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:

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Salto Curuá Hydroelectric Project
PDD Version Number 02
27/02/2008

A.2. Description of the project activity:

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The Salto Curuá Hydroelectric Project (hereafter, the "Project") developed by Curuá Energia S/A (hereafter referred to as the "Project Developer") consists of the installation of a small hydroelectric plant with an installed capacity of 30MW, located in the Curuá River, in the municipality of Novo Progresso, Pará State.

The plant has the objective to provide renewable electricity to the municipalities of Novo Progresso and Castelo dos Sonhos, in Pará State. A transmission line of an estimated 204 km will be built by the project developer and will be connected to those municipalities, referenced in this PDD as Pará isolated grid system (hereafter referred to as "the Grid").

The grid is located in Pará State, in the Amazonian region. This is a very remote area, where the development of electricity supply infrastructure has been difficult. In most of the Amazonian region, the solution for the electricity supply problem, in the remote areas, has been the implementation of an isolated electricity system based on thermal power plants, fired by fossil fuels, mainly diesel oil.

The plant will bring renewable electricity to develop this remote area both socially and economically which is a notoriously difficult task. This project will increase the supply of electricity to the grid, offsetting thermal generation with a renewable source of energy generation. It is not necessary to account for project emissions from the reservoir as the power density of the proposed project will be 100 W/m². The calculation of emissions reductions can be found in section B.6.

The participants of the project recognize that this Project activity is helping Brazil to fulfil its goals of promoting sustainable development. Specifically, the project is in line with host-country specific CDM requirements due to the following reasons:

- Contributes to local environmental sustainability, since it decreases the dependence on fossil fuels, thus improving air quality.
- Contributes towards better working conditions and increases employment opportunities in the area where the project is located.
- Contributes towards better revenue distribution since it assists the regional/local economic development.
- Contributes development of technological capacity because part of the technology comes from developed countries (Germany), but the hand labour and technical maintenance will be provided inside Brazil, consolidating the technology in the country.

- Contributes to regional integration and connection with other sectors. The project facilitates the increase of small hydroelectric plants as a generating source in the region and therefore may encourage other similar companies to replicate this technology.

A.3. Project participants:

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Table 1 - Project participants

Name of party involved (*) ((host) indicates a host party)	Private and/or public entity(ies) Project participants (*) (as applicable)	Kindly indicate if the party involved wishes to be considered as project participant (Yes/No)
Brazil (host)	Curuá Energia S/A	No
United Kingdom of Great Britain and Northern Ireland	EcoSecurities Group PLC	No

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

A.4. Technical description of the project activity:

A.4.1. Location of the project activity:

A.4.1.1. Host Party(ies):

Brazil. (the “Host Country”)

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

Pará State.

A.4.1.3. City/Town/Community etc:

Altamira Municipality

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

The exact location of the project is defined using GPS coordinates 08°46'24”S; 54°57’25”W.

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

According to Annex A of the Kyoto Protocol, this project fits in UNFCCC Sectoral Category 1: Energy Industries (renewable / non-renewable sources).

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

The project consists of a plant that generates renewable electricity to supply electricity to the grid. The hydro power plant has four sets of equipment. Each set consists of one Horizontal Axle Francis type turbine and generator provided by Energ Power Ltda. In a Francis turbine, water flows through the rotor of the turbine; the flow forms a right angle to the turbine axle.

Table 2 – Turbine technical description

Turbine Type	Horizontal Axle Francis
Nominal Capacity	8.62 MW

Table 3 - Generator technical description

Nominal Power	9,37 MVA
Synchronous Speed	600 rpm
Equipment Set Efficiency	87%

By legal definition of the Brazilian Power Regulatory Agency (ANEEL – *Agência Nacional de Energia Elétrica*), resolution number 652, issued on December 9th, 2003, small hydro plants in Brazil must have installed capacity greater than 1MW but not more than 30MW. Although the nominal capacity of the plant is 34.48MW, the installed capacity of the plant is 30MW, because of the efficiency of 87%. All legal authorizations are based on 30MW of installed capacity.

A low level diversion dam raises the water level of the river sufficiently to enable an intake structure to be located on the side of the river. The diversion dam consists of water intake structures, a spillway and an adduction structure, with a total length of about 1500 m. A 138 kV transmission line from the switchyard to the Centrais Elétricas do Pará (CELPA), the system concessionaire sub-station at Novo Progresso is used to connect the plant to the grid.

The technology used in the project is environmentally safe and sound. A run-of-river hydro plant requires only a minimally sized diversion dam, which stores water to generate electricity for short periods of time; the project's reservoir area is 0.3 km^2. The project power density is 100 W/m^2, in compliance with the applicability condition of the methodology.

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

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Table 4 - Estimated Emissions Reductions from the Project

Years	**Annual estimation of emission reductions in tonnes of CO2e**
2008 (April-Dec)	37,505
2009	112,515
2010	112,515
2011	112,515
2012	112,515
2013	112,515
2014	112,515
2015	112,515
2016	112,515
2017	112,515
2018 (Jan- March)	75,010
Total estimated reductions (tonnes of CO2e)	1,125,150
Total number of Crediting years	10
Annual average over the crediting period of estimated reductions (tonnes of CO2e)	112,515

A.4.5. Public funding of the project activity:

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The project will not receive any public funding from Parties included in Annex I of the UNFCCC.

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:

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1. The methodology: ACM0002: “Consolidated baseline methodology for grid connected electricity generation from renewable sources” version 07 in effect as of 14 December 2007 (EB36);
3. The tool for demonstration and assessment of additionality: the approved methodology of “the tool for demonstration and assessment of additionality”, Version 04, in effect as of 14 December (EB36).
4. The “Tool to calculate the emission factor for an electricity system”, version 01, in effect as of EB35.

More information about the methodology can be obtained at:
http://cdm.unfccc.int/methodologies/PAmethodologies/approved.html.

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

Table 5 - Applicability criteria as set out in the methodology

Criteria	Are the criteria met?	Justification
The project activity is the installation or modification/retrofit of a power plant/unit of one of the following types: hydro power plant/unit (either with a run-of-river reservoir or an accumulation reservoir), wind power plant/unit, geothermal power plant/unit, solar power plant/unit, wave power plant/unit or tidal power plant/unit. In case of power plants: The project activity results in new reservoirs and the power density of the power plant, as per definitions given in the Project Emissions section, is greater than 4 W/m2.	Yes	As the description in section A.4.3, the Project consists of a hydro power plant with a diversion dam and thus is in accordance with this requirement. The power density of the reservoir is greater than 10 W/m².
This methodology is not applicable to: project activities that involve switching from fossil fuels to renewable energy at the site of the project activity, since in this case the baseline may be the continued use of fossil fuels at the site; Biomass fired power plants; Hydro power plants[3] that result in new reservoirs or in the increase in existing reservoirs where the power density of the power plant is lower than 4 W/m².	Yes	The project consists in a construction of a new hydroelectric plant, therefore no fuel switch is applicable. The power density is greater than 10 W/m²
The geographic and system boundaries for the relevant	Yes	The plant is connected to the Pará

electricity grid can be clearly identified and information on the characteristics of the grid is available		Isolated System. All data necessary to calculate the grid emission factor was collected with ELETROBRÁS
Applies to grid connected electricity generation from landfill gas capture to the extent that it is combined with the approved "Consolidated baseline methodology for landfill gas project activities" (ACM0001).	Not applicable	The project is a hydroelectric project, thus this condition is not applicable.
5 years of historical data (or 3 years in the case of non hydro project activities) have to be available for those project activities where modification/retrofit measures are implemented in an existing power plant2	Yes	All information required is publicly available in ELETROBRÁS website (http://www.eletrobras.gov.br)

The project activity meets all the conditions above and is therefore applicable to the methodology.

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

The project boundary includes the Pará Isolated Grid, the physical site of the plant as well as the reservoir area. For the baseline determination, only CO_2 emissions from electricity generation in fossil fuel fired power that is displaced due to the project activity were accounted for.

Although the reservoir area is included in the spatial extent of the project boundary, since the project power density is greater than 10 W/m², it is not necessary to account for project emissions.

The grid boundary is clearly defined as the spatial extent of the power plants that can be dispatched without significant transmission constraints. Specifically for this project the grid in question is the Pará Isolated System.

Table 6 - GHG included or excluded in the project boundary

	Source	**Gas**	**Included?**	Justification / Explanation
Baseline	Grid electricity production	CO_2	Included	According to ACM0002, only CO_2 emissions from electricity generation in fossil fuel fired power that is displaced due to the project activity should be accounted for.
		CH_4	Excluded	According to ACM0002
		N_2O	Excluded	According to ACM0002
Project Activity	Hydro electric electricity production	CO_2	Excluded	According to Annex 5, EB 23, hydroelectric power plants with power densities greater than 4 but less than 10 W/m^2 have to use a default emission factor of 90 gCO_2eq/kWh to calculate project emissions. Project power density is 100 W/m² hence this source of emission is not included.
		CH_4	Excluded	
		N_2O	Excluded	

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

The project consists of a new electricity generation facility that will supply electricity to the grid. As stated in the methodology, for project activities that do not modify or retrofit an existing electricity generation facility, the baseline scenario is the following:

Electricity delivered to the grid by the project would have otherwise been generated by the operation of grid-connected power plants and by the addition of new generation sources, as reflected in the combined margin (CM) calculations described in section B.6.1.

The following table provides the key information and data used to determine the baseline scenario:

Table 7 - Key information and data used to determine the baseline scenario

Variable	Unit	Data Source
Operating Margin Emissions Factor (EF_OM_y, in tCO_2/MWh)	tCO_2/MWh	ANEEL, Eletrobras S.A,
Build Margin Emissions Factor (EF_BM_y, in tCO_2/MWh)	tCO_2/MWh	ANEEL, Eletrobras S.A,
Baseline Emissions factor (EF_y)	tCO_2/MWh	ANEEL, Eletrobras S.A,

Electricity generation in the grid is from thermoelectric plants with internal combustion technology and diesel fuelled. The baseline is defined as the Pará isolated grid system which consists of 6 thermoelectric plants, with a total of 10.725 MW of installed capacity. The electricity generation in the grid is 100% thermoelectric. Therefore, thermal technology will be employed in the absence of the project activity.

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):

General Context:

According to the audit report from the Brazilian Court of Audit (2004), the Brazilian Electricity System mainly consists of an interconnected system that is divided into regions of South, Southeast, Middle-West, Northeast and part of the North - the other part of the North Region is isolated from the Brazilian Interconnected system. Pará State, a very remote area, is not connected to this system. Being interconnected is difficult as building and maintaining transmission lines in the middle of the rainforest is complex and expensive. In the rainforest, power sources must be built near the user. Therefore, in order to minimize electricity supply risks in this remote area, the solution has been the implementation of isolated electricity systems, based on thermal fossil fuel fired power plants.

In 1993, in order to promote the development of the North region through a decrease in consumer electricity cost, the Brazilian Government passed a law - 8631/93 - that obliged all energy concessionaires to divide proportionally the costs of fossil fuel (e.g. diesel or fuel oil) consumed in isolated systems in the North region. Subsequently, electricity would be supplied to consumers at a reasonable price. This obligation to divide fuel costs is called CCC -"Conta Consumo de Combustíveis", meaning Fuel Consumption Account.

Besides CCC, the government also created the CCC Subrogation in 1999 (law no. 9648/98). This policy was implemented because CCC only applied to electricity generation from thermal units fired by fossil fuels. The CCC subrogation states that renewable energy can apply for a government subsidy. Therefore, the subrogation of CCC resources facilitates the replacement of fossil fuel consumption by other alternative and renewable sources, as for example, hydro energy (Tolmasquim, 2004).

CCC Subrogation could represent an attractive incentive: according to ANEEL (National Electricity Agency), the costs associated with the implementation of new renewable energy generation unit can be subsided by 50% to 75% and the internal rate of return for these investments will increase considerably. However, there are two main obstacles involved in the CCC Subrogation that will be detailed below and need to be specifically considered for the implementation of the project activity.

In spite of the CCC laws which were created to make electricity affordable to the local population, according to "ANEEL CCC + CCC subrogation utilization guide", other legal devices should be created to help the transition from thermal to renewable energy; the Kyoto Protocol is suggested as an alternative.

However, even with the existence of the CCC subrogation subsidy, as quoted from the Brazilian Court of Audit, there is "lack of interest, from energy concessionaires, to lose the guaranteed CCC resources in order to support generation investments on the basis of alternative sources. Moreover, the North Region concessionaires present an unfavourable economic financial situation. This conjuncture brings unreliability related to capital spending in renewable sources projects to the investors of the generation area …" (Translated from Brazilian Court of Audit, 2004, paragraph 113).

Laws and regulations are different for isolated systems than for interconnected systems. The main distinguishing factor between the two types of systems is the pattern of electricity generation. Interconnected systems are characterized by the participation of private entities while for isolated systems, the government is the dominant provider. Interconnected systems functioning is controlled by three institutions: ONS, the system operator and body responsible for optimization, coordination, control and operation of the system; ANEEL, the national electricity agency, responsible for inspection and regulation of production, transmission, distribution and commercialization of electricity; and MAE, the electricity wholesale market, where electricity transactions are made based on a spot market and regulated by ANEEL. All market transactions are completed at auctions. In 1994, to replace MAE, the CCEE (Câmara *de Comércio de Energia Elétrica* – Electricity Energy Commercialization Chamber) was created; it is responsible, inter alia, for MAE's actions. The system in the Pará, where the project is located, is not interconnected, thus the generation, distribution and commercialization characteristics are different to those of the main interconnected grids and are mainly based on the state model.

In conclusion, isolated systems have a particular pattern of regulation, totally different from that of connected systems. Such isolated systems are unlikely to be connected to the main grid because the interconnection is difficult for the reasons outlined above.

The determination of project scenario additionality is done considering the general context described above and using latest version of the "Tool for the demonstration and assessment of additionality" agreed by the Executive Board, which follows the following steps:

Project participants wish to have the crediting period begin after the registration of the project activity. However, communication between the project developer and the carbon consultants started before the project starting date.

The early stages of the Project construction began in 2002. A short period of time after, the construction was halted due to lack of funds. Construction stayed on hold for a number of years and was only re-started in August 2006 following the refinancing of the project considering CDM revenues. For the assessment of additionality, it is important to note that CDM consideration represented an important part in the decision to go ahead with the project. This situation of starting construction prior to all the financing being in place is common amongst the electricity sector in Brazil, where having action started on the ground tends to make it easier to get licenses and authorizations from the Electricity Agency and to attract investors. This situation is so common that the Electricity Agency has now established a stated period for authorized entities to begin project construction; after this time period, the entities will lose the concession to explore the electricity potential.

The starting date of the project activity is defined as the date in which the construction of the project re-started. Prior to that date, project developers were in contact with carbon consultants and during that communication CDM revenues were seriously considered for the project feasibility.

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

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

All realistic and credible baseline alternatives to the project activity were identified and are listed below.

Scenario 1 Continuation of current practices, i.e. electricity will continue to be generated by the existing generation mix, predominantly fossil-fuel-fired thermal plants, operating in the grid

Scenario 2 Construction of a thermoelectric plant with internal combustion technology, diesel fuelled and with a energy output similar to the project activity and;

Scenario 3 Undertaking of the Project Activity not as a CDM project.

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

Scenario 1 – Is consistent with current laws and regulations. There is no regulation in Brazil to prevent continuation of the current practice.

Scenario 2 – Is consistent with current laws and regulations. There is no regulation in Brazil to prevent implementation of thermoelectric plants. According to law 9074, issued on 07/07/1995, thermoelectric plants can be subject of either tender or authorization, but there is no regulation preventing this kind of plants.

Scenario 3 – Is consistent with current laws and regulations. There is no regulation in Brazil to prevent implementation of hydroelectric plants. According to law 9074, issued on 07/07/1995, hydroelectric plants can be subject of tender, but there is no regulation preventing this kind of plants.

Step 2. Investment Analysis

Sub-step 2a: Determine appropriate analysis method

According to the tool for the demonstration and assessment of additionality, one of three options must be applied for this step: simple cost analysis (where no benefits other than CDM income exist for the project), investment comparison analysis (where comparable alternatives to the project exist) or benchmark analysis.

Option three was chosen (benchmark analysis).

Sub-step 2b: Option III - Apply benchmark analysis

The Net Present Value (NPV) will be used as the most appropriate financial indicator for the analysis. The NPV places a valuation, in terms of present value, on the future income associated with a project or investment alternative; it measures the present value of cash flows generated by the project. The decision to go ahead with the project will not be made unless the NPV is positive. A positive NPV generates value to the company and a negative NPV represents a loss to the company.

In order to perform a benchmark analysis using NPV, a discount rate must be chosen. The basis for the selected discount rate used in the financial analysis is the SELIC rate (Sistema Especial de Liquidação e Custodia, that is, Special System of Clearance and Custody), set by the Banco Central do Brasil (Central Bank of Brazil); this rate represents the expected return of a low risk investment fund[1]. Financial analyses resulting in a negative NPV means that the investment return is lower than the discount rate and thus lower than the return from a low risk investment. A positive NPV represents a return higher than a conservative investment. Scenarios with a negative NPV present significant financial/economical barriers. In 2005, the year when the decision to invest in the project activity was taken, the SELIC rate oscillated between 19.77% and 17.74% (Brazil Central Bank, http://www.bcb.gov.br/?english). In order to be conservative, 17% has been taken as a reference value for the financial analysis. The financial analysis compares the project activity to the benchmark, represented by the SELIC rate.

Sub-step 2c: Calculation and comparison of financial indicators

[1] Central Bank of Brazil http://www.bcb.gov.br/?SELICEN

Table 8 shows the financial analysis for the project activity without carbon finance. As demonstrated, the project NPV without carbon is negative, proving that the Project is not attractive for investors, which inhibits the project's implementation. The cash flow analysis was done for a 12 years period, the average length of loans in the electricity sector. See Annex 3 for more information about the Financial Analysis.

Table 8 - Project Financial Analysis Results

Financial Analysis	Values
Discount Rate	17.00%
NPV	-R$ 19,933,657.25

Sub-step 2d: Sensitivity analysis

A sensitivity analysis was conducted by altering the following parameters:

- Electricity revenues increase;
- Taxes reduction;
- O&M costs reduction;
- Investment reduction.

These parameters were selected as they are the most likely to fluctuate over time. Financial analyses were performed altering these parameters by 10% and assessing what the impact on the project NPV would be (see Table 9 below). Electricity revenues were altered by varying the electricity generation amount, notice that the electricity unitary price is fixed by a PPA.

Table 9 - Sensitivity analysis summary

Sensitivity Analysis	Variation	Project IRR
Electricity Generation	10%	-R$ 14,679,823
Taxes	-10%	-R$ 19,615,813
O&M Costs	-10%	-R$ 10,248,274
Investments	-10%	-R$ 15,246,870

The financial analysis shows that even if the critical parameters are varied more than expected, the NPV of the project is still negative and therefore not financially attractive for a rational investor.

Step 4. Common Practice Analysis

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

The additionality tool specifies that projects are considered similar if "they occur in the same country/region or rely on a broadly similar technology, are of a similar scale, and take place in a comparable environment with respect to regulatory framework, investment climate, access to technology, access to financing, etc." For this Project an analysis of similar activities in the isolated systems from the North Region of Brazil and an analysis of the grid which the project is connected to is considered to be the most appropriate, as investment conditions and some regulatory requirements tend to define these systems rather than regions.

Table 10 - Isolated Systems Configuration in 2006 (source: Eletrobras)

	Number of units		Installed Capacity (MW)	
	Hydro	Thermal	Hydro	Thermal
All Isolated Systems in Brazil	61	1,443	628.549	3,391.543
Pará Isolated Systems	0	173	0	158.817

Table 10 above includes information about the isolated systems in Brazil. Table 11 shows the same data in percentage form. The data was taken from the Operational Plan for 2006, a public report issued by ELETROBRÁS.

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

As shown by the information provided above, generating electricity in hydroelectric plants is not a common activity in isolated systems from the North Region of Brazil. Hydropower stations comprise an insignificant part of the installed capacity of isolated systems.

Table 11 – Thermal and Hydro units in Pará and in all isolated systems in Brazil, 2006 (source: Eletrobras)

	Number of units		Installed Capacity (MW)	
	Pará isolated systems	All	Pará isolated systems	All
Total	173	1,504	158.817	4,020.092
Hydro	0%	4.06%	0%	15.64%
Thermal	100%	95.94%	100%	84.36%

Thermal electricity installed capacity and generation inside isolated systems has historically increased since 2001 until 2006. According to the Operational Plan for 2003 (ELETROBRAS), forecasted hydro generation was 2,048 GWh, while thermal generation was 6,991 GWh. Furthermore, thermal generation was projected to increase by 9% and hydro generation to decrease by 5%. In the Operational Plan for 2005, a comparison between thermal and hydro generations in 2004 and 2005 indicates a clear predominance of thermal generation: hydro generation capacity is an average of 257MW and thermal generation capacity is an average 900MW. In the Operational Plan for 2006, installed thermal capacity remains higher than installed hydro capacity. In comparing the 2005 and 2006 reports, it can be seen that the 2005 installed thermal capacity increased by 7.76% while installed hydro capacity decreased 3.83%.

Therefore, based on this data, it is clearly demonstrated that the prevailing practice of energy generation and installed capacity in the Pará isolated systems is predominantly thermal and, consequently, the trend in the region is the construction of fossil fuel based thermal units rather than the construction of hydro units.

All steps of the Tool for the demonstration and assessment of additionality were satisfied, thus the project is additional to what would have occurred in absence of the project activity.

B.6 Emission reductions

B.6.1. Explanation of methodological choices:

Baseline Emissions:

Baseline emissions include only CO2 emissions from electricity generation in fossil fuel fired power plants that are displaced due to the project activity, calculated as follows:

$$BE_y = \left(EG_y - EG_{baseline}\right) \cdot EF_{grid,CM,y} \qquad (1)$$

Where:

BE_y	Baseline emissions in year y (tCO2/yr).
EG_y	Electricity supplied by the project activity to the grid (MWh).
$EG_{baseline}$	Baseline electricity supplied to the grid in the case of modified or retrofit facilities (MWh). For new power plants this value is taken as zero.
$EF_{grid,CM,y}$	Combined margin CO2 emission factor for grid connected power generation in year ycalculated using the latest version of the “Tool to calculate the emission factor for na electricity system”.

The Project consists of the installation of new power plant, $EG_{baseline} = 0$, thus baseline emissions are calculated as follows:

$$BE_y = EG_y \cdot EF_{grid,CM,y} \qquad (2)$$

The Combined Margin (CM) is calculated according to the latest version of the “Tool to calculate the emission factor for an electricity system”, through the following steps:

Step 1: Identify the electric system:

The Project is located in Pará State and is supplying electricity to the Pará isolated grid system.

Step 2: Select an operating margin (OM) method:

The electricity generation in the grid has been based exclusively on diesel fueled power plants, therefore Option A, Simple OM, was selected.

Step 3: Calculate the operating margin emission factor according to the selected method:

Option C, was selected in order to calculate the operating margin. Fuel consumption per plant is not available for the grid, thus the first option, Option A, could not be selected.

$$EF_{grid,OM,y} = \frac{\sum_i FC_{i,y} \cdot NCV_{i,y} \cdot EF_{CO2,i,y}}{EG_y} \qquad (3)$$

Where:

$EF_{grid,OMsimple,y}$	Simple operating margin CO2 emission factor in year y (tCO2/MWh)
$FC_{i,y}$	Amount of fossil fuel type i consumed in the project electricity system in year y (mass or volume unit)
$NCV_{i,y}$	Net calorific value (energy content) of fossil fuel type i in year y (GJ / mass or volume unit)
$EF_{CO2,i,y}$	CO2 emission factor of fossil fuel type i in year y (tCO2/GJ)
EG_y	Net electricity generated and delivered to the grid by all power sources serving the system, not including low-cost / must-run power plants / units, in year y (MWh)
i	All fossil fuel types combusted in power sources in the project electricity system in year y
y	Three most recent years for which data is available at the time of submission of the CDM-PDD to the DOE for validation (ex ante option)

Step 4: Identify the cohort of power units to be included in the build margin

As described in the Step 5, the Option B2 and the default value for efficiency, are used to calculate the Build Margin. Therefore the BM will be the same for any options to define the sample group of plants *m*. For more information see Annex 3.

Step 5: Calculate the Build Margin emission factor:

The calculation was done as the generation-weighted average emission factor (tCO_2/MWh) of a sample of power plants *m*, applying *Option 1* of the methodology, as follows:

$$EF_{BM} = \frac{\sum_m EG_{m,y} \cdot EF_{EL,m,y}}{\sum_m EG_{m,y}} \qquad (4)$$

Where:

$EF_{grid,BM,y}$	Build margin CO2 emission factor in year y (tCO2/MWh)
$EG_{m,y}$	Net quantity of electricity generated and delivered to the grid by power unit m in year y (MWh)
$EF_{EL,m,y}$	CO2 emission factor of power unit m in year y (tCO2/MWh)
m	Power units included in the build margin
y	Most recent historical year for which power generation data is available

$EF_{EL,m,y}$ is calculated using option B2, only data on electricity generation and the fuel types used is available, the emission factor is determined based on the CO_2 emission factor of the fuel type used and the efficiency of the power unit, as follows:

$$EF_{EL,m,y} = \frac{EF_{CO2,m,i,y} \cdot 3.6}{\eta_{m,y}} \qquad (5)$$

Where:

$EF_{EL,m,y}$	CO2 emission factor of power unit m in year y (tCO2/MWh)
$EF_{CO2,m,i,y}$	Average CO2 emission factor of fuel type i used in power unit m in year y (tCO2/GJ)
$\eta_{m,y}$	Average net energy conversion efficiency of power unit m in year y (%)
y	Three most recent years for which data is available at the time of submission of the CDM-PDD to the DOE for validation (ex ante option)

Step 6: Calculate the combined margin emissions factor:

The calculation was done as the weighted average of the Operating Margin emission factor and the Build Margin emission factor:

$$EF_{grid,CM,y} = w_{OM} \cdot EF_{grid,OM,y} + w_{BM} \cdot EF_{grid,BM,y} \qquad (6)$$

Where the weights w_{OM} and w_{BM}, by default, are 50% (i.e., $w_{OM} = w_{BM} = 0.5$), and $EF_{grid,OM,y}$ and $EF_{gird,BM,y}$ are calculated as described in previous Steps above and are expressed in tCO_2/MWh.

Project Emissions: (*PE*)

The power density is calculated as follows:

$$PD = \frac{Cap_{PJ} - Cap_{BL}}{A_{PJ} - A_{BL}} \qquad (7)$$

Where:

PD	Power density of the project activity, in W/m2.
Cap_{PJ}	Installed capacity of the hydro power plant after the implementation of the project activity (W).
Cap_{BL}	Installed capacity of the hydro power plant before the implementation of the project activity (W). For new hydro power plants, this value is zero.
A_{PJ}	Area of the reservoir measured in the surface of the water, after the implementation of the project activity, when the reservoir is full (m2).

A_{BL}	Area of the reservoir measured in the surface of the water, before the implementation of the project activity, when the reservoir is full (m2). For new reservoirs, this value is zero

The Project power density is 100 W/m², thus Project emissions were estimated to be zero, in accordance to option (b) of the methodology.
Leakage Emissions: (*L*) no leakage emissions calculation is needed.

Emission Reductions: (*ER*)

$$ER_y = BE_y - PE_y \qquad (8)$$

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

Data / Parameter:	**$FC_{i,y}$**
Data unit:	Tonnes
Description:	Amount of each fossil fuel *i,* consumed by all power sources supplying the systems.
Source of data used:	See Annex 3.
Value applied:	See Annex 3.
Justification of the choice of data or description of measurement methods and procedures actually applied :	All values were provided by governmental agencies. Those agencies are responsible to control the electric system.
Any comment:	

Data / Parameter:	**$NCV_{i,y}$**
Data unit:	GJ/tonnes
Description:	Net calorific value (energy content) of fossil fuel type i in year y
Source of data used:	See Annex 3.
Value applied:	See Annex 3.
Justification of the choice of data or description of measurement methods and procedures actually applied :	See Annex 3.
Any comment:	

Data / Parameter:	**$EF_{CO2,m,i,y}$**
Data unit:	tCO_2/GJ
Description:	CO_2 emission factor of fossil fuel type i in year y

Source of data used:	See Annex 3.
Value applied:	See Annex 3.
Justification of the choice of data or description of measurement methods and procedures actually applied :	All values were provided by governmental agencies.
Any comment:	

Data / Parameter:	**EG_y**
Data unit:	MWh
Description:	Net electricity generated and delivered to the grid by all power sources serving the system, not including low-cost / must-run power plants / units, in year y
Source of data used:	See Annex 3.
Value applied:	See Annex 3.
Justification of the choice of data or description of measurement methods and procedures actually applied :	All values were provided by governmental agencies. Those agencies are responsible to control the electric system.
Any comment:	

Data / Parameter:	**$EG_{m,y}$**
Data unit:	MWh
Description:	Net electricity generated and delivered to the grid by all power sources included in the sample group *m*, in year y
Source of data used:	See Annex 3.
Value applied:	See Annex 3.
Justification of the choice of data or description of measurement methods and procedures actually applied :	All values were provided by governmental agencies. Those agencies are responsible to control the electric system.
Any comment:	

Data / Parameter:	**$EF_{grid,CM,y}$**
Data unit:	tCO2/MWh
Description:	Grid Combined Margin
Source of data used:	ELETROBRAS S.A., ANEEL and IPCC, 2006
Value applied:	0.7029
Justification of the choice of data or description of	The Combined Margin was calculated according to the "Tool to calculate the emission factor for an electricity system", all steps were detailed in the section B.6.1.

measurement methods and procedures actually applied :	
Any comment:	

Data / Parameter:	**$EF_{grid,OM,y}$**
Data unit:	tCO_2/MWh
Description:	Grid Operating Margin
Source of data used:	ELETROBRAS S.A., ANEEL and IPCC, 2006
Value applied:	0.7308
Justification of the choice of data or description of measurement methods and procedures actually applied :	OM is calculated according to option (a) Simple OM method of methodology ACM0002 and the "Tool to calculate the emission factor for an electricity system". For further information please refer to Annex 3.
Any comment:	

Data / Parameter:	w_{OM}
Data unit:	Fraction
Description:	Weighting
Source of data used:	ACM0002
Value applied:	0.5
Justification of the choice of data or description of measurement methods and procedures actually applied :	Default weight value for Operating Margin taken from the "Tool to calculate the emission factor for an electricity system"
Any comment:	

Data / Parameter:	**$EF_{grid,BM,y}$**
Data unit:	tCO_2/MWh
Description:	Grid Build Margin
Source of data used:	IPCC, 2006 and "Tool to calculate the emission factor for an electricity system"
Value applied:	0.6750
Justification of the choice of data or description of measurement methods and procedures actually applied :	BM is calculated according to methodology ACM0002 and the "Tool to calculate the emission factor for an electricity system". For further information please refer to Annex 3.
Any comment:	

Data / Parameter:	w_{BM}
Data unit:	Fraction

Description:	Weight
Source of data used:	ACM0002
Value applied:	0.5
Justification of the choice of data or description of measurement methods and procedures actually applied :	Default weighting value for Build Margin taken from the “Tool to calculate the emission factor for an electricity system”
Any comment:	

Data / Parameter:	$\mathbf{Cap_{BL}}$
Data unit:	W
Description:	Installed capacity of the hydro power plant before the implementation of the project activity (W)
Source of data used:	Methodology ACM0002
Value applied:	0.0
Justification of the choice of data or description of measurement methods and procedures actually applied :	The project consists of a new power plant. As defined in the methodology, for new hydro power plants, this value is zero.
Any comment:	

Data / Parameter:	$\mathbf{A_{BL}}$
Data unit:	m^2
Description:	Area of the reservoir measured in the surface of the water, before the implementation of the project activity, when the reservoir is full.
Source of data used:	Methodology ACM0002
Value applied:	0.0
Justification of the choice of data or description of measurement methods and procedures actually applied :	The project consists of a new power plant, with a new reservoir. As defined in the methodology, for new reservoirs, this value is zero.
Any comment:	

B.6.3 Ex-ante calculation of emission reductions:

All equations used to estimate the emission reductions were provided in section B.6.1. The grid emission factor was calculated using equations 1 - 4, according to the description provided in the methodology.

Project emissions, equation 5, baseline emissions, equation 6 and emissions reduction calculations, equation 7, were completed according to the methodology.

Detailed information of how the equations were used, and values applied are provided in Table 12.

Table 12 - The ex-ante emission reductions values and calculations

Parameter	Formula	Value	Unit
BM	provided in section B.6.1	0.6750	tCO_2/MWh
wBM	-	0.5	-
OM	provided in section B.6.1	0.7308	tCO_2/MWh
wOM	-	0.5	-
EF	provided in section B.6.1	0.7029	tCO_2/MWh
Installed_capacity	-	30.00	MW
EG	-	160,073	MWh
Reservoir_area	-	0.3	km^2
Power density	= Installed_capacity/Reservoir_area	100.00	MW/km^2
BE	= EG * EF	112,515	tCO_2e
PE	= EF_{res} * EG / 1000	0	tCO_2e
ER	= BE - PE	112,515	tCO_2e

Table 13 - BM calculation

Efficiency (output/input)	0.395
Efficiency (input/output)	2.53164557
Conversion(TJ/MWh)	0.0036
CEF(tCO2/TJ)	74.07
BM (tCO2/MWh)	0.6750

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

Table 14 - Ex-ante estimation

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 emission reductions (tonnes of CO_2e)
2008 (September - December)	0	37,505	0	37,505
2009	0	112,515	0	112,515
2010	0	112,515	0	112,515
2011	0	112,515	0	112,515
2012	0	112,515	0	112,515
2013	0	112,515	0	112,515
2014	0	112,515	0	112,515
2015	0	112,515	0	112,515
2016	0	112,515	0	112,515
2017	0	112,515	0	112,515
2018(January - August)	0	75,010	0	75,010
Total (tonnes of CO_2e)	0	1,125,150	0	1,125,150
2008 (September - December)	0	37,505	0	37,505

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
Description:	Net electricity delivered to the grid
Source of data to be used:	Project developer and CELPA
Value of data applied for the purpose of calculating expected emission reductions in section B.5	160,073 MWh
Description of measurement methods and procedures to be applied:	The electricity generation will be monitored by a cumulative meter installed at the project plant. Data will be recorded hourly at the project plant and consolidated monthly. Another meter will be installed at the substation and it will be used for sales receipt issuance. The readings at the plant will be cross checked by the sales receipt.
QA/QC procedures to be applied:	Equipment will be subject to a regular maintenance, calibration and testing regime to ensure accuracy. Collected data has low uncertainty levels and to guarantee its accuracy it will be cross checked with the electricity sales

	receipts obtained from the grid operator.
Any comment:	Data will be archived at least for two years after crediting period.

Data / Parameter:	$\mathbf{A_{PJ}}$
Data unit:	m^2
Description:	Surface area of the reservoir
Source of data used:	ANEEL Dispatch 709 issued on 15/07/2005
Value applied:	0.3
Justification of the choice of data or description of measurement methods and procedures actually applied :	The information is taken from documents that are subject of approval by National or State Agencies.
Any comment:	

Data / Parameter:	$\mathbf{Cap_{PJ}}$
Data unit:	Watt
Description:	Installed capacity of the hydro power plant after the implementation of the project activity
Source of data used:	Equipment manufacturer.
Value applied:	30000
Justification of the choice of data or description of measurement methods and procedures actually applied :	The technology provider states the capacity of equipment. The value can easily be checked in the equipment plate.
Any comment:	

Data / Parameter:	$\boldsymbol{\eta_{m,y}}$
Data unit:	-
Description:	Average net energy conversion efficiency of power unit m in year y (%)
Source of data used:	"Tool to calculate the emission factor for an electricity system"
Value applied:	0.395
Justification of the choice of data or description of measurement methods and procedures actually applied :	Default efficiency value from the methodological tool or Open Cycle technology.
Any comment:	

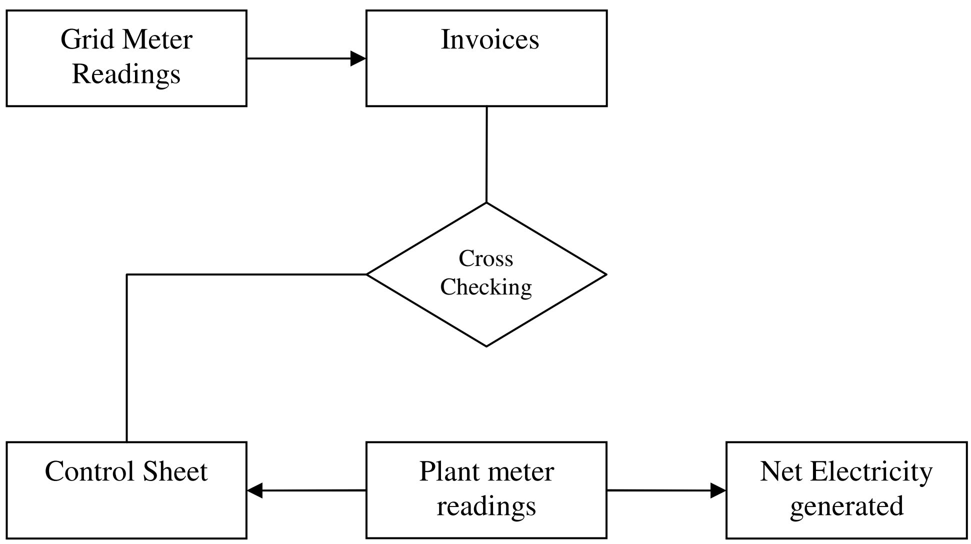
B.7.2 Description of the monitoring plan:

The monitoring of this type of project consists of metering the electricity generated by the renewable technology. Below you find the description of monitoring procedures for data measurement, quality assurance and quality control.

1. Monitoring organisation

The grid operator reads the meter in a monthly basis and this data will be used by the project developer to issue electricity sale invoices. Also in monthly basis plant operators reads the net electricity delivered to the grid in the plant meter located just aside the transmission substation. This meter contain the amount of electricity delivered to the grid and will be used to calculate the amount of CERs generated from the project activity.

Power plant operators also read, on an hourly basis, the gross electricity generated in order to control the plant operation. These readings are also used to check the consistency of the amount of electricity stated in the invoices read by the grid operator.



Metering of Electricity Supplied to the Grid

The main electricity meter for establishing the electricity delivered to the grid will be installed just aside the transmission substation. This electricity meter will be used to check the amount to be paid by the electricity buyer. As this meter provides the main data for CER measurement, it will be the key part of the verification process.

Data will also be measured continuously by the plant operator and at the end of each month the monitoring data will be filed electronically and a back-up will be made regularly. The project developer will keep the electricity sale invoices. Data will be archived electronically and on paper and will be kept for at least two years after the crediting period.

The meter will be installed by either the project developer or the grid company in accordance with Brazilian standards, established by INMETRO *("Instituto Nacional de Metrologia, Normalização e Qualidade Industrial"*- entity responsible for calibration standards) and by ANEEL. Records of the meter (type, make, model and calibration documentation) will be retained in the quality control system.

Quality Control and Quality Assurance

Quality control and quality assurance procedures will guarantee the quality of data collected. The electricity meter(s) will undergo maintenance subject to manufacturer standards. Moreover, meter(s) are calibrated either by the distribution concessionaire CELPA - which signs a long term PPA with the plants - or by the Project Developer, and recalibrated according to manufacturer specifications. Documents will be available during the verification.

To guarantee the consistency and accuracy of the data collected from the meter(s), data will be cross-checked with the sale invoices which will guarantee the amount of electricity supplied to the grid.

The organisation of the monitoring team will be established and clear roles and responsibilities will be assigned to all staff involved in the CDM project. The monitoring will be performed according to internal procedure that will be available at the verification since the project is not operating.

Data will be read off the meter and energy sale invoices will be collected from the small hydro by the plant operation personnel. This information will be transferred to EcoSecurities on a monthly basis in order to monitor emission reductions.

The energy generating equipment will not be transferred from another activity; therefore, leakage effects do not need to be accounted.

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 baseline study and the monitoring methodology were concluded on 27/08/2007. The entity determining the baseline study and the monitoring methodology and participating in the project as the Carbon Advisor is EcoSecurities Brasil Ltda.

Leandro Noel
Rua Lauro Müller, 116/4303.
Rio de Janeiro - RJ
Brazil
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SECTION C. Duration of the project activity / crediting period

C.1 Duration of the project activity:

C.1.1. Starting date of the project activity:

01/08/2006

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

30 years

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 crediting period will start on 01/04/2008, or on the date of registration of the CDM project activity, whichever is later.

C.2.2.2. Length:

10 years – 0 months

SECTION D. Environmental impacts

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

The Project generates no emissions of greenhouse gases, produces no toxic waste, and has limited, controllable and reversible effects on the environment because the project is a small run-of-river hydropower plant which uses water directly from the river; it includes a small storage area designed only to allow the water to flow through the water intake to the turbine. The project can be easily integrated into the landscape and is compatible with the protection of water, fauna and flora.

As for a regulatory permit, the project developer has authorization, as issued by ANEEL (ANEEL Resolution nº 408, issued on 06/08/2002 and Resolution nº 636, issued on 22/10/2002), to operate as an independent power producer.

As for environmental permits, the project has the necessary environmental licenses. The license of installation was issued by the state environmental agency, SECRETARIA EXECUTIVA DE CIENCIA TECNOLOGIA E MEIO AMBIENTE, LI number 0179/2006 issued on 10/10/2006.

A Simplified Environmental Report (SER) was requested by the environmental agency; it was developed in order to identify and undertake ultimate environmental impacts due to the project activity. Regarding the SER, the project activity has no significant negative impacts to the environment, offering overall benefits to the local society; moreover, the SER analyzes the undertaking in environmental perspectives, identifying and assessing the possible environmental impacts and listing its mitigation actions.

Additionally, a Program for Recovering of Degraded Areas (PRDA) and a Monitoring Plan were developed with the purpose to analyse and address eventual negative impacts derived from the project activity. The impacts due to the project are not significant and mitigation will be taken.

All documents related to operational and environmental licensing are public and can be obtained from the state environmental agency.

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:

There are no significant environmental impacts.

SECTION E. Stakeholders' comments

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

According to Resolution #1 dated December 2nd, 2003 from the Brazilian Inter-Ministerial Commission of Climate Change (Comissão Interministerial de Mudança Global do Clima -CIMGC), any CDM project must send a letter with a description of the project and an invitation for comments by local stakeholders. In this case, letters were sent to the following local stakeholders:

- City Hall of Novo Progresso;
- District Attorney (the Ministério Público, i.e. the permanent institution essential for legal functions responsible for defending the legal order, democracy and social/individual interests);
- Chamber of Deputy of Novo Progresso;
- SECRETARIA EXECUTIVA DE CIENCIA TECNOLOGIA E MEIO AMBIENTE;
- Brazilian Fórum of NGOs
- Environmental Agency of Novo Progresso
- Local community associations

Local stakeholders were invited to raise their concerns and provide comments on the project activity for a period of 30 days after receiving the letter of invitation.

Although project proponents tried to find local community associations, none were found. Project proponents will justify this situation to the Brazilian DNA.

E.2. Summary of the comments received:

To date no formal comments have been received from stakeholders.

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

To date no formal comments have been received from stakeholders.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Organization:	Curuá Energia S/A
Street/P.O.Box:	Avenida Miguel Sutil, 12.727
Building:	
City:	Cuiabá
State/Region:	Mato Grosso
Postfix/ZIP:	
Country:	Brazil
Telephone:	
FAX:	
E-Mail:	
URL:	
Represented by:	
Title:	
Salutation:	
Last Name:	
Middle Name:	
First Name:	
Department:	
Mobile:	
Direct FAX:	
Direct tel:	
Personal E-Mail:	

Project Annex 1 participant:

Organization:	EcoSecurities Group Plc.
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State/Region:	
Postfix/ZIP:	02
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E-Mail:	info@ecosecurities.com
URL:	www.ecosecurities.com
Represented by:	
Title:	COO & President
Salutation:	Dr.
Last Name:	Moura Costa
Middle Name:	

First Name:	Pedro
Mobile:	
Direct FAX:	
Direct tel:	+44 1865 202 635
Personal E-Mail:	cdm@ecosecurities.com

Annex 2

INFORMATION REGARDING PUBLIC FUNDING

This project will not receive any public funding from Annex 1 parties.

Annex 3

BASELINE INFORMATION

Table 15 - FA input parameters (R$)

Investment	R$ 157,398,606.36	Reference: ANEEL Resolution 322 05
Subsidy	R$ 111,487,832.77	Reference: ANEEL Resolution 322 06
Net investments	R$ 45,910,773.59	-
Guaranteed electricity generation(MWh)	231439.2	Projeto Básico
O&M Costs (R$/MWh)	77.15	Alternativas energéticas sustentáveis no Brasil /Mauricio Tiomno Tolmasquim, coordenador. - Rio de Janerio: Relume Dumará: COPPE: CENERGIA, 2004
Electricity Tariff (R$/MWh)	119	Project PPA

		Unitary value	Unit	0	1	2	3	4	5	6
Project	Investments	R$ 157,398,606.36	R$	(157,398,606.36)						
	Contingency		%		0.00	0.00	0.00	0.00	0.00	0.00
	Subsidy	R$ 111,487,832.77	R$		74,795,299.58	36,692,533.19				
	Electricity Generation	231,439.20	MWh							
	Electricity Tariff	119.00	R$/MWh		27,541,264.80	27,541,264.80	27,541,264.80	27,541,264.80	27,541,264.80	27,541,264.80
	O&M Costs	77.15	R$/MWh		(17,855,534.28)	(17,855,534.28)	(17,855,534.28)	(17,855,534.28)	(17,855,534.28)	(17,855,534.28)
	(-)Depreciation	10%	%		(15,739,860.64)	(15,739,860.64)	(15,739,860.64)	(15,739,860.64)	(15,739,860.64)	(15,739,860.64)
	Taxes	30%	%		0.00	0.00	0.00	0.00	0.00	0.00
	(+)Depreciation	10%			15,739,860.64	15,739,860.64	15,739,860.64	15,739,860.64	15,739,860.64	15,739,860.64
	BaselineCash Flow		R$	(157,398,606.36)	84,481,030.10	46,378,263.71	9,685,730.52	9,685,730.52	9,685,730.52	9,685,730.52

		7	8	9	10	11	12	Perpetuity
Project	Investments							
	Contingency	0.00	0.00	0.00	0.00	0.00	0.00	
	Subsidy							
	Electricity Generation							
	Electricity Tariff	27,541,264.80	27,541,264.80	27,541,264.80	27,541,264.80	27,541,264.80	27,541,264.80	162,007,440.00
	O&M Costs	(17,855,534.28)	(17,855,534.28)	(17,855,534.28)	(17,855,534.28)	(17,855,534.28)	(17,855,534.28)	(105,032,554.59)
	(-)Depreciation	(15,739,860.64)	(15,739,860.64)	(15,739,860.64)	(15,739,860.64)	0.00	0.00	0.00
	Taxes	0.00	0.00	0.00	0.00	(2,905,719.16)	(2,905,719.16)	(17,092,465.62)
	(+)Depreciation	15,739,860.64	15,739,860.64	15,739,860.64	15,739,860.64	0.00	0.00	0.00
	BaselineCash Flow	9,685,730.52	9,685,730.52	9,685,730.52	9,685,730.52	6,780,011.36	6,780,011.36	39,882,419.79

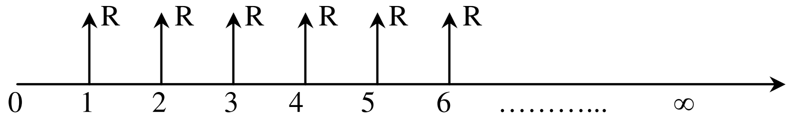

Figure 1 - Flow representing the perpetuity

To correctly address the cash flow timeline, a perpetuity value was inserted in the end of the 12-years period analysed. The perpetuity represents the value, in terms of present value, all future revenues and/or costs. Using the perpetuity the analysis considers a infinite cash flow. According to Samanez (2007) the perpetuity of a flow (Figure 1[2]), can be calculated as:

$$P = R \cdot \left(\frac{1}{i} \right)$$

Where:

P	Is the perpetuity value, in terms of present value
R	Are the revenues in each year, from 0 to infinite;
i	Is the relevant income tax

For the project, the relevant income tax is represented by the discount rate.

[2] In the Project cash flow, the year zero of the figure is represented by the year 12..

Grid Emission Factor Calculation

Pará Isolated System is isolated from Brazilian interconnected systems S-SE-CO and N-NE. The grid is predominantly thermal thus the Simple OM method was selected.

All data used to calculate the Emission Factor are from the following sources:

1. Data obtained from ELETROBRAS: "Programa Mensal de Operação dos Sistemas Isolados" – from January, 2004 to December, 2006
2. Data from IPCC, 2006

A summary of the calculation is provided below.

Table 16 - Data used to calculate EF

			total generation	Oil consumption	Fuel Type	Oil consumption	Emissions	Efficiency	Plant Emissions
Year	Month	Plants (location)	MWh	m³		ton	tCO_2	L/MWh	tCO2/MWh
2004		Novo Progresso	2,245	650	Diesel	546	1,710.09	289.53	0.7617
2004	1	Castelo dos Sonhos	617	197	Diesel	165.48	518.29	319.29	0.8400
2004		Novo Progresso	2,147	618	Diesel	519.12	1,625.90	287.84	0.7573
2004	2	Castelo dos Sonhos	587	185	Diesel	155.4	486.72	315.16	0.8292
2004		Novo Progresso	2,245	647	Diesel	543.48	1,702.20	288.20	0.7582
2004	3	Castelo dos Sonhos	651	202	Diesel	169.68	531.44	310.29	0.8163
2004		Novo Progresso	2,173	628	Diesel	527.52	1,652.21	289.00	0.7603
2004	4	Castelo dos Sonhos	593	181	Diesel	152.04	476.19	305.23	0.8030
2004		Novo Progresso	2,245	646	Diesel	542.64	1,699.57	287.75	0.7570
2004	5	Castelo dos Sonhos	684	210	Diesel	176.4	552.49	307.02	0.8077

2004		Novo Progresso	2,173	625	Diesel	525	1,644.32	287.62	0.7567
2004	6	Castelo dos Sonhos	636	197	Diesel	165.48	518.29	309.75	0.8149
2004		Novo Progresso	2,245	649	Diesel	545.16	1,707.46	289.09	0.7606
2004	7	Castelo dos Sonhos	671	210	Diesel	176.4	552.49	312.97	0.8234
2004		Novo Progresso	2,275	658	Diesel	552.72	1,731.14	289.23	0.7609
2004	8	Castelo dos Sonhos	755	236	Diesel	198.24	620.89	312.58	0.8224
2004		Novo Progresso	2,173	620	Diesel	520.8	1,631.16	285.32	0.7507
2004	9	Castelo dos Sonhos	751	234	Diesel	196.56	615.63	311.58	0.8198
2004		Novo Progresso	2,245	631	Diesel	530.04	1,660.10	281.07	0.7395
2004	10	Castelo dos Sonhos	818	253	Diesel	212.52	665.62	309.29	0.8137
2004		Novo Progresso	2,173	618	Diesel	519.12	1,625.90	284.40	0.7482
2004	11	Castelo dos Sonhos	790	248	Diesel	208.32	652.47	313.92	0.8259
2004		Novo Progresso	3,485	1004	Diesel	843.36	2,641.43	288.09	0.7579
2004	12	Castelo dos Sonhos	796	249	Diesel	209.16	655.10	312.81	0.8230
2005		Novo Progresso	2377	1215	Diesel	1020.6	3,196.55	511.15	1.3448
2005	1	Castelo dos Sonhos	716	335	Diesel	281.4	881.35	467.88	1.2309
2005		Novo Progresso	2147	635	Diesel	533.4	1,670.63	295.76	0.7781
2005	2	Castelo dos Sonhos	632	185	Diesel	155.4	486.72	292.72	0.7701
2005		Novo Progresso	2810	700	Diesel	588	1,841.64	249.11	0.6554
2005	3	Castelo dos Sonhos	702	210	Diesel	176.4	552.49	299.15	0.7870
2005		Novo Progresso	2507	750	Diesel	630	1,973.18	299.16	0.7871
2005	4	Castelo dos Sonhos	644	130	Diesel	109.2	342.02	201.86	0.5311
2005	5	Novo Progresso	2,723	600	Diesel	504	1,578.54	220.35	0.5797

2005		Castelo dos Sonhos	745	34	Diesel	28.56	89.45	45.64	0.1201
2005		Novo Progresso	2434	350	Diesel	294	920.82	143.80	0.3783
2005	6	Castelo dos Sonhos	609	20	Diesel	16.8	52.62	32.84	0.0864
2005		Novo Progresso	2696	400	Diesel	336	1,052.36	148.37	0.3903
2005	7	Castelo dos Sonhos	745	220	Diesel	184.8	578.80	295.30	0.7769
2005		Novo Progresso	2471	492	Diesel	413.28	1,294.41	199.11	0.5238
2005	8	Castelo dos Sonhos	772	230	Diesel	193.2	605.11	297.93	0.7838
2005		Novo Progresso	2372	420	Diesel	352.8	1,104.98	177.07	0.4658
2005	9	Castelo dos Sonhos	673	150	Diesel	126	394.64	222.88	0.5864
2005		Novo Progresso	2245	650	Diesel	546	1,710.09	289.53	0.7617
2005	10	Castelo dos Sonhos	542	80	Diesel	67.2	210.47	147.60	0.3883
2005		Novo Progresso	2173	550	Diesel	462	1,447.00	253.11	0.6659
2005	11	Castelo dos Sonhos	570	120	Diesel	100.8	315.71	210.53	0.5539
2005		Novo Progresso	2266	550	Diesel	462	1,447.00	242.72	0.6386
2005	12	Castelo dos Sonhos	544	155	Diesel	130.2	407.79	284.93	0.7496
2006		Novo Progresso	1524	445	Diesel	373.8	1,170.75	291.99	0.7682
2006	1	Castelo dos Sonhos	450	135	Diesel	113.4	355.17	300.00	0.7893
2006		Novo Progresso	1529	445	Diesel	373.8	1,170.75	291.04	0.7657
2006	2	Castelo dos Sonhos	401	120	Diesel	100.8	315.71	299.25	0.7873
2006		Novo Progresso	1644	480	Diesel	403.2	1,262.84	291.97	0.7681
2006	3	Castelo dos Sonhos	433	130	Diesel	109.2	342.02	300.23	0.7899
2006		Novo Progresso	1696	485	Diesel	407.4	1,275.99	285.97	0.7524
2006	4	Castelo dos Sonhos	467	140	Diesel	117.6	368.33	299.79	0.7887

2006		Novo Progresso	1,759	510	Diesel	428.4	1,341.76	289.94	0.7628
2006	5	Castelo dos Sonhos	550	165	Diesel	138.6	434.10	300.00	0.7893
2006		Novo Progresso	1966	580	Diesel	487.2	1,525.93	295.02	0.7762
2006	6	Castelo dos Sonhos	500	150	Diesel	126	394.64	300.00	0.7893
2006		Novo Progresso	1932	570	Diesel	478.8	1,499.62	295.03	0.7762
2006	7	Castelo dos Sonhos	450	135	Diesel	113.4	355.17	300.00	0.7893
2006		Novo Progresso	1953	580	Diesel	487.2	1,525.93	296.98	0.7813
2006	8	Castelo dos Sonhos	533	160	Diesel	134.4	420.95	300.19	0.7898
2006		Novo Progresso	2000	590	Diesel	495.6	1,552.24	295.00	0.7761
2006	9	Castelo dos Sonhos	567	170	Diesel	142.8	447.25	299.82	0.7888
2006		Novo Progresso	2228	655	Diesel	550.2	1,723.24	293.99	0.7734
2006	10	Castelo dos Sonhos	597	175	Diesel	147	460.41	293.13	0.7712
2006		Novo Progresso	2334	750	Diesel	630	1,973.18	321.34	0.8454
2006	11	Castelo dos Sonhos	620	200	Diesel	168	526.18	322.58	0.8487
2006		Novo Progresso	2146	630	Diesel	529.2	1,657.47	293.57	0.7724
2006	12	Castelo dos Sonhos	620	180	Diesel	151.2	473.56	290.32	0.7638
2007		Novo Progresso	2,245	653	Diesel	548.52	1,717.98	290.87	0.7652
2007	1	Castelo dos Sonhos	838	261	Diesel	219.24	686.67	311.46	0.8194
2007		Novo Progresso	2,028	596	Diesel	500.64	1,568.02	293.89	0.7732
2007	2	Castelo dos Sonhos	763	237	Diesel	199.08	623.53	310.62	0.8172
2007		Novo Progresso	2,245	640	Diesel	537.6	1,683.78	285.08	0.7500
2007	3	Castelo dos Sonhos	844	259	Diesel	217.56	681.41	306.87	0.8074
2007		Novo Progresso	3,075	897	Diesel	753.48	2,359.92	291.71	0.7675
2007	4	Castelo dos	754	230	Diesel	193.2	605.11	305.04	0.8025

		Sonhos							
2007		Novo Progresso	3,425	979	Diesel	822.36	2,575.66	285.84	0.7520
2007	5	Castelo dos Sonhos	786	247	Diesel	207.48	649.83	314.25	0.8268
2007		Novo Progresso	3,455	997	Diesel	837.48	2,623.02	288.57	0.7592
2007	6	Castelo dos Sonhos	816	254	Diesel	213.36	668.25	311.27	0.8189
2007		Novo Progresso	3,599	1,033	Diesel	867.72	2,717.73	287.02	0.7551
2007	7	Castelo dos Sonhos	867	272	Diesel	228.48	715.61	313.73	0.8254
2007		Novo Progresso	3,679	1,063	Diesel	892.92	2,796.66	288.94	0.7602
2007	8	Castelo dos Sonhos	936	291	Diesel	244.44	765.59	310.90	0.8179
2007		Novo Progresso	3,688	1,077	Diesel	904.68	2,833.49	292.03	0.7683
2007	9	Castelo dos Sonhos	908	279	Diesel	234.36	734.02	307.27	0.8084
2007		Novo Progresso	3,743	1,078	Diesel	905.52	2,836.12	288.00	0.7577
2007	10	Castelo dos Sonhos	859	261	Diesel	219.24	686.67	303.84	0.7994
2007		Novo Progresso	3,709	1050	Diesel	882	2,762.45	283.10	0.7448
2007	11	Castelo dos Sonhos	893	271	Diesel	227.64	712.98	303.47	0.7984
2007		Novo Progresso	3711	1054	Diesel	885.36	2,772.98	284.02	0.7472
2007	12	Castelo dos Sonhos	930	279	Diesel	234.36	734.02	300.00	0.7893

BM Calculation: Option B2 for $EF_{EL,m,y}$

Efficiency (output/input)	0.395
Efficiency (input/output)	2.53164557
Conversion(TJ/MWh)	0.0036
CEF(tCO2/TJ)	74.07
BM (tCO2/MWh)	0.6750

Fuel data

Sources	density (kg/m³)	Source	lower heating value (kcal/kg)	Source	lower heating value (Kcal/m³)	Source	NCV (TJ/kton)	Source	Carbon oxidation (%)	Source	Carbon content (tC/TJ)	Source	Carbon Emission Factor (tCO2e/TJ)	Carbon Emission Factor (tCO2e/unit)	Fuel unit
Diesel	840	[1]	10,100	[1]	--		42.29	[1]	100.0%	[2]	20.20	[2]	74.07	3.13	ton

Sources:

[1] Brasilian Energetic Balance,2005

[2] IPCC, 2006

Table 17 - EF calculation summary

Grid Pará

	EF_{OM} (tCO₂/MWh)	Load (MWh)		
2007	0.7577	38602.0000		
2006	0.7785	22711.0000		
2005	0.6583	29221.0000		
	TOTAL	90,534		
	$EF_{OM,SIMPLE}$	0.7308	w_{OM}	0.5
	$EF_{BM,\ 2005}$	0.6750	w_{BM}	0.5
	EF_y(tCO2/MWh)	0.7029		

Conservative assumption on the Grid Emission Factor

The Project is supplying electricity for Isolated systems, which only diesel fuelled generation have been taking place. The transmission line of the project activity will connect two municipalities. One emission factor was calculated for each municipality. In a conservative way the lowest emission factor was taken as the Grid Emission factor of the Pará Isolated System. See tables below for further information.

Novo Progresso

	EF_{OM} (tCO_2/MWh)	Load (MWh)		
2007	0.7577	38602.0000		
2006	0.7785	22711.0000		
2005	0.6583	29221.0000		
	TOTAL	90,534		
	$EF_{OM,SIMPLE}$	0.7308	w_{OM}	0.5
	EF_{BM}	0.6750	w_{BM}	0.5
	EF_y(tCO2/MWh)	0.7029		

Castelo dos Sonhos

	EF_{OM} (tCO_2/MWh)	Load (MWh)		
2007	0.8106	10194.0000		
2006	0.7908	6188.0000		
2005	0.6229	7894.0000		
	TOTAL	24,276		
	$EF_{OM,SIMPLE}$	0.7445	w_{OM}	0.5
	$EF_{BM,\ 2005}$	0.6750	w_{BM}	0.5
	EF_y(tCO2/MWh)	0.7098		

"Tool to calculate the emission factor for an electricity system"

Further explanation on Step 4: Identify the cohort of power units to be included in the build margin

The BM is calculated according to the formula below:

$$EF_{grid,BM,y} = \frac{\sum_m EG_{m,y} \cdot EF_{EL,m,y}}{\sum_m EG_{m,y}}$$

Where, $FE_{EL,m,y}$ is calculated according to Option B2, as follows:

$$EF_{EL,m,y} = \frac{EF_{CO2,m,i,y} \cdot 3.6}{\eta_{m,y}}$$

Considering that all power plants serving the system have been operating under the same characteristics, *i.e*, same technology (open cycle) and fueled with the same fossil fuel (diesel), if default value for efficiency is used, we have a constant value for the efficiency, thus:

If $\eta_{m,y}$ = constant $\forall\, m$ and $EF_{CO2,m,I,y}$ = constant $\forall\, m \Rightarrow FE_{EL,m,y}$ = constant $\forall\, m$

Thus,

$$EF_{grid,BM,y} = EF_{EL,m,y} \cdot \frac{\sum_m EG_{m,y}}{\sum_m EG_{m,y}} \therefore EF_{grid,BM,y} = EF_{EL,m,y}$$

THE BRAZILIAN ELECTRIC SYSTEM

The Brazilian electricity system is mainly composed of the Brazilian Interconnected System (SIN – Sistema Interligado Nacional); about 97% of the electricity generation capacity is included in the SIN. The SIN is an immense grid system, predominantly based on hydroelectric plants. It is comprised by plants located in the South, Southeast, Midwest, Northeast and part of the North Region. The remaining 3% of electricity generation capacity corresponds to small isolated grids, predominantly thermal, fuelled with fossil fuels.

The SIN is divided into two main systems, the S-SE-MW and the N-NE. The isolated systems are located in the Amazonian region; one example of an isolated system is the Rondonia-Acre Isolated System located in the north-western part of Brazil. Figure 2 illustrates the Brazilian electricity system.

For the purposes of the CDM, there are two grid emission factors for the SIN and one emission factor for each isolated system. Calculations are done according to the approved methodology ACM0002. Refer to Table 18 for applicable values for the SIN and Rondonia-Acre systems.

Table 18 - Grid emission factors

Grid System	EF(tCO_2/MWh)
N-NE	0.0767
S-SE-MW	0.2826
Rondonia-Acre	0.9525

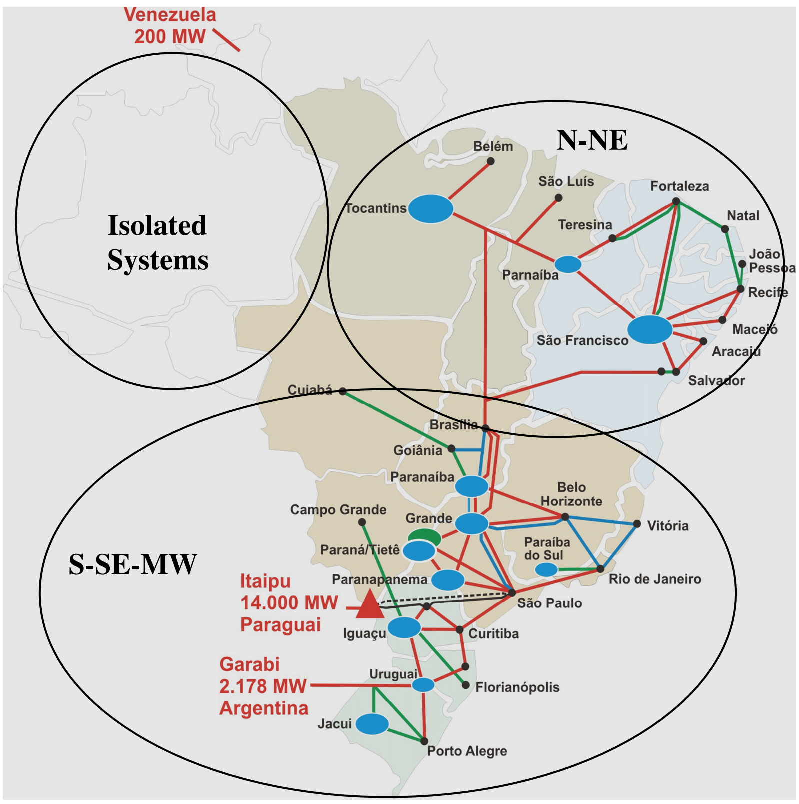

Figure 2 - Brazilian electric system

Annex 4

MONITORING INFORMATION

Please refer to section B.7 above.

Annex 5

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