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

CONTENTS

Annexes

SECTION A. General description of project activity

A.1 Title of the project activity:

Project title: PARAÍSO SMALL HYDROPOWER PLANT – PCH PARAÍSO
PDD version number: 04
Document date: 01 June 2007

A.2. Description of the project activity:

Energias do Brasil is the holding company composed of subsidiary companies that, generates, distributes and sells electricity in Brazil. In 2006 it distributed around 23,95 TWh of electricity for approximately 3 million residential, commercial and industrial costumers, with represents approximately 10 million people. Its subsidiaries for distribution are: Banderirantes Energia in São Paulo, Escelsa in Espirito Santo and Enersul in Mato Grosso do Sul. Enertrade is responsible for electric power commercialization for Energias do Brasil. For last, for generation it is represented by the following companies: Energest, CESA, Costa Rica, Pantanal Energética, EDP Lageado, and Enerpeixe.

Energias do Brasil is controlled by the EDP Group, company leader in production and distribution of electrical power in Portugal. The EDP Group presents unquestionable international sustainability standards, and since 1997 it has been closely following the evolution of the Kyoto Protocol. Its operations in Brazil, in a similar matter, have adopted high sustainability standards, as well as, the adoption of the Kyoto Protocol guidelines.

The installation of Small Hydropower Plants is the direct proof that Energias do Brasil is committed to the environment and sustainable practice. Through the generation of electricity utilizing clean renewable sources, and in compliance with all environmental regulations, Energias do Brasil is a reference on how one can expand generation capacity in a sustainable way.

In this context we would like to present the project activity PCH Paraíso. PCH Paraíso is a small Hydropower Plant of 21.6 MW installed capacity, located in the city of Costa Rica in the State of Mato Grosso do Sul. PCH Paraíso utilizes the Paraíso river Hydropower potential to generate electricity.

PCH Paraíso has the objective to generate electricity to supply the country's economic growth demands for energy, through the use of sustainable renewable sources, such Hydropower Plants generation.

This renewable source of electricity generation has an important contribution to the overall reduction of CO_2 emissions. Although most of the electricity generated in Brazil is by Hydropower Plants, the country's electricity matrix expansion is moving towards a larger participation of thermo power generation. Furthermore, the government has the intention to increase thermo power generation installed capacity by 15%.

In the absence of this project, the tendency shows that fossil fuel intensive energy generation sources would be used instead. Therefore, this project contributes to the reduction of greenhouse gas emissions.

All the social and environmental benefits requested to the project implementation were done. A run-of-river project presents low environmental impact. The expansion of the generation capacity in a sustainable way will develop a better infra-structure, increase the employment rates in the region and increase the tax income. And will be created an entity to manage the income from the sales of the CERs, which will be responsible to allocate this resources on social and environmental projects.

A.3. Project participants:

Table 01 – Party(ies) and private/public entities involved in the activity

Name of Party involved (*) ((host) indicates a host Party)	Private and/or public entity(ies) project participants (*) (as applicable)	Kindly indicate if the Party involved wishes to be considered as project participant (Yes/No)
Brazil	Energias do Brasil 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 not have provided its approval. At the time of requesting registration, the approval by the Party(ies) involved is required.		

A.4. Technical description of the project activity:

In agreement with the definition of the Brazilian Electricity Regulatory Agency (ANEEL), resolution no.652, dated of December 9, 2003, small Hydropower Plant in Brazil should have installed capacity larger than 1 MW and less than 30 MW, and should have a reservoir area less than 3 km^2. According to Eletrobrás (1999), run-of-river projects are defined as: "a project were the rivers dry season flow rate is the same or higher than the minimum require for the turbines."

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. The technology employed at PCH Paraíso Project is well known established technology in the industry.

The Francis turbine is the most widely used among water turbines. This turbine is a type of hydraulic reactor turbine in which the water flow exists the turbine blades in the radial direction. Francis turbines are common in power generation and are used in applications where high glow rates are available at medium hydraulic head. Water enters the turbine through a volute casing and is directed onto the blades by wicket gates. The low momentum water then exists the turbine through a draft tube. In the model, water flow is supplied by a variable speed centrifugal pump. A load is applied to the turbine by means of a magnetic brake, and torque is measured by observing the deflection of calibrated springs. The performance is calculated by comparing the output to the energy supplied. A run-of-river project presents low environmental impact.

Table 02 – Technical Information

Small Hydropower Plant – PCH Paraíso					
Location					
River:	Paraíso	**Basin:**	Paraná	**State:**	MS
Lat:	18^0 37'S	**Long:**	52^0 55'W	**City:**	Costa Rica
Monthly Average Flow (m^3/s) - Period					

Jan	Feb	Mar	Abr	May	Jun	Jul	Ago	Sep	Oct	Nov	Dec
22,9	25,8	24,7	20,6	18,0	17,1	16,0	15,4	15,2	15,8	16,9	19,9

Reservoir			
Area		**Other information**	
No N.A. Max. Normal:	1,205 km^2	**Flow type:**	Run-of-rive
No N.A. Min. Normal:	1,127 km^2	**Time needed for reservoir formation:**	8 days
Turbines			
Type:	Francis Simple Horizontal axel	**Flow:**	14,20 m^3/s
Potency Unit. Nominal:	10,80 MW	**Maximum Head:**	85,20 m
No of generating units:	2	**Maximum Performance:**	93,37%
Rotation:	514,3 rpm		
Energy Studies			
Maximum Gross Fall:	89,07	**Potency of the Plant:**	21.6 MW
Normal Net Fall:	85,77		

A.4.1. Location of the project activity:

A.4.1.1. Host Party(ies):

Brazil

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

Mato Grosso do Sul – Brazilian Midwest region.

A.4.1.3. City/Town/Community etc:

Costa Rica.

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

PCH Paraíso is located in the river Paraíso, in the boundary of Costa Rica and Chapadão do Sul municipalities, in the state of Mato Grosso do Sul. The dam is located approximately 277 km from Campo Grande, the main city of the State of Mato Grosso do Sul. The main access to the dam's reservoir is by BR-163 and MS-349/BR-060 highway.

The approximate geographical coordinates are: latitude 19º 03' south and longitude 52º 59' west. The urban nucleus of the municipalities of Costa Rica and Chapadão do Sul, and Paraíso district, are approximately 70 km, 60 km and 2,2 km, to the dam's reservoir. According to the IBGE 2000 census, the total population that lives in the surroundings of this reservoir are 27.146 inhabitants, where 15.488 are from Costa Rica, 11.658 from Chapadão do Sul and 1.773 from Paraíso.

Localization map:

Figure 01 – Localization Map

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

The project activity fits the **sector 1** with the **sector category: Energy industries (renewable - / non-renewable sources)**.

This project category is the generation of renewable energy, where energy is dispatched to the an Interconnected National Grid – ING.

This project consists in the installation of a Small Hydropower Plant with a reservoir of approximately 1,2 km^2.

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

The Francis turbine is the most widely used among water turbines. This turbine is a type of hydraulic reactor turbine in which the water flow exists the turbine blades in the radial direction. Francis turbines are common in power generation and are used in applications where high glow rates are available at medium hydraulic head. Water enters the turbine through a volute casing and is directed onto the blades by wicket gates. The low momentum water then exists the turbine through a draft tube. In the model, water flow is supplied by a variable speed centrifugal pump. A load is applied to the turbine by means of a magnetic brake, and torque is measured by observing the deflection of calibrated springs. The performance is calculated by comparing the output to the energy supplied. A run-of-river project presents low environmental impact.

Training and maintenance of the project were done due the following classes:

- Security course about installations and services with electricity (40 hours)
- Electric protection in generating units (24 hours);
- Installation, operation and maintenance of vertical bomb (16 hours)
- Operation of hydraulic turbines and regulators of speed (32 hours)
- CIPA course (20 hours)
- Maintenance of centrifugals bombs (24 hours)
- Operation training for operators of plants and substations (24 hours)
- Management introduction for the total quality (8 hours)

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

Table 03 – Estimated amount of emission reductions

Year	Annual estimation of emission reductions in tonnes of CO2e
2007	15,155
2008	30,310
2009	30,310
2010	30,310
2011	30,310
2012	30,310
2013	30,310
2014	30,310
2015	30,310
2016	30,310
2017	15,155
Total estimated reductions (tonnes of CO_2e)	303,095
Total number of crediting years	10
Annual average over the crediting period of estimated reductions (tonnes of CO_2e)	30,310

Conversion Rate: 0.2611 tCO_2MWh

* Production Electric Power from PCH Paraíso started: unit 1 - March 2003 and unit 2 April 2003

The project participant, Energias do Brasil, does not wish to have the crediting period starting prior to the registration of their project activity.

A.4.5. Public funding of the project activity:

There is no public funding involved in this project. The project is being financed by the BNDES – National Bank for Social and Economic Development.

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:

Approval and consolidated baseline methodology ACM0002 – version 06 – 19 may 2006 "Consolidated baseline methodology for grid-connected electricity generation from renewable sources".

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

The chosen methodology is applicable to the project activity because it is a grid-connected electricity generation from a renewable source, where the renewable source is the small Hydropower generation run-of-river connected to the Interconnect National Grid – ING.

Although Brazil has a vast potential for hydropower generation, the government's intention in diversifying the supply of energy in Brazil has shifted the energy matrix towards a more fossil fuel intensive power generation, constructing fossil fuel thermo power plants.

PCH Paraíso does not require an extensive reservoir. It is limited to a lake of approximately 1.2 km^2. Potency of the Plant is 21.6 MW. This qualifies PCH Paraíso to fit in the ACM0002 methodological framework.

It is important to mention the following points:

. In the project activity, there is no fossil fuel substitution in the project site;
. The characteristics of the system in which PCH Paraíso is connected are clear and easily identified.

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

According to the version 06 of ACM0002 methodology, new hydro electric power projects with reservoirs having power densities (installed power generation capacity divided by the surface at full reservoir level) great than 4 W/m^2. If power density of project is greater than 4 W/m^2 and less than or equal 10 W/m^2, is necessary the calculation of the emissions from reservoir expressed as tCO_2e/year. If power density of the project is greater than 10 W/m^2 the emission from the reservoir is considered zero.

$PEy = 0$

Where:

PEy are the emission from reservoir expressed as tCO_2e /year.

The installed power of PCH Paraíso is 21.6 MW and the the surface at full reservoir level is 1,2 km^2. So the power density of the project activity is 18 W/m^2.

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 I three 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 Hydropower Plants on the river with total installed capacity of approximately 10.5 GW. Eighty percent of the Northern region is supplied by diesel fueled power plants;

- ✓ 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 Hydropower Plants generating electricity for this subsystem.

The actions to be implanted in the presented project will occur in the Paraíso river, in the municipal district of Costa Rica, state of Mato Grosso do Sul, Midwest region of the country. This project is based in energy displacement from a renewable energy source to the Interconnected National Grid, that has a tendency of a more fossil fuel intensive composition. The boundary of this project is limited to the South/Southeast/Midwest region of the country.

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

The electric sector in Brazil has been supplied traditionally by 88% great Hydropower Plants, 8% Thermal, 1% small Hydropower Plants and 3% Nuclear (Executive Summary of the Electric Expansion Scenario 2003/2012, CCPE, Ministry of Mines and Energy). Although the country still possesses a great hydropower potential unexplored, most of them are located in the Amazon region, where the environmental restrictions imposes severe limits for energy exploration [MME - I Glide Decenal 2003-12]. Furthermore, those energy sources are very distant of the main consumption centers, which are located in the southeast areas of the country.

In the end of 1990, a strong growth of the demand for energy in contrast to a small increase of installed capacity caused an energy crisis in the turn of 2001/2002 year. One of the government solutions to this problem was to give a larger flexibility to the legislation favoring small independent producers of energy. Furthermore, the possible eligibility of Clean Development Mechanism based on the Protocol of Kyoto brought incentives for the development of small central Hydropower Plants projects, such as PCH Paraíso.

PCH Paraíso, a greenhouse gases (GHG) free power generation project, will result in GHG emission reductions as the result of the displacement of the generation from fossil-fuel thermo power plants that would have otherwise delivered to the ING.

Kartha et al. (2002) stated that, "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 build) and/or 'operation margin' (i.e. affecting the operation of current and/or future power plants)."

For PCH Paraíso, the baseline emission factor is calculated as a combined margin, consisting of the operating margin and the build margin. For the purpose of determining the build margin and the operating margin emission factor, a electricity system project 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 that is connected by transmission lines to the project and in which power plants can dispatch electricity without significant transmissions constraints.

In this context, we adopted the suggested methodological model by UNFCCC - (United Nations Framework for Conventions on Climate Change), ACM0002. This methodology is applicable for renewable energy generation projects that are interconnected to a national grid, which are under the condition that the additional electric capacity is increase by a small Hydropower Plant, run-of-river, such as PCH Paraíso.

The development of the project activity PCH Paraíso is an initiative for the energy supply side for the ING. The Brazilian energy matrix tends to become more fossil fuel intensive in the near future, due to the Brazilian Government's Strategic Plan to diversify the energy supply sources in Brazil. Therefore in the case this initiate was not implemented, it would probably been replaced by a greenhouse gas emission power generation plant, such as a Thermal Electric Plant.

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):

To assess and demonstrate the addionality was used: "*Tool for the demonstration and assessment of additionality*" (Version 03).

As mentioned previously, the construction of the baseline is based on the presumptions that upon the list of opportunities encountered, the natural tendency is that the Brazilian energy matrix tends to shift towards GHG intensive energy generation sources.

The calculation of the GHG energy emission reduction benefits will be done utilizing MWh of generated energy multiplied by the emission factor of the South/Southeast/midwest subsystem (SSMW).

Energest is a company that is part of Energias do Brasil that has as its largest stockholder EDP – Energias de Portugal, a company located in Portugal.

Energias do Brasil has in its energy generation department, an environmental and sustainability group that analysis all projects through Clean Development Mechanism parameters.

In january 2003, Energias de Portugal Brasil- EDP, today Energias do Brasil, started activities in a work group related to Clean Development Mechanism – CDM with Energest, Enertrade and distributors in Brasil.

These work group among other projects defined the revindication of Certified Emission Reduction – CERs by the energy production of Small Hydropower Plan in Brasil one of there aims.

The project participant, Energias do Brasil, does not wish to have the crediting period starting prior to the registration of their project activity.

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

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

Even though the current energy supply matrix in the country is highly based on renewable energy sources, in specific hydropower plants, there is an apparent indication that the percentage of thermal electric plants will increase in the next years. This will make the energy supply system more intensive towards fossil fuel energy source utilization.

This implication is based on a series of facts:

- The necessity to expand the generation and transmission to coupe with the future demands, will promote the need in investments for the next 8 years on the order of US$ 34 billion (source: CCPE). This represents R$ 11 billion per year, only to address the planed infra-structure.

- The energy crisis of 2001 has caused great political scars that no government would ever want to face again. The government will increase investments in the energy sector, even though it is consider less priority than other sectors, such as the social arena.

- The necessity to expand the energy generation structure in the country in the short run, can be easily achieve through the implantation of thermal energy plants, due to the following:

  ✓ It takes less time to be built;

  ✓ The thermal energy technology is better known among the investors (“players”) due to their past experiences apllied in their countries of origin, and therefore preferred;

  ✓ Petrobras – Brazilian Petroleum Company will provide support to most of the investment in this sector, since their strategic plan is to expand natural gas exploration and utilization;

  ✓ In order to recuperate and regulate the Brazilian water reservoirs capacities, the plan to revitalize the electric sector indicates that it will be achieved through the acquisition of thermo power as an alternative solution.

It is also important to mention the information displayed in the Electric Energy Crisis Management Chamber “Câmara de Gestão da Crise de Energia Elétrica (CGE)”, in the document entitled: “Electric energy supply increase strategy strategic program”, published in May of 2002.

In this document there is a detailed plan about the expansion strategy program. Besides expansion in generation, the CGE has also been prioritizing and facilitating investments in transmission and transformation, as follows:

Table 04 – Electric energy supply increase strategy strategic program

Source: Electric energy supply increase strategy strategic program 2001 – 2004 "Programa Estratégico de Aumento da Oferta 2001 – 2004"

In the planned expansion program, there is a significant portion of thermo power plants that will be added to the Interconnected Nation Grid on a precaution basis. This is the aquired energy through the Brazilian Commerce of Emergency Energy "Comercializadora Brasileira de Energia Emergencial (CBEE)" that represents an addition of 2.153MW during the period of 2002/2004, viewed as a precaution.

In summary, the Brazilian generation expansion during 2001 to 2004, considered only the more consolidated projects, ending up with a total of 26.325MW (Strategic Program + Precaution Purchases), in which 11.594MW came from thermo power generation.

In other words, it is possible to assume that from 2001 up to 2004, 44% of the total electric generation expansion occurred through the use of thermal generation.

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

The project is in conformity with all existing Brazilian legislations and regulations that are applicable to the nature of its operations, as well as, to the region where it is installed.

Step 2. Investment analysis

Since the chosen alternative was the Barrier Analysis (Step 3), this step is not considered.

Step 3. Barrier analysis

The barriers considered are the following:

• Lack of investment sources to finance the private sector in the country, and high costs on available alternatives;

• Energy sector regulation impact, once the sector is still driven by regulator institution. The creation of PROINFA indicates that without this specific support, there would not have been implementations of renewable energy projects.

• If projects do not have access to the benefits and incentives of the PROINFA program, it is implied that they will be competing with other market opportunities.

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

Until the beginning of the 1990 as the energy sector was composed almost exclusively of state-owned companies. From 1995 on, due to the increase on international interest rates and the lack of investment capacity of the government, the government was forced to look for alternatives. The solution 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 fair competition environment, with the gradual elimination of the captive consumer. The option to choose an electricity service supplier began in 1998 for the largest consumers.

• 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 government 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.

At the end of 2000, five years after the beginning of the privatization process, the results were still modest (Figure 02). 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 03.

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 in demand.

The remaining alternative, to increase the capacity factor of the older plants, was the most widely used, as can be seen in Figure 04. 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 05 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 water 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.

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 Plants. 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 24^{th}, 2000, and Ministry of Mines and Energy Directive 43 February 25^{th}, 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 26^{th}, 2002, Article 29). As of December 2004, only 20 plants totaling around 9,700 MW were operational.

During the rationing of 2001 the government also launched the Emergency Energy Program with the shor-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 Hydropowerity is and will continue to be the main source for the electricity base load in Brazil. However, most if not all-water 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 form Hydropower Plants to natural gas Plants (Shaeffer et al., 2000). With discoveries of vast reserves of natural gas in the Santos Basin in 2003 (Figure 06) 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 with 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 distribution 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 form political interference. Second, rules will need to be designed for the transition form 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 unbundling of vertically-integrated companies still have to be defined. Distribution companies are currently allowed to buy up to 30% of their electricity form their own subsidiaries (self-dealing). Finally the government's policy for the natural gas sector needs to be defined within a specific sector framework.

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

In order to analyze accurately the investment environment in Brazil, the Brazilian Prime Rate, known, as SELIC rate, as well as the CDI – Inter-bank Deposit Certificate, which is the measure 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 operation. 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 funding operations from BNDES are made primarily through commercial banks. As the credit market is dominated by shorter maturities (90-days to 01-year) there are rare long-term credit lines being made available except for 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., 2004). Also, the capital market is not well developed in the country to provide stock market public funding.

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 horizon of their placements. It has made savers look for the most liquid investment and 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 a 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.

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 (Figure 07).

The project activity proposal for small Hydropower Plant is under development based on *project finance*. To finance construction, project sponsors took advantage of the financing lines of BNDES. This financial support covers in average 70% of the costs of the project with a TJLP tax rate of 9% (according to the cash flow information of the project) plus an additional 4.5-5% spread risk rate for a term of 10 years and 2 years grace period.

The project was set up with an expected financial IRR (Internal Rate of Return) of approximately 15,77% per year, without the benefit of the CER revenues. This project IRR is below to the SELIC rate, set on the year that the project was financed, which was 18,11%. It is important to observe that the investment in the project is risky compared to the Brazilian government bonds at the time.

If one hypothetically considered the CERs as a revenue input to calculate the projects' IRR, one would noticed that it would increase the IRR from 15,77% to 16,72 %. This increase would not have justified the risk that the investor undertook on undergoing this project.

Besides a greater IRR on the project, the CERs can bring other additional benefits. Since the largest stockholder of this project is a European firm (Energias de Portugal), this project allows the firm to apply its environmental and sustainable strategy abroad. This is an important driver for investors from foreign companies when investing in renewable energy in developing countries.

The generation of credits to European firms is important, but as presented in this report, it does not have a financial relevancy. Furthermore, the gain from the commercialization of the CDMs will be invested in environmental and social activities utilizing a fund that is being developed by Energias do Brasil to apply their sustainability strategic plans.

Through this analysis presented, one can notice that there are a series of barriers to projects in this field, and the CERs become an important driver to the firm in selecting their projects.

Project financial barriers analysis

The high guarantees to finance an energy project in Brazil is a barrier to the development of new projects in this sector. Insurance, financial guarantees, financial advisors, are requirements that raise the costs of these projects and a feasibility barrier to the financing of these projects.

Another financial barrier is the contract for buying and selling electrical energy. These contracts are required to obtain long-term financing from banks. The lack of adequate commercial agreements for buyers of energy influences directly in the negotiation process between banks and the project developer. Since the majority of Brazilian concessionaries does not have a satisfactory credit history, it becomes a barrier for long-term financing processes.

Due to the lack of success in the series of programs and incentives that was created in the past years, one can conclude the difficulties and existing barriers to implement small Hydropower Plant projects in Brazil. The first incentive program was called PCH-COM structured between 2000/2001. In February of 2001 the tariff was planned to be around R$ 67,00/MWh, which price was the reference to the "font for competitive energy", or the average additional costs to the energy generated regularly. But the market reference font for small Hydropower Plant energy price was around R$ 80,00/MWh.

Even though the tariff was low, the incentives were based on the guarantees of the contracts for buying and selling electrical energy and special financial sources. The program was not successful due to the special guarantees and some contract clauses. Furthermore, this program was not considered to be a project finance type, therefore the direct guarantees had to be provided from the developer besides the project itself. In April of 2002, the PROINFA law was created to bring incentives to the sector. During the first public hearing of PROINFA in the beginning of 2003, the small Hydropower Plant tariff was planned to be around R$ 125,09/MWh (based in June of 2003, and to be utilized by the IGP-M Inflation Index). But in the 30th of March of 2004, the Ministry of Mines and Energy (MME) edited a Amendment no. 45, that defined the tariff to be R$ 117,02/MWh (based in March of 2004, and to be adjusted by the IGP-M), that would then be around R$ 132,00/MW in June of 2005. In 2005, the BNDES presented its final position on their lines of incentives for financing through the PROINFA, which is different for what was considered at first to the program and considered insufficient. This means that for the last 5 years, the government had to present one new proposal (or incentive) every year, to call the attention of the developers to invest in the small Hydropower Plants sector.

Although afinancing line of BNDES had been used in the project, PCH Paraiso had not access to the best conditions, like the PROINFA's financing lines, what demonstrate a barrier.

For example the PROINFA spread risk is around 1,5% to 2,0% (source: BNDES – www.bndes.gov.br), less than 50% of the spread that PCH Paraíso had access.

In the case of the PCH Paraíso project activity the energy is being commercialized at R$ 96,74/MWh, at the same time projects using PROINFA were selling energy today at the tariff above R$ 135,00/MWh..

Even considering closed values for the projects comparing to the tariff of PROINFA, it is clear that PROINFA has other benefits a 20 year contract with Eletrobrás and specifics financing lines from BNDES.

The BNDES financing has not the same favorable conditions as PROINFA's financing. The project financed by the PROINFA program are eligible for CDM project activities. So it is possible to demonstrate the adicionality of the PCH Paraíso project activity. Other fact is that the majority of the new PCHs are implementing CDM projects activities

In conclusion the CDM incentives have an important role for overcoming the financial barriers of the PCH Paraíso project activity.

Lack of Infrastructure

The region where the project is located is isolated. There is a lack of infrastructure, such as, highways, roads, communication and transportation. The project developers had to implement these types of installations before the project started. Besides all these elements, there were no qualified professionals in this region as well.

Institutional Barriers

As described above, since 1995 the electric market polices have been in a permanent change in Brazil.

> An excessive number of laws and norms were created in an attempt to organize and to provide incentives to the energy sector. The results from this regulatory instability were in adverse from what it was originally intended. During the period of energy rationalization, the prices of electricity surpassed R$ 600,00/MWh (around US$ 200,00/MWh) and the marginal price projected to the new energy reached levels of R$ 120,00 to R$ 150,00/MWh (around US$ 45,00). In the middle of 2004, the average electricity price was lower than R$ 50,00/MWh (around US$ 20,00/MWh). This relative high electricity price volatility in Brazil, even though during a short period of time, helped to make the market harder to be analyzed by the developers.
> National Electric Energy Agency (ANEEL - Agência Nacional de Energia Elétrica - www.aneel.gov.br)

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.

Step 4. Common practice analysis:

One of the points to be considered when analyzing a Hydropower Plant project investment in the period (2001-2005) was the possibility to participate in the PROINFA Federal Government Program. Although some projects started construction independently from PROINFA, the program was considered one of the more viable financing alternatives for these projects, which would provide long-term contracts for buy and sell energy and special financial conditions. The Activity Project PCH Paraíso was eligible to participation in the Program, but addressed the market risks in its own structuring way instead.

Both processes of negotiating a contract to buy and sell energy with utility companies and obtaining funding from BNDES have proved to be very cumbersome. BNDES also requires excessive guarantees in order to provide financing. Other risks and barriers are related to the operational and technical issues associated with Hydropower Plants, including their capability to comply with the contracts to buy and sell energy 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 contract to buy and sell energy with a utility company, but the utilities do not have the incentives or motivation to buy electricity directly form independent power producers.

Due to the reason mentioned above, only 1,3% of installed capacity came from small Hydropower Plants (1,2 GW from a total of 88,7 GW). Furthermore, from the 6.934 MW built in the country, only 403 MW are small Hydropower Plants. In 2004, there were only 9 small Hydropower Plant projects, a total of only 5,22 MW, that were authorized by the regulatory agency. There are a lot of other projects that are still in development, waiting for better investment opportunities. The majority of developers that financed their projects outside the PROINFA, considered CDM as a decisive factor. To our knowledge, the majority of similar projects in development in the country participates in the PROINFA program, and the ones that do not, considers CDM in their analysis. National Electric System Operator (ONS – Operador Nacional do Sistema - www.ons.org.br)

Furthermore, the Brazilian government declared that the projects in the PROINFA will also be eligible to participate in CDM. The legislation that created the PROINFA took in consideration the possible CDM revenues into account.

The incentives are still not in placed, and the existing ones are towards the rapid installation of fossil fuel thermoelectric plants. The energy sector suffered for more than a year (2003-2004) of the lack of regulations, and even today the legislation is not clear to investors and developers. Financing and financial guarantees are both a barrier for investments in renewable energy projects in the country. The high cost of capital in Brazil is a barrier to the project to be developed.

In accordance to Brazilian legislation, small Hydropower Plants are plants with installed capacity of more than 1 MW and up to 30 MW and with a reservoir area less than 3 km². In general, they are Hydropower Plants with run-of-river Hydropower Plants with low environmental impact.

This project activity is not the business-as-usual scenario in the country where large Hydropower Plants and natural gas thermo power projects represent the majority of recently installed capacity. With the financial benefit derived from the CDM, it is anticipated that other project developers will benefit from this new source of revenue.

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.

In the particular case of the PCH Paraíso, the activity registration of this project will promote the creation of a fund for investments in sustainability projects by Energias do Brasil. This fund will finance social and environmental projects through the use of the revenue from the CERs.

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

The chosen methodology is applicable to the project activity because it is a grid-connected electricity generation from a renewable source, where the renewable source is the small Hydropower generation run-of-river connected to the Interconnect National Grid – ING.

Although Brazil has a vast potential for hydropower generation, the government's intention in diversifying the supply of energy in Brazil has shifted the energy matrix towards a more fossil fuel intensive power generation, constructing fossil fuel thermo power plants.

PCH Paraíso does not require an extensive reservoir. It is limited to a lake of approximately 1,2 km^2. This qualifies PCH Paraíso to fit in the ACM0002 methodological framework.

It is important to mention the following points:

. In the project activity, there is no fossil fuel substitution in the project site;
. The characteristics of the system in which PCH Paraíso is connected are clear and easily identified.

The baseline for the calculation of the emission factor for the integrated nation grid South/Southeast/Midwest region was developed following the parameters of ACM0002.

The information determining the baseline is as follows:

✓ The electricity system in Brazil has been historically divided into two subsystems: Norte/Northeast and South/Southeast/Midwest. This configuration is a reflection of the historical physical evolution of these systems that were naturally developed close to the great consuming centers of the country.

The evolution of both systems has shown that the integration of these systems was a natural tendency to the Brazilian electric grid. In 1998, the Brazilian government announced the first part of this connection through the interconnection between the lines of North/Northeast with the South/Southeast/Midwest lines. With investments around US$ 700 million, the connection had as its main objective to help solve the electric power problems of the country. In this new scenario the South/Southeast/Midwest was able to supply energy to the North/Northeast and vice-versa.

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

Data / Parameter:	**EG_y**
Data unit:	MWh / years
Description:	Generation of electricity of the project dispatched in the grid
Source of data used:	NSO – National System Operator
Value applied:	PCH Paraíso has an installed potency of 21.6 MW, a yield of 61.35% generating 13.25 MW per hour. In one year 116,078.7 MWh / year.
Justification of the choice of data or description of measurement methods and procedures actually applied :	A standard data for energy industries projects activist. Measurement of 15 minutes and monthly recording
Any comment:	

Data / Parameter:	**EF_Y**
Data unit:	tCO_2/MWh
Description:	Emission Factor
Source of data used:	To be calculate using ACM0002
Value applied:	0.2611
Justification of the choice of data or description of measurement methods and procedures actually applied :	Simple OM / BM
Any comment:	

Data / Parameter:	**$EFOM,_Y$**
Data unit:	tCO_2/MWh
Description:	Emission Factor
Source of data used:	To be calculate using ACM0002
Value applied:	0.4349
Justification of the choice of data or description of measurement methods and procedures actually applied :	Simple OM
Any comment:	

Data / Parameter:	**EF_{BM}**
Data unit:	tCO_2/MWh
Description:	Emission Factor
Source of data used:	To be calculate using ACM0002
Value applied:	0.0872
Justification of the choice of data or description of measurement methods and procedures actually applied :	BM
Any comment:	

Data / Parameter:	**λ_y**
Data unit:	tCO_2/MWh
Description:	Emission Factor
Source of data used:	To be calculate using ACM0002
Value applied:	0.5130

Justification of the choice of data or description of measurement methods and procedures actually applied :	Fraction of time in that the central of low cost/inflexible operate in the margin.
Any comment:	

B.6.3 Ex-ante calculation of emission reductions:

The project scenario follows the same logic, as established to the construction of the baseline scenario.

Power generation from Small Hydropower Plant does not need complementary fossil fuels, so that the calculation of Project Emissions by Year (PE_{year}) as described in the baseline methodology of ACM0002 – version 6 – 19 may 2006 – is not necessary for this project.

Therefore the formula to calculate the reduction of GHG emissions for this project is simplified; containing just the amount of electric power generated by the project (MWh) multiplied by the emission factor of the Interconnected National Grid in the sub-system SSEMW, as presented by the formula below:

$$\mathbf{BE_{electricity,\ year} = EG_{year} \times EF_{electricity,\ year}}$$

Where:
$BE_{electricity,\ year}$ = Displacement of baseline emissions
EG_{year} = Amount of electric power produced by the Small Hydropower Plant
$EF_{electricity,\ year}$ = CO_2 emission rate by ING sub-system SSENW

The calculation of emissions reductions is made by the formula:

$$\mathbf{ER_{year} = BE_{electricity,\ year} - PE_{year}}$$

Where:
ER_{year} = Reduction of emissions in a year with the project activity
PE_{year} = Project emissions in a defined year

As it was previously demonstrated PE_{year} is zero (0), it is possible to infer that emissions reduced by the project activity in a year correspond to the displacement of baseline emissions, therefore:

$$\mathbf{ER_{year} = BE_{electricity,\ year}}$$

The baseline calculations were done based on “option 2” of the approved and consolidated methodology ACM0002, i.e. *“If baseline scenario is grid power imports”*. Therefore, the emission factor for the grid is calculated according to approved and consolidated methodology ACM0002.

Baseline methodology determines CO_2 emission factor for ING-SSEMW, which the project is connected.

The chosen method to calculate the operational margin (OM) for the baseline emission factor is option (b) *"Simple Adjusted OM"*, since option (c), *"Dispatch Data Analysis OM"*, that could also be a way to determine the factor, has barriers for collection and validation of the necessary data.
For calculating the operational margin (OM) it was required to obtain with National System Operator (NSO) information on ING daily power dispatch. This kind of information is not regularly provided by NSO, and direct contact with the entity was required for such purpose.
Information as received includes the years 2003, 2004, and 2005, and presently are the latest available at this stage.

Calculation of the emission factor of simple adjusted operational margin (OM)

References for variables as mentioned below can be found in the text of the methodology as used.
According to the methodology, it is required to determine the simple adjusted operational margin emission factor ($EF_{OM,\ simple\ \ adjusted,\ y}$). For such purpose the equation below will be used:

$$EF_{OM,simple\_adjusted,y} = (1-\lambda_y)\frac{\sum_{i,j} F_{i,j,y}.COEF_{i,j}}{\sum_j GEN_{j,y}} + \lambda_y \frac{\sum_{i,k} F_{i,k,y}.COEF_{i,k}}{\sum_k GEN_{k,y}} \text{ (tCO}_2\text{e/GWh)}$$

According to the Brazilian electrical sector regulations, it is assumed that all low operating costs (Hydropower Plants) are mandatory dispatched to the ING, where nuclear plants produce no emissions.

$$\frac{\sum_{i,k} F_{i,k,y}.COEF_{i,k}}{\sum_k GEN_{k,y}} = 0 \text{ (tCO}_2\text{e/GWh)}$$

It was submitted to the DOE all the information given in by NSO, as well as all the tables used for the calculations of the emission factor.

The Lambda Factor was calculated according to all requirements as indicated in the methodology used.

Year	Lambda
2003	0,5312
2004	0,5055
2005	0,5130

It was also necessary to consider electric power generated by ING-SSEMW each year.

Year	Electric load(MWh)
2003	274.670.644

2004	284.748.295
2005	296.690.687

Calculated the average of the three years, determining $EF_{OM,simple\_adjusted}$

$$EF_{OM,simple\_adjusted\ 2002\_2004} = 0{,}4349\ tCO_2/MWh$$

According to the methodology used, it must be calculated the building margin (BM) emission factor, to be determined by the formula as follows:

$$EF_{BM,y} = \frac{\sum_{i,m} F_{i,m,y}.COEF_{i,m}}{\sum_{m} GEN_{m,y}}$$

In this case, according to the methodology, generation of electric power is 20% of the total generated in the most recent year, i.e., 2004, as well as the 5 most recently built generating plants less 20%. By calculating it will be found:

$$EF_{BM,2005} = 0{,}0872\ tCO_2/MWh$$

Finally, ING-SSEMW baseline emission factor is calculated as the arithmetic average of operational margin (OM) and building margin (BM), therefore:

$$EF_{electricity,2003-2005} = 0{,}5 * 0{,}4349 + 0{,}5 * 0{,}0872 = 0{,}2611\ tCO_2/MWh$$

Emissions in ING-SSEMW baseline will be proportional to power generated by the project activity as presented above in this document during its lifetime, therefore it can be stated that baseline emissions ($BE_{electricity,\ y}$) are calculated by multiplying the emission rate of NIS-SSEMW baseline ($EF_{electricity,2002-2004}$) by the electric power generated by the project activity .

$$\mathbf{BE_{electricity,y} = EF_{electricity,2002-2004}\ x\ EG_y}$$

Baseline emissions will therefore be calculated according to the formula:

$$\mathbf{BE_{electricity,y} = 0.2611\ tCO_2/MWh\ x\ EG_y}\ \ (in\ tCO_2e)$$

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

According to the description of the methodology, calculation of emission reductions will be made using the equation presented above. The following table presents estimated gains of electric power generation and resulting reduction of GHG emissions. With the implementation of the initiative Energias do Brasil is estimated to reach a reduction of **303.082 tCO_2e** in ten years.

Year	Estimative of the project emissions (tCO_2e)	Estimative of the baseline scenario emissions (tCO_2e)	Leakage (tCO_2e)	Estimative of the project activity emission reduction (tCO_2e)
2007	0	15,155	0	15,155
2008	0	30,310	0	30,310
2009	0	30,310	0	30,310
2010	0	30,310	0	30,310
2011	0	30,310	0	30,310
2012	0	30,310	0	30,310
2013	0	30,310	0	30,310
2014	0	30,310	0	30,310
2015	0	30,310	0	30,310
2016	0	30,310	0	30,310
2017	0	15,155	0	15,155
Total	0	303,095	0	303,095

Conversion Rate: 0.2611 tCO_2/MWh
* Production Electric Power from PCH Paraíso started: unit 1 - March 2003 and unit 2 April 2003

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

B.7.1 Data and parameters monitored:

Data / Parameter:	**EG_y**
Data unit:	MWh/years
Description:	Generation of electricity of the project dispatched in the grid
Source of data to be used:	Measured energy connected at the grid and receipt of sales
Value of data applied for the purpose of calculating expected emission reductions in section B.5	PCH Paraíso has an installed potency of 21.6 MW, a yield of 61.35% generating 13.25 MW per hour. In one year 116,078.7 MWh / year.
Description of measurement methods and procedures to be applied:	Measurement of 15 minutes and monthly recording
QA/QC procedures to be applied:	Yes
Any comment:	

Data / Parameter:	**EF_Y**
Data unit:	tCO_2/MWh
Description:	Emission Factor of CO_2 from the ING

Source of data to be used:	To be calculate using ACM0002
Value of data applied for the purpose of calculating expected emission reductions in section B.5	0.2611
Description of measurement methods and procedures to be applied:	Simple OM / BM
QA/QC procedures to be applied:	No
Any comment:	This data is calculated, so does not need QA procedures.

Data / Parameter:	$\mathbf{EF_{OM,y}}$
Data unit:	tCO_2/MWh
Description:	Emission Factor of CO_2 from the operational margin of ING
Source of data to be used:	To be calculate using ACM0002
Value of data applied for the purpose of calculating expected emission reductions in section B.5	0.4349
Description of measurement methods and procedures to be applied:	Simple OM
QA/QC procedures to be applied:	No
Any comment:	This data is calculated, so does not need QA procedures.

Data / Parameter:	$\mathbf{EF_{BM,y}}$
Data unit:	tCO_2/MWh
Description:	Emission Factor of CO_2 from the building margin of ING
Source of data to be used:	To be calculate using ACM0002
Value of data applied for the purpose of calculating expected emission reductions in section B.5	0.0872
Description of measurement methods	Calculated as[∑ i Fi, y*COEFi] / [∑m GENm,y].

and procedures to be applied:	
QA/QC procedures to be applied:	No
Any comment:	This data is calculated, so does not need QA procedures.

Data / Parameter:	λ_y
Data unit:	tCO_2/MWh
Description:	Fraction of time in that the central of low cost/inflexible operate in the margin.
Source of data to be used:	
Value of data applied for the purpose of calculating expected emission reductions in section B.5	0.5130
Description of measurement methods and procedures to be applied:	Calculated as[∑ i Fi, y*COEFi] / [∑m GENm,y]. Above of recently built plants of energy defined in the base methodology
QA/QC procedures to be applied:	No
Any comment:	This data will be required for the calculation of baseline emissions (from grid electricity) and will be obtained through published official sources.

B.7.2 Description of the monitoring plan:

The consolidated Methodology of monitoring ACM0002 defines the procedures of monitoring of the activities of the project.

Monitoring Plan:

The data to be collected for the monitoring reports are updated by the emission factors ($EF_{OM,y}$, $EF_{BM,y}$, EF_y) monthly value of energy generated (EG_y).

The data of the emission factors will be annually updated starting from the data of ruling of plants, supplied by ONS.

The measurement of the generated energy is totally automated. All sensors relative instrument to the generation of electricity is redundant, as well as the instrument that totals the generated energy. These are connected through interface serial to a system supervisor (also redundant) installed in the room of control of each plant. The supervisor updates all the operational data in intervals of 5 seconds. The operator has access to this information through the supervisor or directly in the total instruments installed in the control panel at the same room.

All energy generated by PCH Paraíso is informed to the national regulatory authorities. The electric power market is strictly regulated and the existent norms specify the measurement equipments installed and the standard procedures to be followed.

The whole documentation is electronically stored, and the operators have direct access in case the information and documentation is needed.

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)

The date is 01 June 2007. The responsible for the project management as well as for registration, monitoring, measurement and reporting is Energias do Brasil.

The monitoring personnel is trained according to the monitoring National Electric System Operator (ONS – Operador Nacional do Sistema) procedures. All the generation data are stored in that procedures way.

The equipments of monitoring are calibrated and are frequently inspected according to the National Electric System Operator procedures.

Corporate Name: Energias do Brasil
Address: Rua Bandeira Paulista, 530
Zip code / City: 04.532-001 – São Paulo – SP
Country: Brazil
Contact person: José Lopes Alves
Position: Director
Telephone: +55 11 2185 5993
Fax: +55 11 2185 5974
E-mail: jose.lopesalves@energiasdobrasil.com.br

Corporate Name: PricewaterhouseCoopers
Address: Av. Francisco Matarazzo, 1400 - Torre Torino
Zip code / City: 05.001-903 – São Paulo – SP
Country: Brazil
Contact person: Ernesto Cavasin Neto
Position: Consultant
Telephone: +55 11 3674 2000
Fax: +55 11 3674 2000
E-mail: ernesto.cavasin@br.pwc.com

SECTION C. Duration of the project activity / crediting period

C.1 Duration of the project activity:

C.1.1. Starting date of the project activity:

The Small Hydropower started operation: unit 1 – March, 13 2003 and unit 2 – April, 12 2003

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

30year–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:

Not applicable.

C.2.1.2. Length of the first crediting period:

Not applicable.

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

The Small Hydropower started operation: unit 1 – March, 13 2007 and unit 2 – April, 12 2003
The credit period will begin after the registration that is expected to June 2007.

C.2.2.2. Length:

10 year-0m

SECTION D. Environmental impacts

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

The current environmental impacts of PCH Paraíso implantation for the electric power production were contemplated in the entitled document "EIA/RIMA" Environmental Impact Assessment Study.

PCH Paraíso received all the necessaries environmental licenses.

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 identified environmental aspects of the project are presented in the EIA/RIAMA document, which presents all mitigations procedures and measurements to an appropriate environmental impact management. It is worth to point out that the study was already approved by the competent environmental agencies and all environment impact adjustments are done or in process.

SECTION E. Stakeholders' comments

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

According to the federal and local legislation, the environmental licensing process requires public hearings with local stakeholders. The same legislation require that the announcement of the license (LP, LI and LO) to be posted in the official state or local journal and others regional journals.

For the development of the project activity in the standards established by the UNFCCC and Designated National Authorities (DNA), with high levels of transparency with the society, the Energias do Brasil established specific public hearing about the Clean Development Mechanism (CDM) project PCH Paraíso. The community had the opportunity to clarify doubts about the Kyoto Protocol, CDM and the impacts of the project.

The stakeholders from local, regional and national levels received an invitation letter. Energias do Brasil also published an informative about the meeting in the Mato Grosso do Sul majors newspapers, making possible for the people who were interest in the subject attend the public hearings.

Besides the stakeholders comments required for the PCH Paraíso environmental license, the Brazilian Designated National Authorities (DNA) demands that the stakeholders comments must be based on a translated version of the Project Design Document (PDD) and that validation report to be edited by a Designated Operational Entity (DOE), according the Resolution n.1 - 11 of September of 2003, in order to present a letter of approval.

During the public hearing the participants were encouraged to ask questions. All questions were answered and doubts clarified by Energias do Brasil.

At the end of the meeting the stakeholders comments were handwrite by a participant, and was read out loud to all the presents at the time in order to receive a consensual agreement.

All the stakeholder comments goes through the company plans, which previously predicted that all the income of the sales of CERs of this project activity will be allocated in a fund managed by an entity founded exclusively to this objective. This fund will support social-environmental projects.

In the annex (Annex 6) are the stakeholder that received the invitation letter and the list of the participants at the public hearing.

E.2. Summary of the comments received:

The Brazilian Designated National Authorities (DNA) demands that all projects must be open to comments before validation.

As described above Energias do Brasil made the specific public hearing about the project in the region was the project is located.

As mentioned above, at the end of the public hearing the stakeholders prepared a document with their comments.

The stakeholders comments are shown below:

Translation:

In the possible approval of the carbon credits, one must attended the following propositions:

- The income fund must give priority to regional social-environmental projects to water resources protection, with the objective to conserve these resources.

- In the creation of an entity to manage this income of these credits, the city where the Small Hydropower Plant is located must participated in the decision process of the allocation of this income.

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

All comments received in the context of the environmental and operational licensing process were incorporated into current projects.

The comments about the CDM Project activity presented during the public hearing, as well as all the comments that may appear during the validation process, will be undertaken in transparency manner by Energias do Brasil.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Organization:	Energias do Brasil
Street/P.O.Box:	Rua Bandeira Paulista, 530
Building:	
City:	São Paulo
State/Region:	São Paulo
Postfix/ZIP:	04.532-001
Country:	Brazil
Telephone:	+55 11 2185 5993
FAX:	+55 11 2185 5974
E-Mail:	jose.lopesalves@energiasdobrasil.com.br
URL:	http://www.energiasdobrasil.com.br
Represented by:	
Title:	Environment and Sustaintability Director
Salutation:	Mr.
Last Name:	Alves
Middle Name:	Lopes
First Name:	José
Department:	
Mobile:	
Direct FAX:	+55 11 2185 5993
Direct tel:	+55 11 2185 5974
Personal E-Mail:	jose.lopesalves@energiasdobrasil.com.br

Annex 2

INFORMATION REGARDING PUBLIC FUNDING

There is no public funding involved in this project. The project is being financed by the BNDES – National Bank for Social and Economic Development.

Annex 3

BASELINE INFORMATION

The baseline for calculating the emission rate for ING-SSEMW was developed according to the parameters of ACM0002, option 2 – Baseline scenario, being power imported from ING, where the emission factor is calculated in accordance with ACM0002 parameters.
Brazilian electric power system has been historically divided into two sub-systems: North-Northeast (N-NE) and South-Southeast-Midwest (S-SE-MW) This is mostly due to the historical evolution of the physical system, that has naturally been developed next to large consumption centers in the country.

The natural evolution of both systems increasingly demonstrates that integration is to come about. In 1998, the Brazilian Government announced the first part of an interconnection line between N-NE and S-SE-MW. With investments of about US$ 700 million, the main purpose of the connection, at least in the Government's point of view, was to help to solve electric power problems existing in the country. S-SE-MW region could supply to N-NE in case of need, and conversely.

In spite of the established connection, technical documents still consider the Brazilian system as having two subsystems (Bosi , 2000)

"…where the Brazilian Electric Power System is divided into three separate sub-systems"

(i) The Interconnected System South/Southeast/Midwest
(ii) The Interconnected System North/Northeast, and
(iii) The Insulated System (corresponding to 300 locations electrically insulated from interconnected systems)"

Bosi (2000) also provides strong arguments favoring the so-called multi-project Baselines:

"For large countries, with different boundary circumstances and different power systems based in different regions, baselines of multi-projects in the electric sector may require to be disaggregated below the country level for a believable representation of what could have happened otherwise".

Finally, it is necessary to consider that although both systems are connected today, the electric power flow between them is limited by the capacity of transmission lines. Thus, only a part of the electric power generated in each of the systems can be transmitted. It is to expect that such part can change its direction and magnitude (until the limit of transmission lines) depending on hydrological patterns, climate, and other non-controllable factors. However it is not to expect that it represents a significant amount of the power demand of each sub-system. It should also be considered that the SE-NE interconnection was completed in 2004 only.

Presently Brazilian electric power system has nearly 91.3 GW of installed capacity, from a total of 1,420 generating companies. From these, nearly 70% are Hydropower Plants, 10% natural gas fueled thermo electrical plants, 5.3% diesel and fossil fuel thermoelectric plants, 3.1% plants fueled by biomass (sugarcane residue, rice bran, wood, etc…), 2% nuclear plants, 1.4% mineral coal plants, and yet 8.1 GW of installed capacity from neighboring countries (Argentina, Uruguay, Venezuela, and Paraguay) that can transmit power to the Brazilian network.

This extra capacity is really mostly ensured by 6.3 GW of the Paraguayan part of Binacional Itaipu, a Hydropower Plant jointly operated by Brazil and Paraguay, that delivers practically all generated power to the Brazilian network

Approved methodologies AM0015 and ACM0002 require project proponents to account for "all generating sources serving the system". In that way, when applying one of these methodologies, project proponents in Brazil should search for, and research, all power plants serving the Brazilian system.

Efficiency data on fossil fuel plants were taken from IEA document. This was made after considering that there was no more detailed information on efficiency, from public, renowned, and reliable sources.

From the reference as mentioned:

The efficiency of conversion (%) of fossil fuels to thermo electrical plants fed with fossil fuel was calculated based on the installed capacity of each plant and on the power effectively produced. For most thermo electrical plants under construction, a constant value of 30% was used to estimate its fossil fuel conversion efficiency.

This value was based on data as available in the literature and on observation of real conditions of this kind of plants operating in Brazil. It was assumed that the only 02 natural gas-combined cycle plants (amounting to 648 MW) have higher efficiency rate.

Table – Emission Factors

Emission factors for the Brazilian South-Southeast-Midwest interconnected grid

Baseline (including imports)	EF_{OM} [tCO2/MWh]	Load [MWh]	LCMR [GWh]	Imports [MWh]
2003	0,9823	288.933.290	274.670.644	459.586
2004	0,9163	302.906.198	284.748.295	1.468.275
2005	0,8086	314.533.592	296.690.687	3.535.252
	Total (2003-2005) =	**906.373.081**	**559.418.939**	**1.927.861**
	$EF_{OM, simples-ajustada}$ [tCO2/MWh]	**$EF_{BM,2004}$**	**Lambda**	
	0,4349	0,0872	λ_{2002}	
	Alternative weights	**Default weights**	0,5312	
	w_{OM} = 0,75	w_{OM} = 0,5	λ_{2003}	
	w_{BM} = 0,25	w_{BM} = 0,5	0,5055	
	EF_{CM} [tCO2/MWh]	**DefaultEF_{OM} [tCO2/MWh]**	λ_{2004}	
	0,3480	0,2611	0,5130	

Annex 4

MONITORING INFORMATION

- - - - -