	S-SE-CO	H	Salto Grande (MG)	Jan-1956	102.0	1	0.0	0.0%	0.000
111	S-SE-CO	H	Mascarenhas de Moraes (Peixoto)	Jan-1956	478.0	1	0.0	0.0%	0.000
112	S-SE-CO	H	Itutinga	Jan-1955	52.0	1	0.0	0.0%	0.000
113	S-SE-CO	C	S. Jerônimo	Jan-1954	20.0	0.26	26.0	98.0%	1.294
114	S-SE-CO	O	Carioba	Jan-1954	36.2	0.3	20.7	99.0%	0.902
115	S-SE-CO	O	Piratininga	Jan-1954	472.0	0.3	20.7	99.0%	0.902
116	S-SE-CO	H	Canastra	Jan-1953	42.5	1	0.0	0.0%	0.000
117	S-SE-CO	H	Nilo Peçanha	Jan-1953	378.4	1	0.0	0.0%	0.000
118	S-SE-CO	H	Fontes Nova	Jan-1940	130.3	1	0.0	0.0%	0.000
119	S-SE-CO	H	Henry Borden Sub.	Jan-1926	420.0	1	0.0	0.0%	0.000
120	S-SE-CO	H	Henry Borden Ext.	Jan-1926	469.0	1	0.0	0.0%	0.000
121	S-SE-CO	H	I. Pombos	Jan-1924	189.7	1	0.0	0.0%	0.000
122	S-SE-CO	H	Jaguari	Jan-1917	11.8	1	0.0	0.0%	0.000
				Total (MW) =	**64,478.6**				

* Subsystem: S - south, SE-CO - Southeast-Midwest

** Fuel source (C, bituminous coal; D, diesel oil; G, natural gas; H, hydro; N, nuclear; O, residual fuel oil).

[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 GHG mitigation projects in the electric power sector.* OECD/IEA information paper, October 2002.

[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 from Jan. 1, 2001 to Dec. 31, 2003).

[5] Agência Nacional de Energia Elétrica. Superintendência de Fiscalização dos Serviços de Geração. *Resumo Geral dos Novos Empreendimentos de Geração* (http://www.aneel.gov.br/, data collected in november 2004).

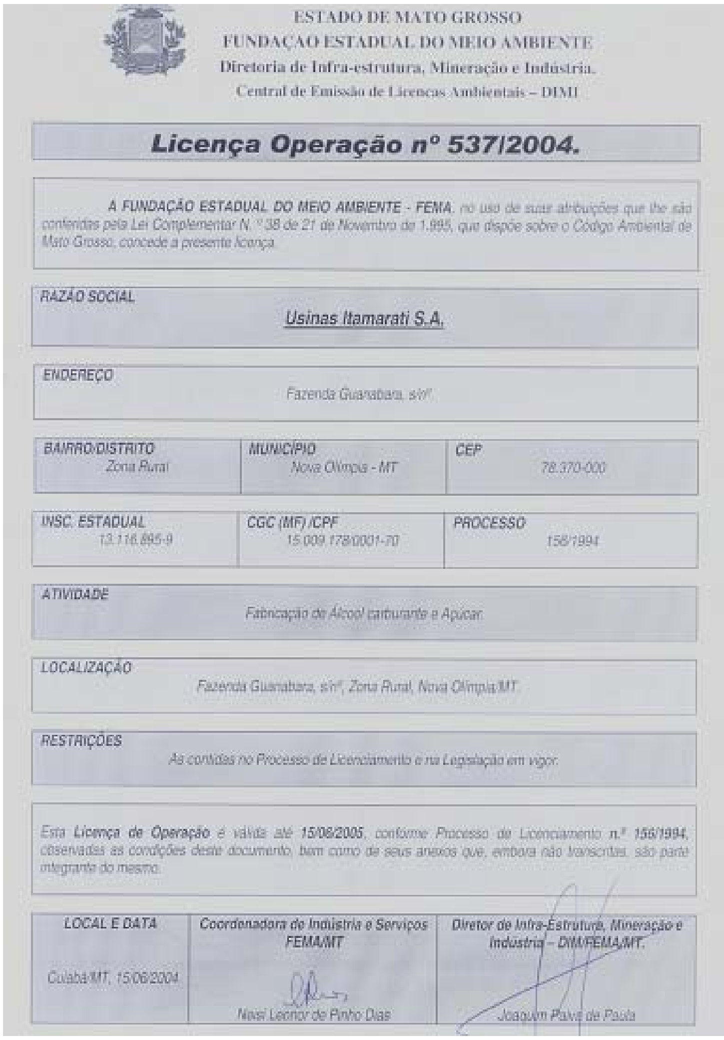
Table 16 – Power plants database for the Brazilian South-Southeast-Midwest interconnected grid, part 2

Annex 4 – Monitoring Plan

As per the procedures set by the Approved monitoring methodology AM0015: “Monitoring methodology for emissions reductions from grid connected bagasse cogeneration projects”

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.

Annex 5 - Figures



ESTADO DE MATO GROSSO
FUNDAÇAO ESTADUAL DO MEIO AMBIENTE
Diretoria de Infra-estrutura, Mineração e Indústria.
Central de Emissão de Licencas Ambientais – DIMI

Licença Operação nº 537/2004.

A FUNDAÇÃO ESTADUAL DO MEIO AMBIENTE - FEMA, no uso de suas atribuições que lhe são conferidas pela Lei Complementar N. º 38 de 21 de Novembro de 1.995, que dispõe sobre o Código Ambiental de Mato Grosso, concede a presente licença.

RAZÃO SOCIAL
Usinas Itamarati S.A.

ENDEREÇO
Fazenda Guanabara, s/nº.

BAIRRO/DISTRITO	MUNICÍPIO	CEP
Zona Rural	Nova Olímpia - MT	78.370-000

INSC. ESTADUAL	CGC (MF) /CPF	PROCESSO
13.116.895-9	15.009.178/0001-70	156/1994

ATIVIDADE
Fabricação de Álcool carburante e Açúcar.

LOCALIZAÇÃO
Fazenda Guanabara, s/nº, Zona Rural, Nova Olímpia/MT.

RESTRIÇÕES
As contidas no Processo de Licenciamento e na Legislação em vigor.

Esta **Licença de Operação** é válida até **15/06/2005**, conforme Processo de Licenciamento **n.º 156/1994**, observadas as condições deste documento, bem como de seus anexos que, embora não transcritas, são parte integrante do mesmo.

LOCAL E DATA	Coordenadora de Indústria e Serviços FEMA/MT	Diretor de Infra-Estrutura, Mineração e Indústria – DIM/FEMA/MT.
Cuiabá/MT, 15/06/2004	Nasi Leonor de Pinho Dias	Joaquim Paiva de Paula

DOCUMENTOS ANEXOS

Parecer Técnico nº 417/COISE/DMI/2004

Autos de Inspeção Notificação nº 54.393 datados em 23/04/2004 (pag. 01 e 02)

CONDIÇÕES DE VALIDADE DESTA LICENÇA

- Esta Licença Renova a LO 0208/2003.

Joaquim Paiva de Paula

Diretor de Infra-estrutura, Mineração e Indústria.

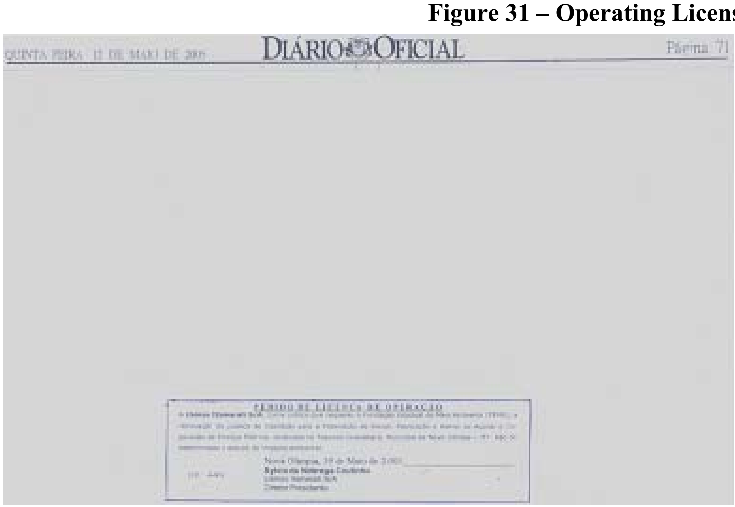
DIMI/FEMA/MT.

CONDIÇÕES GERAIS

1 - A presente Licença não dispensa e nem substitui Alvará ou Certidão de qualquer natureza exigidas pela Legislação Federal, Estadual ou Municipal.

2 - Os equipamentos de controle ambiental existente, deverão ser mantidos e operados adequadamente de modo a obter a maior eficiência, sendo tal responsabilidade única e exclusiva da empresa.

Figure 31 – Operating License



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Nova Olímpia, 19 de Maio de 2005

Figure 33 – Announcement of the issuance of operating license

Annex 6 – Tables

	Exported Energy to the grid (MWh)	tCO_2 avoided	Total tCO_2 avoided (accumulated)	
Total 2001*	14,862	4,136	4,136	1st
Total 2002	31,616	8,799	12,935	2nd
Total 2003	35,474	9,872	22,807	3rd
Total 2004	31,586	8,790	31,598	4th
Total 2005	31,800	8,850	40,448	5th
Total 2006	31,800	8,850	49,297	6th
Total 2007	31,800	8,850	58,147	7th
** Since September/2001*	**194,076**	**58,147**		

Table 17 – Usinas Itamarati Estimated Emission Reductions

Annex 7 – Bibliography

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