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

CONTENTS

SECTION A. General description of project activity

A.1 Title of the project activity:

Project title: Baguari Hydropower Plant CDM Project Activity (hereafter referred to simply as "Baguari Project").

PDD version number: 1

Date (DD/MM/YYYY): 31/10/2007.

A.2. Description of the project activity:

The primary objective of the Baguari Hydropower Plant CDM Project Activity is to 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 (and the Latin America and the Caribbean region's) electricity consumption.

The Latin America and the Caribbean region countries have expressed their commitment towards achieving a target of 10% renewable energy of the total energy use in the region. Through an initiative of the Ministers of the Environment in 2002 (UNEP-LAC, 2002), a preliminary meeting of the World Summit for Sustainable Development (WSSD) was held in Johannesburg in 2002. In the WSSD final Plan of Implementation no specific targets or timeframes were stated, however, their importance was recognized for achieving sustainability in accordance with the Millennium Development Goals[1].

The privatization process initiated in 1995 arrived with an expectation of adequate tariffs and better prices for generators. It drew the attention of investors to possible alternatives not available in the centrally planned electricity market. At the end of the 1990's a strong increase in demand in contrast with an under-average increase in installed capacity caused the supply crisis/rationing from 2001/2002. One of the solutions the government provided was flexible legislation favoring smaller independent energy producers. Furthermore the possible eligibility under the Clean Development Mechanism of the Kyoto Protocol drew the attention of investors in hydropower projects.

This indigenous and cleaner source of electricity will 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

[1] WSSD Plan of Implementation, Paragraph 19 (e): "Diversify energy supply by developing advanced, cleaner, more efficient, affordable and cost-effective energy technologies, including fossil fuel technologies and renewable energy technologies, hydro included, and their transfer to developing countries on concessional terms as mutually agreed. With a sense of urgency, substantially increase the global share of renewable energy sources with the objective of increasing its contribution to total energy supply, recognizing the role of national and voluntary regional targets as well as initiatives, where they exist, and ensuring that energy policies are supportive to developing countries' efforts to eradicate poverty, and regularly evaluate available data to review progress to this end."

electricity generation by fossil fuel sources (and CO_2 emissions), which would be generating (and emitting) in the absence of the project.

Baguari Project improves the supply of electricity with clean, renewable hydroelectric power while contributing to the regional/local economic development. Hydropower run-of-river plants provide local distributed generation and provide site-specific reliability and transmission and distribution benefits including:

- Increased reliability, shorter and less extensive outages;
- Lower reserve margin requirements;
- Improved power quality;
- Reduced lines losses;
- Mitigation of transmission and distribution congestion, and;
- Increased system capacity with reduced T&D investment.

It can be said that fair income distribution is achieved from job creation and an increase in people's wages, however better income distribution in the region where the Baguari Project is located is obtained from less expenditures and more income in the local municipalities. The surplus of capital that these municipalities will have could be translated into investments in education and health which will directly benefit the local population and indirectly impact a more equitable income distribution. This money would stay in the region and be used for providing the population better services which would improve the availability of basic needs. A greater income comes from the local investment on the local economy, and a greater tax payment, which will benefit the local population.

The project activity is a run-of-river hydropower plant with a total installed capacity of 140 MW, located in Fernandes Tourinho, Sobrália, Governador Valadares e Periquito cities, state of Minas Gerais, Southeast region of Brazil. The turbines are scheduled to become operational as follow:

Power Generation Unit	Installed Capacity	Date scheduled to start the operation
1	35	30/09/2009
2	35	30/12/2009
3	35	28/02/2010
4	35	30/04/2010

The Project is owned by Consórcio UHE Baguari, which is a consortium formed by the shareholders presented below:

§ Bagari I Geração de Energia Elétrica S.A.: 51%, it is Special Purpose Company of Neoenergia;

§ CEMIG Geração e Transmissão S.A: 34%;

§ Furnas Centrais Elétricas: 15%

A.3. Project participants:

Table 1 - Party(ies) and private/public entities involved in the project activity

Name of Party involved (*) ((host) indicates a host Party)	Private and/or public entity(ies) Project participants (*) (as applicable)	Kindly indicate if the Party involved whishes to be considered as project participant (Yes/No)
Brazil (host)	Consórcio UHE Baguari (private entity)	No
	Ecoinvest Carbon Brasil Ltda. (private entity)	
(*) In accordance with the CDM modalities and procedures, at the time of making the CDM-PDD public at the stage of validation, a Party involved may or may not have provided its approval. At the time of requesting registration, the approval by the Party(ies) involved is required.		

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

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.:

State of Minas Gerais.

A.4.1.3. City/Town/Community etc:

Fernandes Tourinho, Sobrália, Governador Valadares e Periquito cities.

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

Baguari CDM Project is located between the intersection of the following geographic coordinates:

Latitude: 19° 01’ 21’’S

Longitude: 42° 07’ 27’’W

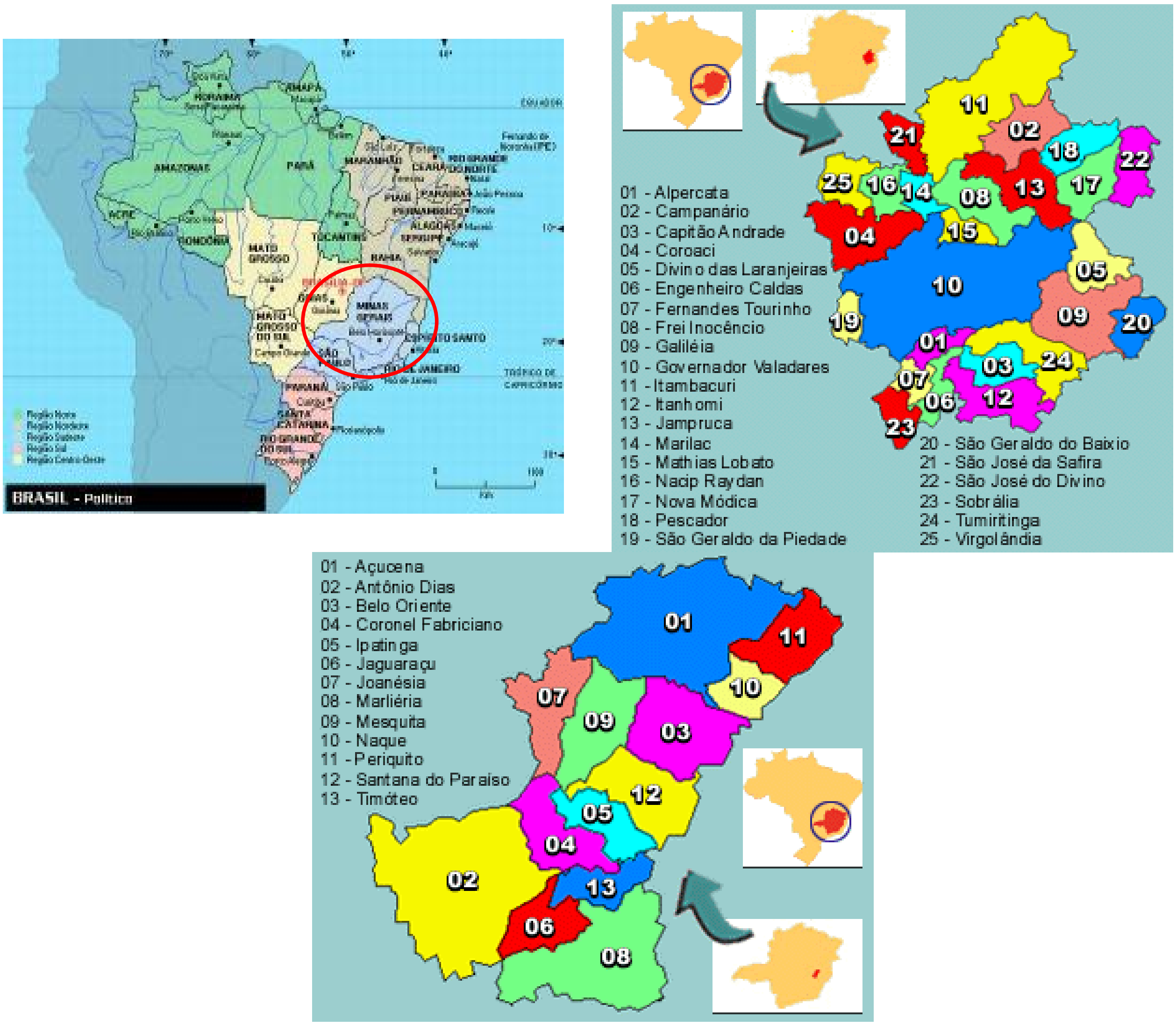

Figure 1 - Political division of Brazil showing the state of Minas Gerais (on the left) and the cities involved in the project activity (Source: City Brazil, 2006)

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

Renewable electricity generation for a grid.

Sectoral Scope: 1 – Energy industries (renewable - / non-renewable sources)

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

The facility description follows:

- 18 m waterfall for 140 MW total installed capacity (4 × 35 MW Bulb turbines). Both turbines and generators are manufactured by Voith Siemens. The turbines are scheduled to become operational accordingly to the table in section A.2. The assured energy is of 702,552 MWh/year and the capacity factor is 0.57.

- Reservoir size of 16.06 km² and power density of 8.72 W/m^2.

Baguari Hydropower Plant CDM Project Activity uses water from Doce River to generate electricity with 140 MW of total installed capacity. The facility contains dam (reservoir area 16.06 km^2), which stores water in order to generate electricity for short periods of time. Run-of-river projects do not include significant water storage, and must therefore make complete use of the water flow. A typical run-of-river scheme involves a low-level diversion dam and is usually located on swift flowing streams (Figure 2).

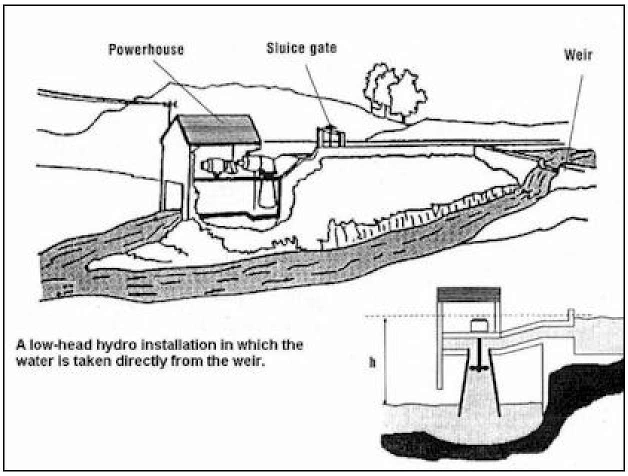

Figure 2- Schematic view of run-of-river power plant

According to Eletrobrás (1999), run-of-river projects are defined as "the projects where the river's dry season flow rate is the same or higher than the minimum required for the turbines," as it is the case of the Baguari Hydro Power Plant Project. A low-level diversion dam raises the water level in the river sufficiently to enable an intake structure to be located on the side of the river. The intake consists of a trash screen and a submerged opening with an intake gate. Water from the intake is normally taken through a pipe (called a penstock) downhill to a power station constructed downstream of the intake and at as low a level as possible to gain the maximum head on the turbine.

To determine the river's dry season flow rate, data provided to Aneel indicating monthly average river flow at the project activity location from 1931 to 2004 was used (Table 2).

Table 2 - Doce's river monthly average flow at the project location

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Average 1931 to 2004 (m^3/s)	942.8	771.9	699.3	535.9	412.6	352.3	314.2	280.8	276.8	327.9	523.8	793

The dry season in the region is from May to October. With the numbers in the above table the average dry season flow rate is *327.43 m^3/s*.

Another way to characterize run-of-river power plants comes from the definition of the World Commission of Dams (WCD, 2000):

"Run-of-river dams. *Dams that create a hydraulic head in the river to divert some portion of the river flows. They have no storage reservoir or limited daily poundage. Within these general* *classifications there is considerable diversity in scale, design, operation and potential for adverse impacts."*

- Maximum volume of the dam: 3,491,000 m^3
- Dry season average flow rate: 327.43 m^3/s
- Days of poundage at maximum volume of the dam: 1.23 days

Then, to the understanding or the project participants, the Baguari Hydropower Plant can be considered a run-of-river power plant according to all the presented criteria.

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

Considering the baseline 0.2826 tCO_2e/MWh, applicable to grid-connected renewable power generation project activities in Brazil, the full implementation of the hydropower plant connected to the Brazilian interconnected power grid will generate the estimated annual reduction as in Table 3 below.

Table 3 - Project Emission Reductions Estimation

Years	Annual estimation of emission reductions in tonnes of CO2e
2009 (Starting in October 1st)	8,526
2010	118,722
1011	135,312
2012	135,312
2013	135,312
2014	135,312
2015	135,312
2016 (Until September 30 th)	101,206
Total Estimated Emissions Reductions (tonnes of CO2e)	905,012
Total number of crediting years	7
Annual average over the crediting period of estimated reductions (tonnes of CO2e)	**129,287**

A.4.5. Public funding of the project activity:

No public funding, including official development assistance, was or will be used in Baguari Run-of-river Hydropower Plant CDM Project Activity.

SECTION B. Application of a baseline and monitoring methodology

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

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

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

The chosen methodology is applicable to grid-connected renewable power generation project activities, under the condition of electricity capacity additions from run-of-river hydro power plants, as it is the case with Baguari Project.

Beside of this, the Brazil's large territorial extension and its vast hydro potential have been determinative in the definition of the country's current electricity generation industry, which is predominantly hydro-based. The future scenario shows an increase in the consumption of fossil fuels, mainly natural gas, in accordance with the intention of the government to diversify the Brazilian's energy supply.

B.3. Description of the sources and gases included in the 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 hydropower generation source, which is represented by the respective river basin of the project close to the power plant facility, 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 regions. Thus the energy generation and, consequently, the transmission are concentrated in two subsystems. The energy expansion has concentrated in two specific areas:

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

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

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

Considering that the power density of Baguari is between 4 and 10W/m^2, there will be emissions associated with the reservoir. Indirect emissions can result from project construction, transportation of materials and fuel and other upstream activities. Nevertheless no significant net leakage from these activities was identified.

Table 4 - Emission sources and gases related to the project actvity

	Source	Gas	Included?	Justification / Explanation
Baseline	Electric Energy Use	CO2	Yes	To generate electricity as happen in thermo plants emits greenhouse gases such as: carbon dioxide "CO2"
Project Activity	Emission from reservoir	CH4	Yeas	Emission from reservoir is identified in the project activity, according to the power density calculation

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

In the absence of the project activity, large quantities of carbon dioxide (CO2) would be emitted to the atmosphere. 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. So, the baseline scenario is identified as the continuation of the current (previous) situation of electricity supplied by large hydro and thermal power stations – or by Diesel oil, in the case of isolated systems.

Since the federal government launched in the beginning of the year of 2000 the Thermoelectric Priority Plan and vast reserves of natural gas were discovered in the Santos Basin in 2003 the policy of using natural gas to generate electricity remains a possibility and it will continue to generate interest from private-sector investors in the Brazilian energy sector.

On the other hand, 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). Considering this, the baseline scenario is the continuation of the current situation of electricity supplied by large hydro and thermal power stations. For more details, please refer to section B.5.

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

The additionality of the project activity shall be demonstrated and assessed using the latest version of the “Tool for the demonstration and assessment of additionality” (version 03) agreed by the CDM Executive Board, which is available on the UNFCCC CDM web site[2].

Following are the necessary steps for the demonstration and assessment of Baguari Project additionality.

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

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

The identified realistic alternatives to the project activity are:

- Continuation of the present scenario, with the supply of electricity from the S-SE-CO Brazilian interconnected grid.
- The implementation of the project without incentives from the CDM.

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

Both the project activity and the alternatives scenarios are in compliance with all applicable regulations.

SATISFIED/PASS – Proceed to Step 3

Step 3. Barrier analysis

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

Sector Regulation Instability

Energy sector regulation impact must be considered as a barrier, once the sector was under complete reformulation in the period of 2000 to 2004, reflecting in the future years. To substantiate this, 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 government, it 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:

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[2] UNFCCC - United Nations Framework Convention on Climate Change (www.unfccc.int)

- 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 by 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), to 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.

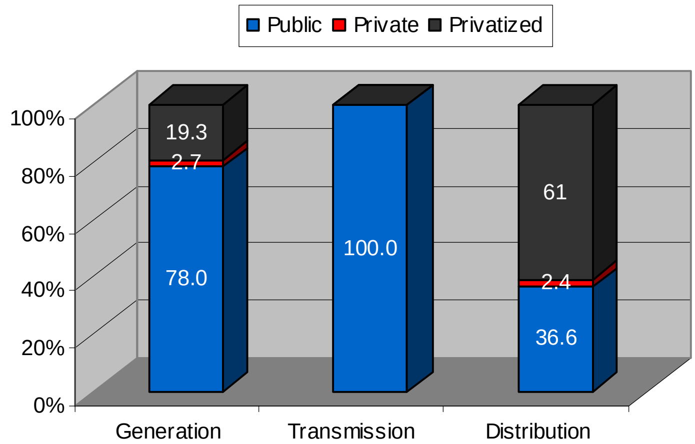

Figure 3 - Participation of private capital in the Brazilian electricity market in December 2000 (Source: BNDES, 2000).

At the end of 2000, five years after the beginning of the privatization process, the results were still modest (Figure 3). Despite high expectations, investments in new generation did not follow the increase in consumption.

The decoupling of GDP (average of 2% increase in the period of 1980 to 2000) from electricity consumption (average of 5% increase in the same period) is well known in developing countries, mainly due to the expansion of supply services to new areas and the growing infrastructure. The necessary measures to prevent bottlenecks in services were taken. These include an increase of generation capacity higher than GDP growth rates 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 4.

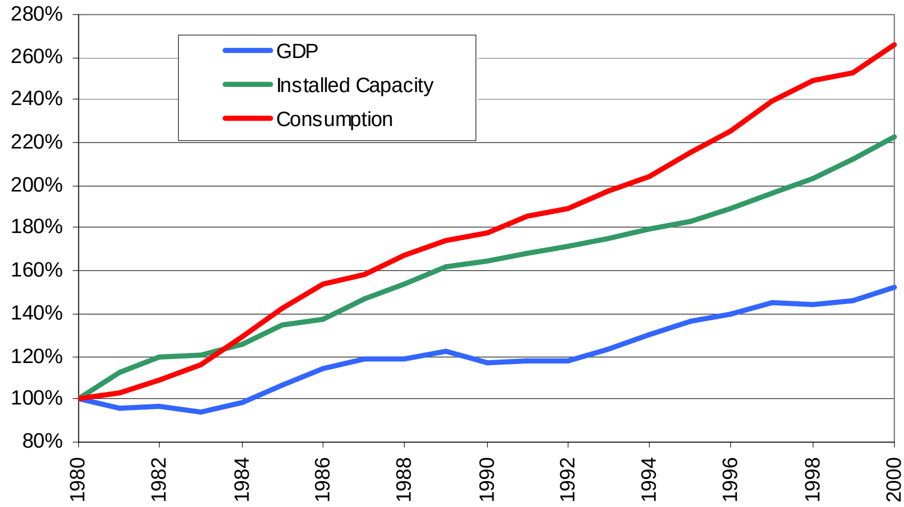

Figure 4 - Cumulated variation of GDP, electricity supply (installed capacity) and demand (consumption) (Source: Eletrobrás, http://www.eletrobras.gov.br; IBGE, http://www.ibge.gov.br/).

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 program achieved considerable results, it was not able to alone balance the increase of demand.

The remaining alternative, to increase the capacity factor of the older plants, was the most widely used, as can be seen in Figure 4. 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.

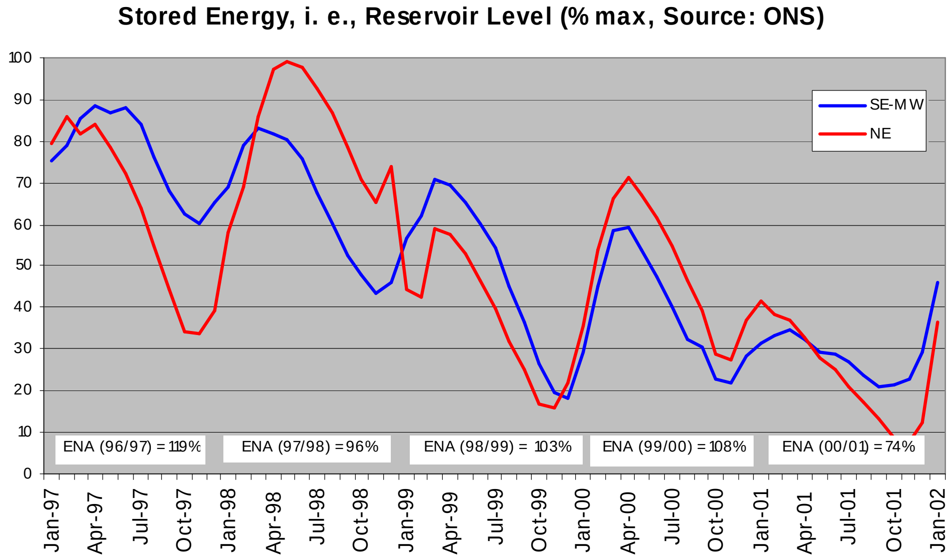

Figure 5 - Evolution of the water stored capacity for the Southeast/Midwest (SE-MW) and Northeast (NE) interconnected subsystems and intensity of precipitation in the rainy season (ENA) in the southeast region compared to the historic average (Source: ONS, http://www.ons.org.br/)

Figure 5 shows what happened to the levels of "stored energy" in 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.

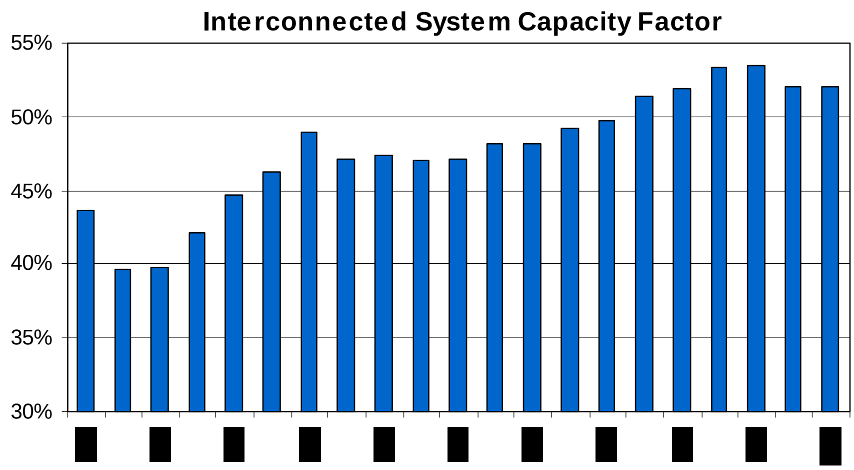

Figure 6 - Evolution of the rate of generated energy to installed capacity (Source: Eletrobrás, http://www.eletrobras.gov.br/).

Aware of the difficulties since the end of the 1990's, the Brazilian government signaled that it was strategically important for the country to increase thermoelectric generation and consequently be less dependent on hydropower. With that in mind the federal government launched at 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, totaling 17,500 MW of new installed capacity to be completed by December 2003. During 2001 and the beginning of 2002 the plan was reduced to 40 plants and 13,637 MW to be installed by December 2004 (Federal Law 10,438 of April 26th, 2002, Article 29). As of December 2004, only 20 plants totaling around 9,700 MW were operational.

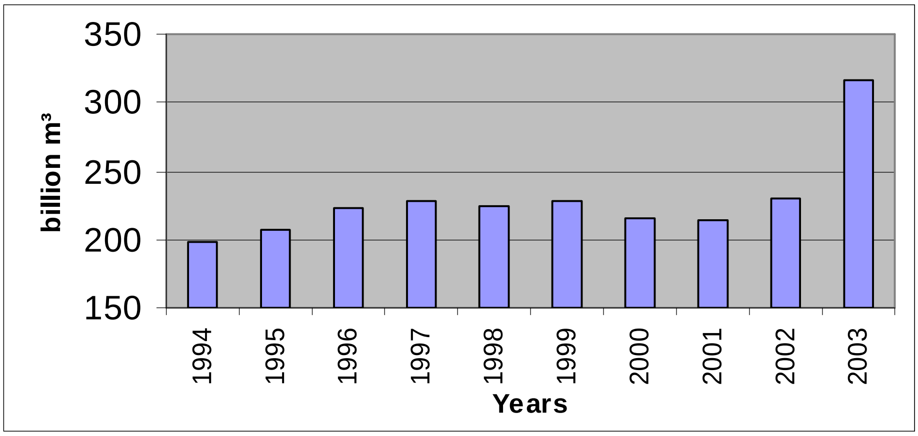

Figure 7 - Evolution of the Brazilian natural gas proved reserves (Source: Petrobras, http://www.petrobras.com.br/)

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 that hydroelectricity is and will continue to be the main source 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). In the Figure 7, it can be realized that with discoveries of vast reserves of natural gas, specially with the discovery of Santos Basin in 2003, the policy of using natural gas to generate electricity remains a possibility and will continue to have interest from private-sector investments in the Brazilian energy sector.

In power since January 2003, the newly elected government decided to fully review the electricity market institutional framework. A new model for the electricity sector was approved by Congress 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% of their projected electricity demand over the following 3 to 5 years. These projections will be submitted to a new institution called Energy Planning Company (*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. 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%. 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, Power Monitoring 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 the new model reduces market risk, its ability to encourage private investment in the electricity sector 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 role to play in long-term planning should be avoided by preventing from political interference. 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% 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.

At the time of the Baguari construction started, the lack of instability from the electric sector in the last years provided many uncertainties related to this market. CDM incentives were the key points to decision-making to implement the project activity.

Investment Barrier

The volatility of the interest rates in Brazil is strong enough to avoid many private infrastructure investments. As can be seen on the figure below, the Brazilian financial market is not stable enough to create a fully satisfactory environment for investments in infrastructure projects. The SELIC Rate has been very volatile ranging from a minimum of 15% p.a. in January 2001 to a maximum of 45% p.a. in March 1999 (Figure 9).

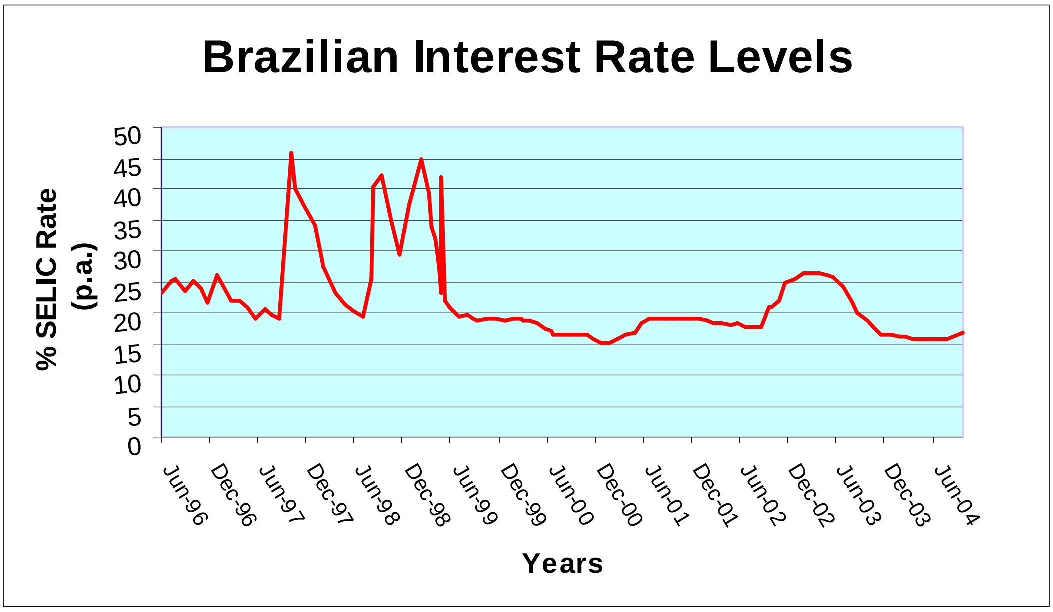

Figure 9 - SELIC rate (Source: Banco Central do Brasil, http:/www.bcb.gov.br/)

It is ungrounded to state that a project activity is economically feasible without a detailed analysis of the existing economic scenario at the time the project was set up. According to Adelman, “the only constant in development is systematic dynamic changes”. In Brazil there’s a considerable lack of funding to productive investment. The domestic credit is scarce, expensive and concentrated on short term maturities. As described in the Investment Barrier of the PDD, the majority of the private resources are not reverted to the productive sector. The pension funds, insurance companies and mutual funds invest mostly in public bonds and most firms and companies finance themselves out of retained surpluses.

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 Figure below shows the low level of the domestic credit reverted to private sector. There are several reasons for Brazil being not on a better position compared to other countries. The high level of the interest rates in Brazil avoids the savings to be invested in private and productive sector.

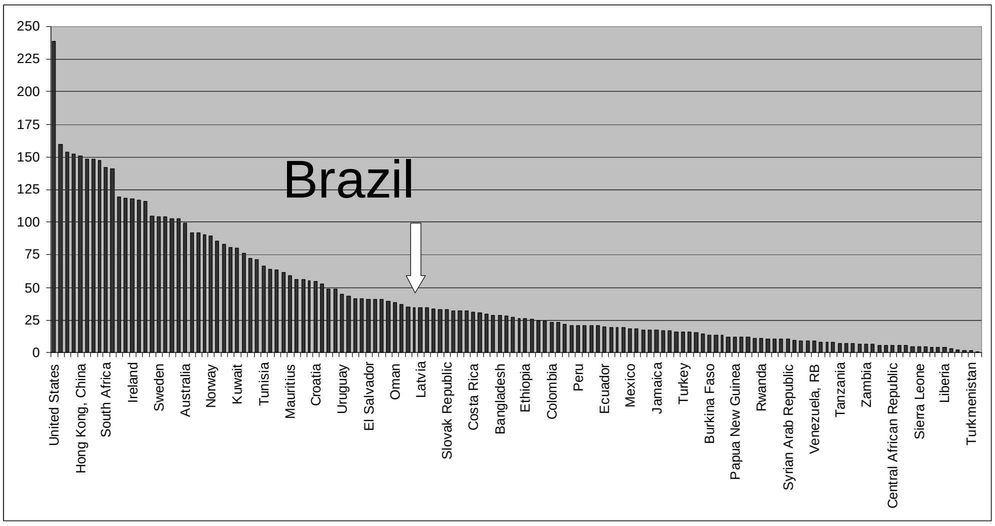

Figure 10 - Domestic credit to private sector - % of GDP, 2003 (Source: WDI 2005).

Beyond the high interest rates in Brazil, there are other issues in the financial market that contributes to make local interest rate spreads one of the highest in the world. Market volatility (described in Sector Regulation Instability and Institutional Barrier), jurisdictional uncertainty, insufficient competition among the financial institutions and high taxes are some of the issues that prevent the allocation of savings in the productive sector and rise the interest rate spreads in Brazil.

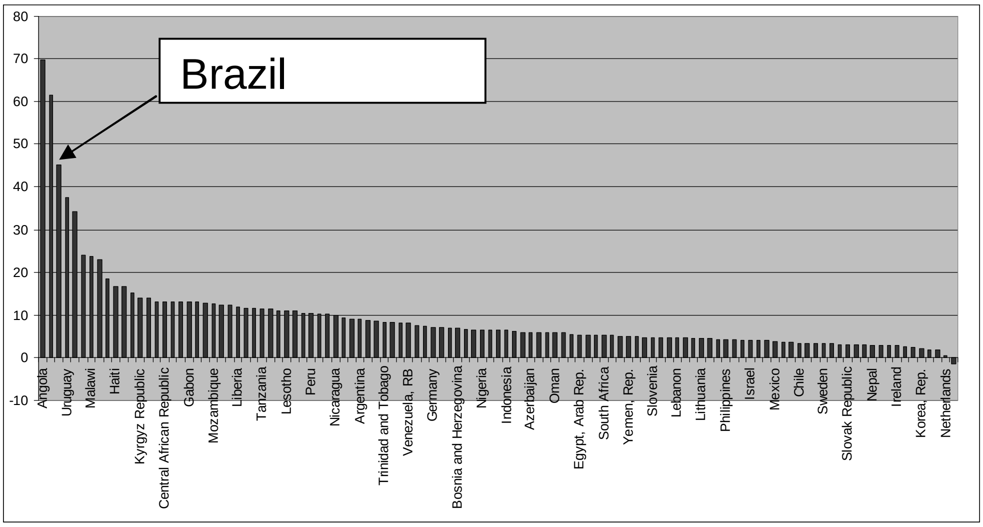

Figure 11 - Interest rate spreads - percentage points, 2003 (Source: WDI 2005).

Lack of Infrastructure

The region where the project is located is isolated and undeveloped. There is a lack of infrastructure, such as roads, reliable electricity supply, communication and transports. The project sponsor had to develop these facilities before the implementation of the project. In addition, there were no qualified personnel available in the region due to the lack of schools and universities. The carbon credits from Baguari CDM Project would contribute to a better infrastructure and a better implementation of social and environmental programs in the region thought Baguari investments.

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 BR$ 600/MWh (around USD 200/MWh) and the forecasted marginal price of the new energy reached levels of BR$ 120 – 150/MWh (around USD 40). In the middle of 2004, the average price was bellow BR$ 50/MWh (less than USD 20/MWh). This relatively high volatility of the electricity price in Brazil, although in the short term, contributes to difficult the analysis of the market by the developers (CCEE, 2007).

CERs revenues would bring the project additional benefits and would reduce the effects from electricity price instability due to the fact that they are generated in hard currencies (US Dollar or EURO), as described in investment barriers.

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. Implementing the project activity without the CDM incentive is not a feasible alternative. Possible project sponsors would certainly prefer to 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 an interesting investment alternative.

SATISFIED/PASS – Proceed to Step 4

Step 4. Common practice analysis

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

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

Both processes of negotiating a PPA with utility companies and obtaining funding from BNDES have proved to be very cumbersome. The developers perceive BNDES requiring excessive guarantees in order to provide financing. Although this might be the Bank role as a financing institution to mitigate risk, it is understood as a market barrier. Other risks and barriers are related to the operational and technical issues associated with hydropower plants, including their capability to comply with the PPA contract and the potential non-performance penalties.

Regardless of the risks and barriers mentioned above, the main reason for the reduced number of similar project activities is the financial burden. Project feasibility requires a PPA contract with a utility company, but the utilities do not have the incentives or motivation to buy electricity directly from independent power producers.

In addition, common practice in Brazil has been the construction of large-scale hydroelectric plants with large reservoirs and, more recently, of thermal fossil fuel plants, with natural gas, which also receive incentives from the government. Already 21.3% of the power generated in the country comes from thermal power plants, and this number tends to increase in the next years, since 42% of the projects approved between 1998 and 2005 are thermal power plants (compared to only 14% of SHPs)[3].

In the most recent energy auction, which took place on December 16th, 2005, in Rio de Janeiro, 20 concessions for new power plants were granted, of which only two are for SHPs (28 MW). From the total of 3,286 MW sold, 2,247 MW (68%) will come from thermal power plants, from which 1,391 come from natural gas fired thermal power plants, i.e., 42% of the total sold[4].

Regarding hydroelectric power, as a matter of comparison the average of the Brazilian hydropower plants, totalizing 70,140 MW installed capacity, is 1.92 W/m^2 of power density[5]. Hence hydroelectric power plants with small reservoirs, as it is the case of Baguari, which has a power density of 8.72 W/m^2, can not be considered as the common practice in Brazil.

In summary, Baguari Project Activity is not the business-as-usual scenario in the country where large hydro with large reservoirs and natural gas fired thermal power projects - with a greater environmental impact than the proposed project activity - represent the majority of recently installed capacity. With the financial benefit derived from the CDM, it is anticipated that other project developers would benefit from this new source of revenue and then would decide to develop such projects.

CDM has made it possible for some investors to set up their hydropower plants and sell their electricity to the grid. The registration of the proposed project activity will have a strong impact in paving the way for similar projects to be implemented in Brazil.

SATISFIED/PASS – Project is ADDITIONAL

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

According to the selected approved methodology (ACM0002, 2006), the 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. 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

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[3] ANEEL – *Agência Nacional de Energia Elétrica* (Brazilian power regulatory agency)

[4] Rosa, Luis Pinguelli. Brazilian. Newspaper “Folha de São Paulo”, December 28, 2005.

[5] Brasil. Ministério de Minas e Energia. Plano Decenal de Expansão de Energia Elétrica: 2006-2015 / Ministério de Minas e Energia; colaboração Empresa de Pesquisa Energética. – Brasília: MME: EPE, 2006.307 p.

power plants can be dispatched without significant transmission constraints.

From ACM0002 (2006), 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.

The second alternative, 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*):

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

Where:

- l_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*),

- **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**

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

- The five power plants that have been built most recently, or
- The power plants capacity additions in the electricity system that comprise 20% of the system generation (in MWh) and that have been built most recently.

Project participants should use from these two options that sample group that comprises the larger annual generation.

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

$$EF_y = w_{OM} \cdot EF_{OM,y} + w_{BM} \cdot EF_{BM,y}$$ **Equation 3**

Where the weights w_{OM} and w_{BM}, by default, are 50% (i.e., w_{OM} = w_{OM} = 0.5). Alternative weights can be used, as long as w_{OM} + w_{BM} = 1, and appropriate evidence justifying the alternative weights is presented.

According to ACM0002, version 6, May 19, 2006, new Hydro electric power projects with reservoirs, shall account for project emissions, estimated as follows:

a) if the power density of project is greater than 4W/m2 and less than or equal to 10W/m2:

$$PE_y = \frac{EF_{Res} * EG_y}{1000}$$

where,

PE_y	Emission from reservoir expressed as tCO_2e/year
ES_{Res}	is the default emission factor for emissions from reservoirs, and the default value as perEB23 is 90 Kg CO_2e /MWh.
EG_y	Electricity produced by the hydro electric power project in year y, in MWh

b) If power density of the project is greater than 10W/m^2, PE_y = 0.

Indirect emissions can result from project construction, transportation of materials and fuel and other upstream activities. Nevertheless no significant net leakage from these activities was identified.

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

This section shall include a compilation of information on the data and parameters that are not monitored throughout the crediting period but that are determined only once and thus remains fixed throughout the crediting period and that are available when validation is undertaken. The parameters chosen for the calculation of the emissions factor were ex-ante.

Data / Parameter:	**Reservoir area**
Data unit:	km^2
Description:	
Source of data used:	Surface area at full reservoir level
Value applied:	8.72[2]
Justification of the choice of data or description of measurement methods and procedures actually applied:	Data is monitored only at start of the project. The value is estimated by the national electricity agency at the concession phase and is thoroughly calculated and determined during the environmental licensing phase (very low uncertainty level).
Any comment	n/a

Data / Parameter:	**EF_y**
Data unit:	tCO_2/MWh
Description:	CO_2 emission factor of the grid
Source of data used:	ONS (Operador Nacional do Sistema Elétrico – Operator of the Brazilian Electric System)
Value applied:	0.2826 tCO2/MWh
Justification of the choice of data or description of measurement methods and procedures actually applied:	Calculated according the approved methodology – ACM0002. The baseline emission factor (EFy) is calculated as a combined margin (CM), consisting of the combination of operating margin (OM) and build margin (BM) factors. Calculations for this combined margin are based on data from an official sources (National Dispatch Center for the power generation data; EB decision regarding thermodynamic efficiency of power by fuel types information) with very low level of uncertainty and made publicly available. Data ex-post calculated and monitored yearly.
Any comment:	n/a

Data / Parameter:	**$EF_{OM,y}$**
Data unit:	tCO_2/MWh
Description:	CO_2 Operating Margin emission factor of the grid
Source of data used:	Data provided by ONS (National dispatch center). Calculated according the approved methodology – ACM0002
Value applied:	0.4749 tCO2/MWh
Justification of the choice of data or description of measurement methods and procedures actually applied:	Calculated according the approved methodology – ACM0002, using option (b) Simple Adjusted OM. Ex-ante data vintage was chosen.
Any comment:	

Data / Parameter:	$\mathbf{EF_{BM,y}}$
Data unit:	tCO_2/MWh
Description:	CO_2 Build Margin emission factor of the grid
Source of data used:	Data provided by the National Electric System Operator (ONS). Calculated according the approved methodology – ACM0002
Value applied:	0.0903 tCO_2/MWh
Justification of the choice of data or description of measurement methods and procedures actually applied:	Calculated according the approved methodology – ACM0002. Ex-ante data vintage was chosen.
Any comment:	

Data / Parameter:	l_y
Data unit:	
Description:	Fraction of time during which low-cost/must-run sources are on the margin
Source of data used:	Data provided by the National Electric System Operator (ONS). Calculated according the approved methodology – ACM0002
Value applied:	l_{2004}=0.4937, l_{2005}=0.5275, l_{2006}=0.4185
Justification of the choice of data or description of measurement methods and procedures actually applied:	Calculated according the approved methodology – ACM0002.
Any comment:	

Data / Parameter:	$F_{i,y}$
Data unit:	Mass of volume
Description:	Amount of fossil fuel consumed by each power plant
Source of data used:	Latest local statistics. Publicly available official data.
Value applied:	Large amount of data (individual data/parameter for each power plant). Data used in the calculations are presented in the spreadsheets appended to the PDD.
Justification of the choice of data or description of measurement methods and procedures actually applied:	Calculated according the approved methodology – ACM0002.
Any comment:	

Data / Parameter:	$GEN_{j/k/n,y}$
Data unit:	MWh/a
Description:	Electricity generation of each power plant
Source of data used:	Latest local statistics. Publicly available official data.
Value applied:	Large amount of data (individual data/parameter for each power plant). Data used

	in the calculations are presented in the spreadsheets appended to the PDD.
Justification of the choice of data or description of measurement methods and procedures actually applied:	Calculated according the approved methodology – ACM0002.
Any comment:	

Data / Parameter:	***$GEj_{i/k/ll,y\ IMPORTS}$***
Data unit:	MWh
Description:	Electricity imports quantity to the project electricity system
Source of data used:	Latest local statistics. Publicly available official data.
Value applied:	Large amount of data (individual data/parameter for each power plant). Data used in the calculations are presented in the spreadsheets appended to the PDD.
Justification of the choice of data or description of measurement methods and procedures actually applied:	Calculated according the approved methodology – ACM0002.
Any comment:	

Data / Parameter:	***$COEF_{i,j\ y}$***
Data unit:	tCO_2/mass or volume unit
Description:	CO_2 emission coefficient of fuels used in connected electricity systems
Source of data used:	Obtained from Intergovernmental Panel on climate Change (IPCC), International Energy Agency (IEA) and Organisation for Economic Co-operation and Development (OECD). Publicly available official data.
Value applied:	Large amount of data. Data used in the calculations are presented in the spreadsheets appended to the PDD.
Justification of the choice of data or description of measurement methods and procedures actually applied:	Calculated according the approved methodology – ACM0002.
Any comment:	

Data / Parameter:	***$COEF_i$***
Data unit:	tCO_2/mass or volume unit
Description:	CO_2 emission coefficient of each fuel type
Source of data used:	Obtained from Intergovernmental Panel on climate Change (IPCC), International Energy Agency (IEA) and Organisation for Economic Co-operation and Development (OECD). Publicly available official data. Default data and literature statistics are used to check the local data.
Value applied:	Massive amount of data, individual values for each plant of the grid, raw data

	available for validation.
Justification of the choice of data or description of measurement methods and procedures actually applied:	Calculated according the approved methodology – ACM0002.
Any comment:	

Data / Parameter:	***Plant name***
Data unit:	Text
Description:	Identification of power source/ plant for the OM
Source of data used:	Obtained from the National Electric System Operator (ONS)
Value applied:	Massive amount of data. Data used in the calculations are presented in the spreadsheets appended to the PDD.
Justification of the choice of data or description of measurement methods and procedures actually applied:	According National Electric System Operator (ONS).
Any comment:	

Data / Parameter:	***Plant name***
Data unit:	Text
Description:	Identification of power source/ plant for the BM
Source of data used:	Obtained from the National Electric System Operator (ONS)
Value applied:	Massive amount of data. Data used in the calculations are presented in the spreadsheets appended to the PDD.
Justification of the choice of data or description of measurement methods and procedures actually applied:	According National Electric System Operator (ONS).
Any comment:	

B.6.3 Ex-ante calculation of emission reductions:

According to the selected approved methodology (ACM0002), 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, two 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. A smaller 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 plants will be integrated to the South-Southeast-Midwest interconnected electricity system.

From ACM0002, 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[6] 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 5 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.

Table 5 - Share of hydroelectricity production in the Brazilian S-SE-CO interconnected system from 2002 to 2006 (ONS, 2007)

Year	Share of hydroelectricity (%)
2002	88.9%
2003	90.7%
2004	86.9%
2005	88.2%
2006	86.1%

[6] Low operating cost and must run resources typically include hydro, geothermal, wind, low-cost biomass, nuclear and solar generation (ACM0002, 2006).

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*):

$$EF_{OM,simple-adjusted,y} = (1 - l_y)\frac{\sum_{i,j} F_{i,j,y} \cdot COEF_{i,j}}{\sum_j GEN_{j,y}} + l_y \cdot \frac{\sum F_{i,k,y} \cdot COEF_{i,k}}{\sum_k GEN_{k,y}}$$ **Equation 4**

Where:

- l_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 - *Operador Nacional do Sistema Elétrico*, in the form of daily consolidated reports (ONS-ADO, 2007). Data from 143 power plants, comprising 68.2 GW installed capacity and around 932 TWh electricity generation over the 3-year period were considered. With the numbers from ONS, Equation 5 is calculated, as described below:

$$EF_{OM,y} = \frac{\sum_{i,k} F_{i,k,y} \cdot COEF_{i,k}}{\sum_k GEN_{k,y}}$$ **Equation 5**

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 *k* 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., $COEF_{i,k}$ for these plants is zero. Hence, the low-cost/must-run part of the Equation 4 is null, so this equation turns to the following: .

$$EF_{OM,simple-adjusted,y} = (1-l_y).EF_{OM-non,y} = (1-l_y).\frac{\sum_{i,j} F_{i,j,y} \cdot COEF_{i,j}}{\sum_j GEN_{j,y}}$$ **Equation 6**

Where:

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

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

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

$$F_{i,j,y} = \frac{GEN_{i,j,y} \cdot 3{,}6 \times 10^{-6}}{h_{i,j,y} \cdot NCV_i}$$ **Equation 7**

$$COEF_{i,j} = NCV_i \cdot EF_{CO2,i} \cdot 44/12 \cdot OXID_i$$ **Equation 8**

$$Hence,\ F_{i,j,y} \cdot COEF_{i,j} = \frac{GEN_{i,j,y} \cdot EF_{CO2,i} \cdot OXID_i \cdot 44/12 \cdot 3{,}6 \times 10^{-6}}{h_{i,j,y}}$$ **Equation 9**

Where variable and parameters used are:

- $\sum_{i,j} F_{i,j,y}$ is given in [kg], $COEF_{i,j}$ in [tCO_2e/kg] and $F_{i,j,y} \cdot COEF_{i,j}$ in [tCO_2e]
- $GEN_{i,j,y}$ is the electricity generation for plant *j*, with fuel *i*, in year *y*, obtained from the ONS database, in MWh
- $EF_{CO2,i}$ is the emission factor for fuel *i*, obtained from the IPCC Guidelines for National Greenhouse Gas Inventories (2006, Volume 2), in kgC/GJ or tC/TJ.
- $OXID_i$ is the oxidization factor for fuel *i*, obtained from the IPCC Guidelines for National Greenhouse Gas Inventories (2006, Volume 2), in %.
- 44/12 is the carbon conversion factor, from tC to tCO_2.
- 3.6 x 10^{-6} is the energy conversion factor, from MWh to TJ.

- $\eta_{i,j,y}$ is the thermal efficiency of plant *j*, operating with fuel *i*, in year *y*, obtained from Bosi et al. (2002).
- NCV_i is the net calorific value of fuel *i* [TJ/kg].

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

The l_y factors are calculated as indicated in methodology ACM0002, with date obtained from the ONS database. Figure 9, Figure 10 and Figure 11 present the load duration curves and l_y calculations for years 2004, 2005 and 2006, respectively.

The results for years 2004, 2005 and 2006 are presented in Table 6.

Table 6 - 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 2004-2006 (ONS-ADO, 2007).

Year	$\frac{\sum_{i,j} F_{i,j,y} \cdot COEF_{i,j}}{\sum_j GEN_{j,y}}$ **[tCO$_2$/MWh]**	l_y **[%]**
2004	0.9886	0.4937
2005	0.9653	0.5275
2006	0.8071	0.4185

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 6, Figure 9, Figure 10 and Figure 11.

Finally, applying the obtained numbers to calculate $EF_{OM,simple\text{-}adjusted,2004\text{-}2006}$ as the weighted average *of* $EF_{OM,simple\text{-}adjusted\ 2004}$, $EF_{OM\ simple\text{-}\ adjusted,2005}$ *and* $EF_{OM,simple\text{-}adjusted,2006}$ and l_y to equation below:

- $EF_{OM,simple\text{-}adjusted,2004\text{-}2006} = 0.4749\ tCO_2e/MWh.$

- **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:

$$EF_{BM,y} = \frac{\sum_{i,m} F_{i,m,y} \cdot COEF_{i,m}}{\sum_m GEN_{m,y}} \qquad \textbf{Equation 10}$$

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

- The five power plants that have been built most recently, or
- The power plants capacity additions in the electricity system that comprise 20% of the system generation (in MWh) and that have been built most recently.

Project participants should use from these two options that sample group that comprises the larger annual generation.

Applying the data from the Brazilian national dispatch center to Equation 2:

- $EF_{BM,2006} = 0.0903\ tCO_2e/MWh.$

- **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 11**

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

$$EF_y = 0.5 \times 0.4749 + 0.5 \times 0.0903$$

- $EF_y = 0.2826\ tCO_2e/MWh.$

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)	

The emission reductions by the project activity (ER_y) during a given year *y* are the product of the baseline emissions factor (EF_y, in tCO_2e/MWh) times the electricity supplied by the project to the grid (EG_y, in MWh), as follows:

$$ER_y = EF_y \cdot EG_y$$ **Equation 12**

According to ACM0002, version 6, May 19, 2006, new Hydro electric power projects with reservoirs, shall account for project emissions, estimated as follows:

a) if the power density of project is greater than $4W/m^2$ and less than or equal to $10W/m^2$:

$$PE_y = \frac{EF_{Res} * EG_y}{1000}$$

where,

PE_y	Emission from reservoir expressed as tCO_2e/year
ES_{Res}	is the default emission factor for emissions from reservoirs, and the default value as perEB23 is 90 Kg CO_2e /MWh.
EG_y	Electricity produced by the hydro electric power project in year y, in MWh

Installed capacity: 140MW
Reservoir area: 16.06 km^2
Power density: 140MW/16.06 km^2 = 8.72 MW/ km^2 or 8.72 W/m^2.

The power density of Baguari Project is greater than $4W/m^2$ and less than or equal to $10W/m^2$, then the calculation of project emissions is necessary considering a emission factor of 90 kg CO_2e/MWh. Please refer to section B.6.4. for the results.

b) If power density of the project is greater than $10W/m^2$, $PE_y = 0$.

Not applicable.

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

Table 7 - tCO2 total estimation reduction of the project

Years	**Estimation of Project Activity Emissions** (tonnes of CO_2e)	**Estimation of Baseline emissions** (tonnes of CO_2e)	**Estimation of Leakage** (tonnes of CO_2e)	**Estimation of Overall emission Reductions** (tonnes of CO_2e)
2009 (Starting in October 1st)	3,984	12,511	0	8,526
2010	55,478	174,200	0	118,722
1011	63,230	198,541	0	135,312
2012	63,230	198,541	0	135,312
2013	63,230	198,541	0	135,312
2014	63,230	198,541	0	135,312
2015	63,230	198,541	0	135,312
2016 (Until September 30 th)	47,292	148,498	0	101,206
Total (tonnes of CO_2e)	**422,903**	**1,327,914**	**0**	**905,012**

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

B.7.1 Data and parameters monitored:

Data monitored and required for verification and issuance will be kept for two years after the end of the crediting period or the last issuance of CERs for this project activity, whichever occurs later. The parameters chosen for the calculation of the emissions factor were ex-ante (see Section B.6.2).

Data / Parameter:	Electricity generation of the Project delivered to grid (EGy)
Data unit:	MWh/year
Description:	Energy metering connected to the grid and the annual energy generation report
Source of data to be used:	Energy meter and receipt of electricity purchase
Value of data applied for the purpose of calculating expected emission reductions in section B.5	702,552 MWh/year
Description of measurement methods and procedures to be applied:	n/a
QA/QC procedures to be applied:	Energy metering QA/QC procedures are explained in Annex 4 (the equipments used have by legal requirements extremely low level of uncertainty). Measured and monitored yearly.
Any comment:	

B.7.2 Description of the monitoring plan:

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

Date of completing the final draft of this baseline section and the monitoring methodology (DD/MM/YYYY): 30/07/2007.

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Ecoinvest is the Project Advisor and also a Project Participant.

SECTION C. Duration of the project activity / crediting period

C.1 Duration of the project activity:

C.1.1. Starting date of the project activity:

(DD/MM/YYYY) 01/10/2009.

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

35y-0m

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

C.2.1. Renewable crediting period

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

(DD/MM/YYYY) 01/10/2009.

C.2.1.2. Length of the first crediting period:

7y-0m

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

Not applicable.

C.2.2.2. Length:

Not applicable.

SECTION D. Environmental impacts

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

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

In Brazil, the sponsor of any project that involves construction, installation, expansion or operation of any polluting or potentially polluting activity or any other capable to cause environmental degradation is obliged to secure a series of permits from the relevant environmental agency (federal and/or local, depending on the project).

Project sponsors have to obtain all licenses required by the Brazilian environmental regulation (Resolution CONAMA - *Conselho Nacional do Meio Ambiente* (National Environmental Council) n° 237/97):

- The preliminary license (*Licença Prévia* or LP),
- The construction license (*Licença de Instalação* or LI); and
- The operating license (*Licenca de Operação* or LO).

The environmental permit process has an administrative nature and was implemented by the National Environmental Policy, established by the Law n. 6938 dated on October 31st, 1981. Additionally, other norms and laws were issued by CONAMA and local state agencies.

In order to obtain all environmental licenses every small hydro projects shall mitigate the following impacts:

- Inundation of Indian lands and slaves historical areas – the authorization for that depends on National Congress decision;
- Inundation of environmental preservation areas, legally formed as National Parks and Conservation Units;
- Inundation of urban areas or country communities;
- Reservoirs where there will be urban expansion in the future;
- Elimination of natural patrimony;
- Expressive losses for other water uses;
- Inundation of protected historic areas; and
- Inundation of cemeteries and other sacred places.

The process starts with a previous analysis (preliminary studies) by the local environmental department. After that, if the project is considered environmentally feasible, the sponsors have to prepare the Environmental Assessment, which is basically composed by the following information:

- Reasons for project implementation;
- Project description, including information regarding the reservoir;
- Preliminary Environmental Diagnosis, mentioning main biotic, and anthropic aspects;
- Preliminary estimation of project impacts; e
- Possible mitigating measures and environmental programs.

The result of those assessments is the Preliminary License (LP), which reflects the environmental local agency positive understanding about the environmental project concepts.

In order to obtain the Construction License (LI) it is necessary to present (a) additional information about previous assessment; (b) a new simplified assessment; or (c) the Environmental Basic Project, according to the environmental agency decision informed at the LP.

The Operation License (LO) is a result of pre-operational tests during the construction phase to verify if all exigencies made by environmental local agency were completed.

The plant possesses the preliminary and the construction issued by Minas Gerais Environmental Agency (FEAM - *Fundação Estadual do Meio Ambiente do Estado de Minas Gerais*). Given that, the project does not imply in negative transboundary environmental impacts, on the contrary, the licenses would not be issued.

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

The plant possesses the preliminary and the construction issued by Minas Gerais Environmental Agency (FEAM - *Fundação Estadual do Meio Ambiente do Estado de Minas Gerais*). Given that, the project does not imply in negative transboundary environmental impacts, on the contrary, the licenses would not be issued.

All licenses for the project are available for consultation under request, as well as the environmental studies.

SECTION E. Stakeholders' comments

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

According to the federal and local state legislation, the environmental licensing process requests public hearings with the local community. Also, the same legislation requests the announcement of the issuance of the licenses (LP, LI and LO) in the local state official journal (*Diário Oficial do Estado*) and in the regional newspapers. The announcements for the project are available for consultation under request.

Besides the stakeholders comments requested for the environmental licenses, the Brazilian Designated National Authority, "*Comissão Interministerial de Mudanças Globais do Clima*", requests comments from local stakeholders, and the validation report issued by an authorized DOE according to the Resolution no. 1, issued on 11th September 2003, in order to provide the letter of approval.

The Resolution determines that copies of the invitations for comments sent by the project proponents at least to the following agents involved in and affected by project activities:

- Municipal governments and City Councils;
- State and Municipal Environmental Agencies;
- Brazilian Forum of NGOs and Social Movements for Environment and Development;
- Community associations;
- State Attorney for the Public Interest;

Invitation letters were sent to the following agents (copies of the letters and post office confirmation of receipt communication are available upon request):

No concerns were raised in the public calls regarding the project.

E.2. Summary of the comments received:

No comments were received so far.

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

No comments were received so far.

Annex 1

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Annex 2

INFORMATION REGARDING PUBLIC FUNDING

No public funding is involved in the present project.

This project is not a diverted ODA from an Annex 1 country.

Annex 3

BASELINE INFORMATION

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

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

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

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

i) The South/Southeast/Midwest Interconnected System;

ii) The North/Northeast Interconnected System; and

iii) The Isolated Systems (which represent 300 locations that are electrically isolated from the interconnected systems)"

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

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

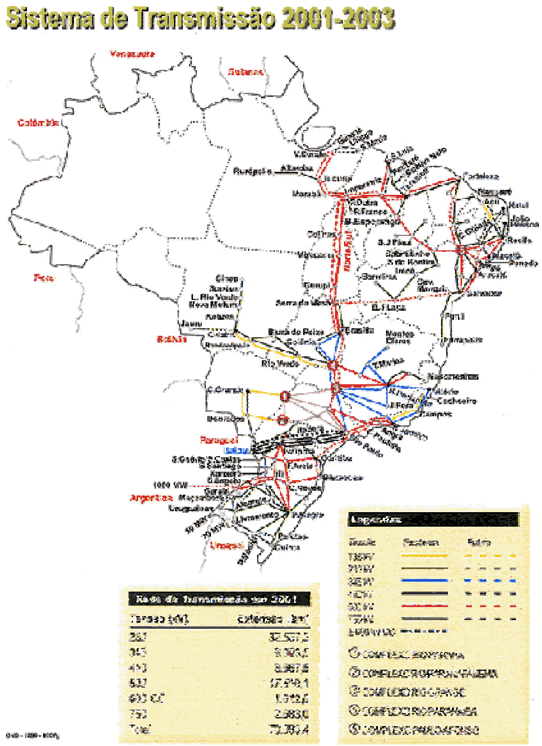

Figure 8 - Brazilian Interconnected System (Source: ONS)

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 ACM0002 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 2004, 2005 and 2006.

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).

Table 8 - Ex ante and ex-post operating and build margin emission factors

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

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

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 (2004, 2005 and 2006). The Low-cost/Must-run generation was determined as the total generation minus fossil-fuelled thermal plants generation, this one determined through daily dispatch data provided by ONS. All this information has been provided to the validators, and extensively discussed with them, in order to make all points crystal clear. The figures below show the load duration curves for the three considered years, as well as the lambda calculated.

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

Emission factors for the Brazilian South-Southeast-Midwest interconnected grid			
Baseline	EF_{OM} [tCO_2/MWh]	λ_y	Generation [MWh]
2006	0.8071	0.4185	315,192,117
2005	0.9653	0.5275	315,511,628
2004	0.9886	0.4937	301,422,617
	$EF_{OM,simple-adjusted}$ [tCO_2/MWh]	$EF_{BM,2006}$	Default EF_y [tCO_2/MWh]
	0.4749	0.0903	0.2826
	Alternative weights	Default weights	
	w_{OM} = 0.75	w_{OM} = 0.5	Alternative EF_y [tCO_2/MWh]
	w_{BM} = 0.25	w_{BM} = 0.5	0.379

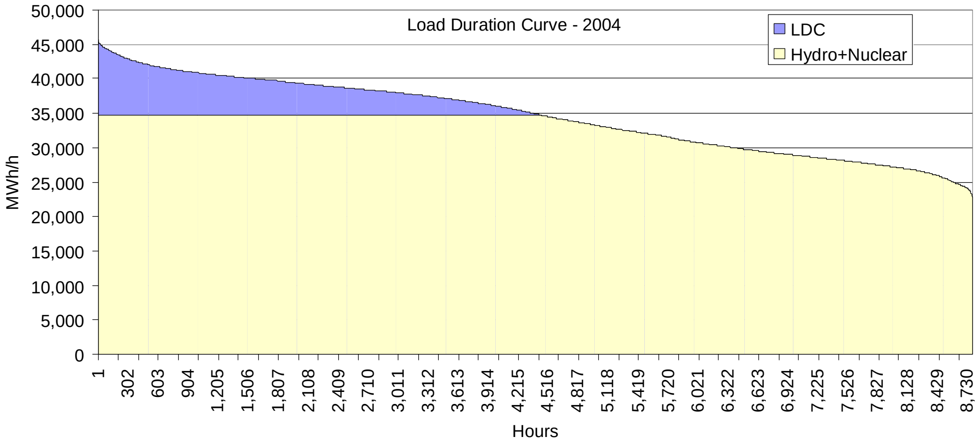

Figure 9 - Load duration curve for the S-SE-CO system, 2004

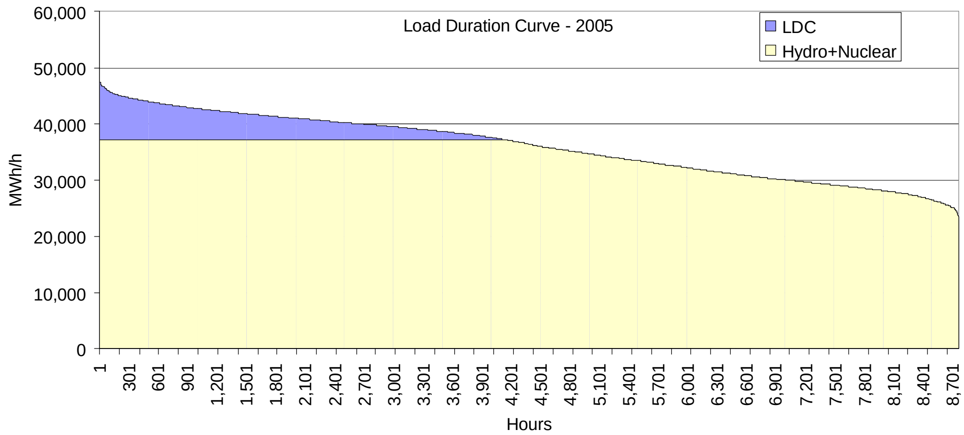

Figure 10 - Load duration curve for the S-SE-CO system, 2005

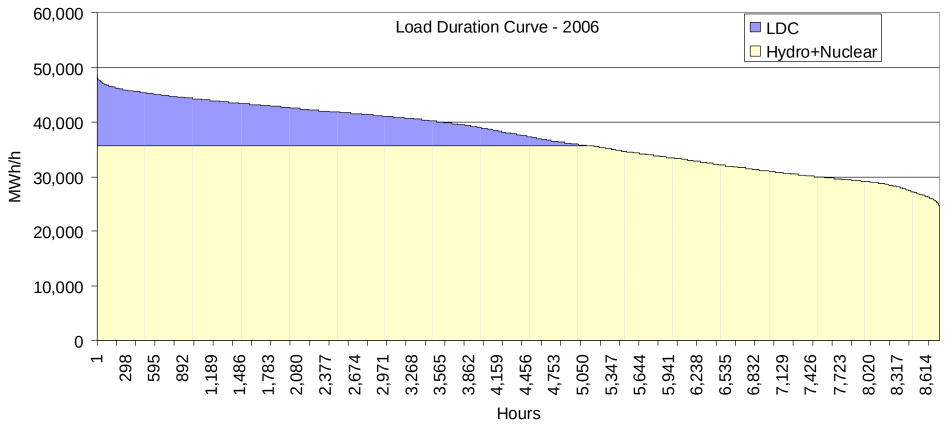

Figure 11 - Load duration curve for the S-SE-CO system, 2006

Annex 4

MONITORING INFORMATION

As of the procedures set by the "Approved consolidated monitoring methodology ACM0002" – "Consolidated monitoring methodology for zero-emissions grid-connected electricity generation from renewable sources", Version 6 (2006).

The project 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. Beyond that, information about power generation and energy supplied to the grid are controlled by the Chamber of Electric Energy Commercialization CCEE (from the Portuguese *Câmara de Comercialização de Energia Elétrica*). CCEE makes feasible and regulates the electricity energy commercialization and is responsible for monitors monthly the energy delivered to the grid.

Measurements are controlled in real time by the Hydropower Plant Digital System, so that any problems can be detected (like water shortage, materials inside the turbines, meter inaccuracy, etc). In case of any problem, plant personnel will be put in action. The Hydropower Plant is responsible for the project management, as well as for organising and training of the staff in the appropriate monitoring, measurement and reporting techniques.

Annex 5

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