**PROJECT DESIGN DOCUMENT FORM
FOR SMALL-SCALE CDM PROJECT ACTIVITIES (F-CDM-SSC-PDD)
Version 04.1**

PROJECT DESIGN DOCUMENT (PDD)

Title of the project activity	SHP Itaguaçu CDM Project (JUN 1146), Brazil
Version number of the PDD	2
Completion date of the PDD	20/08/2012
Project participant(s)	Itaguaçu Energia S/A and Carbotrader Assessoria e Consultoria em Energia Eireli (both are private entity)
Host Party(ies)	Brazil
Sectoral scope(s) and selected methodology(ies)	Sectoral Scope I - Energy Industries (renewable/non-renewable sources) AMS-I.D methodology
Estimated amount of annual average GHG emission reductions	14,818tCO_2

SECTION A. Description of project activity

A.1. Purpose and general description of project activity

The project activity consists in the construction of the Small Hydro Power Plant (SHP) Itaguaçu with 14.22MW of Power Installed. The Itaguaçu SHP is located in the Pitanga city in the Paraná State, Brazil.

The project activity purpose is to provide electrical energy from a renewable source to the Brazilian National Interconnected System (SIN - from the Portuguese: Sistema Interconectado Nacional), offsetting the fossil fuels thermal generation, helping to attend the rising energy demand in Brazil.

The scenario existing prior to the implementation of the project activity is the same that the baseline scenario, that consists in the use of electrical energy from the SIN, that includes the use of fossil fuels thermal generation.

The estimative of GHG emission reductions is 14,818tCO_2 annually totalizing 103,725tCO_2 for the first seven years crediting period, can be renewable for more two periods of seven years each one.

With respect to the contribution of the project in the greenhouse gases emissions mitigation (GHG) and the global warming, the project activity reduces the emissions of these gases avoiding the entrance in operation of thermoelectric units that burn fossil fuel in its operation. In the absence of this project activity, these fossil fuels would be burnt in the thermoelectric generating units interconnected to the grid. This initiative helps Brazil to meet its goals of promoting sustainable development.

For the Project Participants the project activity is a sustainable alternative for the electricity generation because the project consist of Small Hydropower Plant with a small reservoir, it has low environmental impact, almost zero if compared to the large hydroelectric power plants.

Moreover, the project activity is in line with the specific requirements[1] of the CDM (Clean Development Mechanism) of the country host, because:

- Contributes with the sustainable development because it will reduce the fossil fuel use (non-renewable source). Thus the project contributes to a better utilization of the natural resources and it does use of clean and efficient technologies;
- It contributes to better working conditions and increases the employment opportunities in the area where the project is located (rural area);
- It contributes to the better conditions for the local economy, because the use of renewable energy reduces the fossil fuel dependence, the amount of associated pollution and the social costs related with it.

[1] The specific requirements of the CDM are in the document "Manual para Submissão de Atividades de Projeto no Âmbito do MDL – from CIMGC Brazil (DNA)", Page 16.

A.2. Location of project activity
A.2.1. Host Party(ies)
Brazil

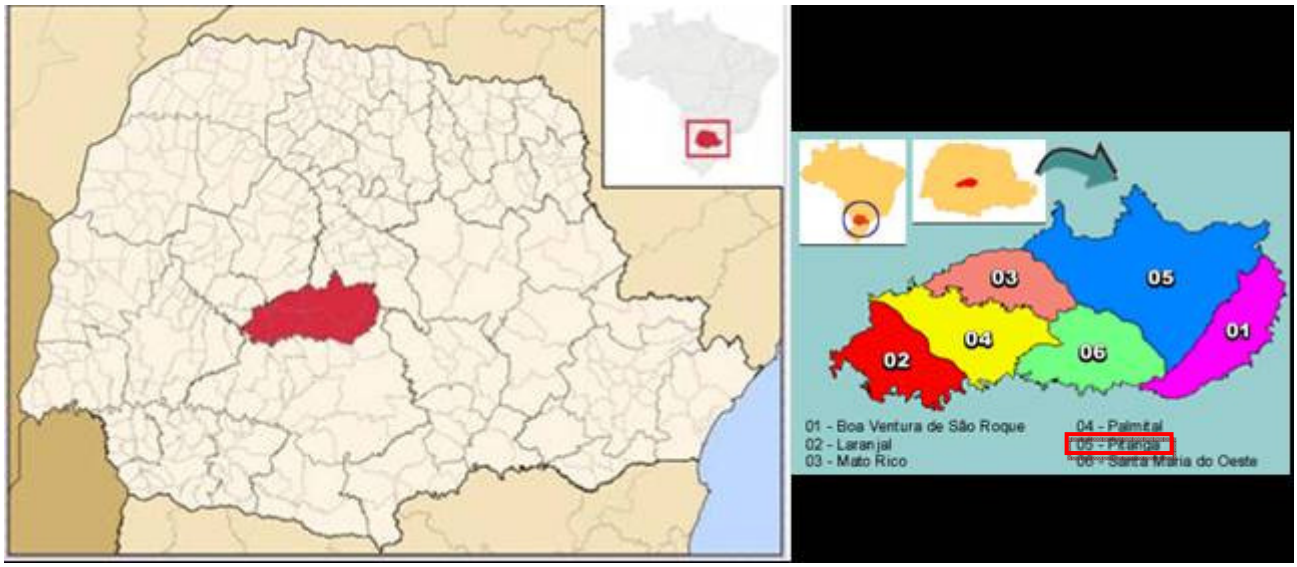
A.2.2. Region/State/Province etc.
South Region – Paraná State (PR)

A.2.3. City/Town/Community etc.
Pitanga City

A.2.4. Physical/ Geographical location
The project activity is located in the Pitanga River in the municipality of Pitanga, State of Paraná, Brazil. The geographical coordinates are: 24°41'37.03" S 51°31'08.76" W or Latitude: -24.693619 and Longitude: -51.5191 (in decimal).

The Figure 1 illustrates the exact enterprise location:

Figure 1: Geographical location of Pitanga city.



Source: http://commons.wikimedia.org/wiki/File:Parana_Micro_Pitanga.svg
and City Brazil - http://www.citybrazil.com.br

A.3. Technologies and/or measures
The project activity consists in the use of water coming directly from the river to generate electricity. The water potential gravitational energy is used to move the turbines. The turbines trigger the generators that produce the electrical energy. This is a source of clean and renewable energy that presents minimal impact on the environment.

The technology and equipment used in the project activity will be developed and manufactured in Brazil. There is no forecast transfer technology or know-how to the host country.

The SHP Itaguaçu venture will be interconnected to the Brazilian energy grid and should provide power for this electrical system. The connection point should be in the Pitanga Substation (far 34.7 Km). More details about the SHP SIN connection in the B.7.3 Section.

The venture is classified as Small Hydro Power plant. According to the Resolution 652, of 9/12/2003 from ANEEL to be considered a small hydroelectric plant, the area of the reservoir must be less than 3 km^2 (300 ha) and generation capacity must be between 1 MW and 30 MW. This type of enterprise is also called "run of river" plant which does not include significant water stocks.

The technical characteristics of the equipments that will be implemented in the SHP can be seen in the Table 1 below:

Table 1: Main datas of the SHP Itaguaçu

SHP	**Itaguaçu**
Installed Power (MW)	14.22
Reservoir Area (Km^2)	0.340
Power density (W/m^2)	41.82
Turbines Type	Francis
Quantity	2
Power (kW)	7,324
Flow water (m^3/s)	12.18
Spin (rpm)	600
Generators	
Quantity	2
Nominal Power (kVA)	7,900
Effective Power (kW)	7,110
Power Factor	0.9
Frequency(Hz)	60

In operation under the existing scenario, prior to the implementation of the project activity that is the same that the baseline scenario, there were not any operating in the place where the SHP shall be installed, then there were not any facility, systems or equipments working.

A.4. Parties and project participants

Party involved (host) indicates a host Party	Private and/or public entity(ies) project participants (as applicable)	Indicate if the Party involved wishes to be considered as project participant (Yes/No)
Brazil (host)	Itaguaçu Energia S/A (private entity)	No
	Carbotrader Assessoria e Consultoria em Energia Eireli (private entity)	

A.5. Public funding of project activity

There is no public funding provided by international organizations for the performance of the project works so the carbon credits revenue are the option chosen.

A.6. Debundling for project activity

Based on the information provided in Appendix C of the simplified modalities and procedures for small scale CDM project activities, this project activity is not a debundled component of a larger project or program. This is a unique CDM project proposed by the project developer at this moment. The project participant have not registered or operated (are not therefore engaged in any way) in any other small-scale CDM project activities in hydropower, or using any other technologies within the project boundary, and surrounding the project boundary.

SECTION B. Application of selected approved baseline and monitoring methodology

B.1. Reference of methodology

Approved baseline and monitoring methodology:

AMS-I.D. - Grid connected renewable electricity generation -Version 17 (valid from 3 June 201 onwards).

And the Tool:

"Tool to calculate the emission factor for an electricity system" – version 02.2.1 EB 63, valid from 29 September 2011 onwards.

B.2. Project activity eligibility

In accordance to the list of sector scopes available on the UNFCCC website, the category in which the project is classified is the Sector Scope I - Energy Industries (renewable/non-renewable sources).

The project activity is applicable for type I of small-scale projects (renewable energy), methodology I.D. – Grid connected renewable electricity generation – because it is in accordance with all the applicability requirements necessary for this category.

This category encompasses renewable sources, as hydro, which supplies electricity to a national or a regional grid. In order to be eligible to that project category the small hydro power plants must satisfy at least one of the following conditions:

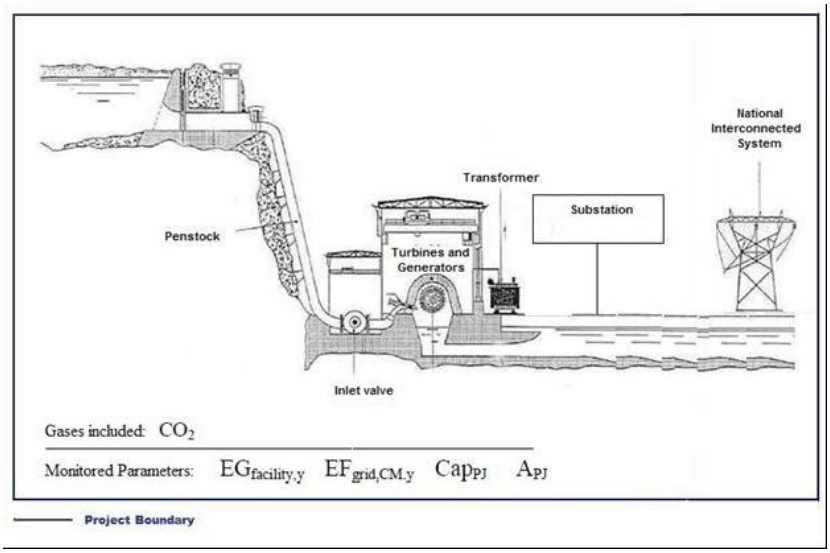
• The project activity is implemented in an existing reservoir with no change in the volume of reservoir (not applicable) ;
• The project activity is implemented in an existing reservoir, where the volume of reservoir is increased and the Power Density of the project activity in the Project Emissions section is greater than 4 W/m2 (not applicable) ;
• 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 (applicable).

The Installed Capacity of the SHP Itaguaçu that will be implemented in this project activity is 14.22 MW. The maximum limit established for Small Scale CDM Projects is 15 MW. So, the capacity of this project is below of the limit established by the methodology. It will be a Greenfield power plant and it will result in a new reservoir with 41.82 W/m^2 of Power Density (PD), so greater than 4 W/m^2 eligible for this methodology.

B.3. Project boundary
According to the methodology AMS-I.D the project boundary encompasses the physical and geographical locality of renewable generation source.

In this way the project boundary is the area where the project is located, which contains the area of the reservoir, dam, the powerhouse which includes the main equipments as turbines and generators, the SHPs substations, the measurement system and the National Interconnected Grid.

The diagram below shows the project boundary:



Regarding the grid connection point, the SHP Itaguaçu electricity will be dispatched to the Copel substation (Companhia Paranaense de Energia - the local utility grid system) located in the Pitanga city - PR, being this the connection point[2] with the SIN.

B.4. Establishment and description of baseline scenario

The project activity is the installation of a new grid-connected renewable power plant/unit. The baseline scenario is the electricity delivered to the grid by the project activity that otherwise would have been generated by the operation of grid-connected power plants or by the addition of new generation sources.

The baseline emissions are the product of electrical energy baseline $EG_{BL,y}$ expressed in MWh of electricity produced by the renewable generating unit multiplied by the grid emission factor (in tCO_2e/MWh) calculated in a transparent and conservative manner

The region where is located the Pitanga city (Paraná State) and its neighbouring municipalities is supplied by the National Interconnected Electric Grid. Part of the electricity produced by the project activity would have to be generated, in the case of its absence, by thermal plants connected to the electrical grid and fed by fossil fuels, increasing anthropogenic emissions. The addition of 14.22 MW by the SHP Itaguaçu shall comply with all requirements of a small scale project activity under Clean Development Mechanism.

In this context, the project activity uses as source for the Emission Factor calculation the National Interconnected System (SIN) datas of the operating and building margin, these datas are public available and provided by the Designated National Authority (DNA) of the host country.

The CO_2 Emission Factor resulting of the electrical energy generation verified in the Brazil SIN is calculated based on the generation registers of the plants centrally operated by the **National Grid Operator (ONS)**, which includes thermoelectric power plants that use fossil fuel as energy source.

The methodology used to this calculation is the dispatch data analysis, which is the most appropriate in determining the emission factor of the electrical grid.

This information is needed for renewable energy projects connected to the electric grid and implemented in Brazil as a **Clean Development Mechanism (CDM)** of the Kyoto Protocol.

The emission factor datas results from the National Grid Operator (ONS), Mines and Energy Ministry (MME) and the Science and Technology Ministry workforce , which become publics and available for the CDM project proponents . Thus, they can be applied in the calculation of *ex-ante* emissions avoided by the project activity calculation, and the emission reduction shall be calculated *ex-post*.

Further details of the development of the project baseline can be viewed through the link: http://www.mct.gov.br/index.php/content/view/73318.html.

B.5. Demonstration of additionality

According to the Guidelines on the Demonstration of Additionality of Small-Scale Project Activities (version 09.0 of 20 July 2012), a barrier analysis must be done in order to demonstrate the project additionality, as described below:

[2] More details about the connection point can be found in the document *"res2003317_Autorizacao PIE.pdf",* Art. 2.

"Participants in the project shall provide an explanation to show that the activity of the project would not have occurred anyway due to at least one of the following barriers":

(a) **Investment barrier**: This barrier evaluates a financially more viable alternative to the project activity would have led to higher emissions;

(b) **Technological barrier:** This barrier evaluates a less technologically advanced alternative to the project activity involves lower risks due to the performance uncertainty or low market share of the new technology adopted for the project activity and so would have led to higher emissions;

(c) **Barrier due to prevailing practice:** This barrier evaluates prevailing practice or existing regulatory or policy requirements would have led to implementation of a technology with higher emissions;

(d) **Other barriers:** This barrier evaluates without the project activity, for another specific reason identified by the project participant, such as institutional barriers or limited information, managerial resources, organizational capacity, financial resources, or capacity to absorb new technologies, emissions would have been higher.

The project activity Barrier is described below:

Investment barrier

The Benchmark analysis was used in order to demonstrate the Investment barrier (considered appropriate to this kind of project activity decision context)[3].

The financial indicator selected for the CDM project activity is the Internal Rate of Return (**IRR**), since this is considered appropriated for this project type and decision context.

The financial/economic analysis is based on parameters that are market standards.

The benchmark analysis is performed by comparing the equity IRR with the benchmark. The established benchmark for this comparison is the **Cost of Equity** **(K_e),** extracted from the Weighted Average Costs of Capital (WACC) calculation, in line with the accountable rules generally accepted. The details are described below:

Calculation and comparison of financial indicators

K_e – Cost of Equity

The Weighted Average Costs of Capital considers the weighted costs of equity and third parties capital that any company or sector have.

The sum of return rates required by the creditors (shareholders or third parties) weighted by the participation of each financial agent over the total debt, results the weighted average cost of capital of the

[3] Other options could be the simple cost or the investment comparison analysis, but since the project activity has other revenues than the CDM benefits the simple cost must be discarded and there are not other investment alternatives for the project sponsors. So the benchmark analysis was adopted in order to check the additionality.

companies (WACC). This cost shall be overcome by the project`s return in order to allow the company to honor their commitments and to invest in its growth.

The cost of equity was calculated as the sum of a tax free of risk (US Bonds) plus a Brazilian risk premium plus a global risk premium to the equity investment. This methodology of calculation follows the recommendations to the calculation of the equity presented in the "Guidelines on the assessment of investment analysis" published in 62 meeting of the CDM Executive Board (Annex 5), from July, 15th 2011.

Cost of Equity calculation

The cost of equity was calculated as follows:

$\mathbf{K_e = GB + PE_g}$

Where:

$\mathbf{K_e}$ = Cost of equity;
GB = Tax Free of Risk (Rf) + Host country risk premium (ERP)
$\mathbf{PE_g}$ = Global Equity risk premium

GB = 5.800% + 4.644% = 10.444%

Rf = Average of return rates of American Bond (T-Bond) corresponding to years 2001 to 2010[4];
ERP (EMBI+ $_{2001-2010}$) = Average of Brazilian Risk Premium, based on data from JP Morgan corresponding to years 2001 to 2010[5];

$\mathbf{PE_g}$ = Global Equity Risk Premium provided by Aswath Damodaran[6] .

Therefore:

$\mathbf{K_e}$ = 10.444% + (0.633 * 7.50)% = 15.191%

Considering the exclusion of the inflation rate 4.224%[7], the Itaguaçu Energia S/A **Cost of Equity is 10.97%[8].**

Below, the table 2 summarizes the reference values to the project activity IRR and the equity value used as benchmark.

Table 2: Comparative table between project activity IRR and the project benchmark

[4] http://pages.stern.nyu.edu/~adamodar/New_Home_Page/datafile/histret.html
[5] http://www.ipeadata.gov.br/Default.aspx
[6] http://pages.stern.nyu.edu/~adamodar/New_Home_Page/datafile/ctryprem.html weighted by the SHP Beta value (0.633)
[7] http://pt.wikipedia.org/wiki/Infla%C3%A7%C3%A3o#Hist.C3.B3rico_do_Quadro_Inflacion.C3.A1rio_no_Brasil
[8] Please, check the worksheet "Cost_Equity_SHP Itaguaçu_v1" provided to more details about the calculation performed

Benchmark - Cost of Equity (%)	IRR Itaguaçu (%)
10.97	**7.65**

The cash-flow was elaborated for the operational lifetime of the project activity (30 years), getting an Internal Return Rate (IRR) equal 7.65%, without revenues of the Certified Emissions Reductions (CERs). With the CERs revenue 8.01%.

As the cash flow of project activity is considered confidential information, this will be integrally presented to the validation entities in a separated worksheet. In the worksheet are also identified all the reference sources to the applied values.

The cash flow has as main input values the following:

Table 3: Main Inputs Values of cash flow

Parameter	SHP Itaguaçu
Investment (R$)	78,400,000.00
Assured Energy (MWaverage)	8.514
Energy Price (R$/MWh)	146.00
Operation and Maintenance (% on total assets)	3.50

The project's IRRs have stayed below of the project proponent`s cost of equity value. The analysis shows that the project is destroying capital of the investor considering the parameters that compose the calculation of Itaguaçu's cost of equity, facing therefore investment barrier.

The CERs are highly significant instruments for entrepreneurs in overcoming barriers, improving investment quality and hence stimulating future investments in clean energy generation.

To better understand the investment barrier was also performed a **sensitivity analysis** in which were varied the following parameters: (1) Energy Price, (2) Investment, (3) Assured Energy and (4) Operation and Maintenance (O&M) costs, in order to check the financial impact of these on the project.

A **Breakeven Point Analysis** was performed in order to discuss the likelihood of occurrence of these scenarios.

The table 4 presents the main results of the analysis.

Table 4: SHP Itaguaçu sensitivity analysis.

Parameter	Original Value	Breakeven point	% of deviation
Investment (R$)	78,400,000.00	61,622,400.00	- 21.40%
Assured Energy (MWaverage)	8.514	10.15	+ 19.25%
Energy Price (R$/MWh)	146.00	174.10	+ 19.25%
Operation and Maintenance (% on total assets)	3.50	1.11	- 68.20%

Likelihood of occurrence of scenarios of the breakeven point

To achieve the Breakeven point is not considered feasible due to factors which can be viewed below:

Investment (R$)

Regarding the total investment costs, the input values come from the document "Minutes of Extraordinary Board Meeting" from September 30th 2010 and also the document "Correcto Outsourcing´s Offer[9]". Furthermore, in the document "finpchs_BNDES.pdf from 29/08/2007", the average cost price of investment to other SHPs of the same size range in construction in Brazil, has been R$ 5.3 million/MW installed[10] so very similar to the project activity R$ 5.5 million/MW installed (almost 2 years later).

The sensitivity analysis shows that to reach the benchmark, the investment values should have been 21.40% lower than the previously forecasted. Its breakeven point is R$ 61,622,400.00. Fluctuations of this amplitude are not possible to occur.

Thus, the input values are adequate as well conservative.

Assured Energy (MWaverage)

The Assured Energy is 8.514 MWaverage (74,578.5 MWh/year), as described in the document "Minutes of Extraordinary General Meeting" from September 30th 2010. Also the calculation was delivered to the ANEEL in order to be validated from this technical entity. The calculation is based on well established parameters in accordance with the normative rules[11].

To lead the IRR of project activity to reach the applied benchmark, the assured energy of the SHP Itaguaçu should be 10.15 MWaverage (19.25% greater than the established). Since the assured energy is considered a long term average generation it is impossible to occur this level of variation in a long term (during the project lifetime).

Energy Price (R$/MWh)

The energy price value, R$ 146.00/MWh, used in the financial calculations is in the document "Minutes of Extraordinary General Meeting" from September 30th 2010 and can be crosschecked with the Power Purchase Agreement from another SHP presented in the document "CCEI_CERT – 008-2011.pdf" with

[9] Third Party Company
[10] Document "finpchs_BNDES.pdf and in http://www.abimaq.org.br/ceimaq/meta3/download/finpchs.pdf "
[11] Document "Energia Assegurada protocolado na ANEEL.pdf", from August 11th 2011, since the SHP ANEEL new authorization should be done to 14 MW (prior 9 MW), the Assured Energy calculations were delivered to be audited by the ANEEL agency.

the same energy price and signed on the 01/01/2011 (during the Buyer searching, at the time of the investment decision, the energy price is already known). Furthermore, the energy price from the CCEE (Electrical Energy Commercialization Chamber) auction just prior to the investment decision was R$ 133.25 for the higher energy price sold in this action (supplied by a Small Hydro also)[12].

Operational Costs - O&M

This parameter (which comprehends the sum of employees` salaries and maintenance costs) was considered 3.5% of the total asset per year (R$ 2,744,000.00). To achieve the benchmark would be necessary a decrease of 68.20% in this parameter, fluctuation on this level is impossible to occur showing that this is a not sensible enough parameter for this kind of project activity.

In the light of the variations above described, it is possible to verify that for all analyzed parameters the breakeven point overcome the variation margin of 10% determined by CDM as sensitivity indicator. Therefore, fluctuations of this amplitude would not lead the IRR of project activity to reach or overcome the considered benchmark.

The project activity has taken in consideration the revenues of CERs sales for the implantation. These financial benefits generated in strong currency (euro or dollar) bring to the project a better security against monetary depreciations.

Therefore, the project activity is additional.

Table 5: Timeline of SHP Itaguaçu implantation events.

30th September 2010	Investment decision: Meeting minute from the Board Directory
14th December 2010	Starting date : Contract of turbines and hydro mechanicals equipments
10th January 2011	CDM Prior consideration
1st May 2011	Start of SHP construction
31st January 2013	Forecast of start of the Commercial Operation

B.6. Emission reductions

B.6.1. Explanation of methodological choices

Baseline emissions

The baseline emissions are the product of the electricity supplied by the project activity to the grid ($EG_{BL, y, in}$ MWh) multiplied by the baseline emissions factor ($EF_{CO2,grid,y}$, in tCO_2/MWh).

$$BE_y = EG_{BL,y} \cdot EF_{CO2,grid,y}$$

Where:

[12] http://www.ccee.org.br/StaticFile/Arquivo/biblioteca_virtual/Leiloes/3_Reserva/Resultado_completo_3_LER_2013.pdf

BE_y =Baseline Emissions in year *y* (t CO_2e/year)
$EG_{BL,\ y}$ = Quantity of net electricity supplied to the grid as a result of the implementation of the CDM project activity in year *y* (MWh/year)
$EF_{CO2\ grid,\ y}$ = Combined margin CO_2 emission factor for grid connected power generation in year y calculated using the latest version of the "Tool to calculate the emission factor for an electricity system" (tCO_2/MWh).

The Emission Factor can be calculated in a transparent and conservative manner using the combined margin (CM), consisting of the combination of Operating Margin (OM) and Build Margin (BM) according to the procedures described in the "Tool to calculate the Emission Factor for an electricity system".

Thus, from the tool, the emission factor of the grid is $EF_{grid,CM,y}$ which in this case is the same used in the present project activity: $EF_{CO2,grid\ y}$.

Considering that the project activity is based on SHPs, the calculation of the combined margin emissions factor shall use the following default values for w_{OM} and w_{BM}:

w_{OM} = 0.5 and w_{BM} = 0.5 for the first crediting period , and w_{OM} = 0.25 and w_{BM} = 0.75 for the second and third crediting period.

Project Emissions

PD Itaguaçu = 14.22 MW / 0.340 Km^2 = 41.82 W/m^2

Since the SHP Power Density (PD) is higher than $10W/m^2$ (as defined in the ACM0002 methodology).

$PE_y = 0$

PE_y = Project Emission in the year *y*

Leakage

There is no energy transfer from the generating equipments to any other activity outside of project activity boundary. Then the leakage is considered zero.

$L_y = 0$

Emissions Reductions

The emission reduction is calculated as follows:

$ER_y = BE_y - PE_y - L_y$

As $PE_y = 0$ and $L_y = 0$, ER_y is:

$ER_y = BE_y$

B.6.2. Data and parameters fixed ex ante

Data / Parameter	$Cap_{Itaguaçu,y}$
Unit	W
Description	SHP Installed Power after the implementation of the project activity.
Source of data	Project Site
Value(s) applied	14,220,000
Choice of data or Measurement methods and procedures	Technical specification of the generators.
Purpose of data	Calculation of project emissions.
Additional comment	

Data / Parameter	$A_{Itaguaçu,y}$
Unit	m^2
Description	Area of the reservoir measured in the water surface, after the implementation of the project activity, when the reservoir is full.
Source of data	Reservoir in the Project site.
Value(s) applied	340,000
Choice of data or Measurement methods and procedures	Measured from topographical surveys, maps, satellite pictures, etc.
Purpose of data	Calculation of project emissions.
Additional comment	

B.6.3. Ex-ante calculation of emission reductions

The baseline methodology considers the determination of the grid emissions factor which the project activity is connected as the core data to be determined in the baseline scenario. In Brazil, the grid is interconnected by the National Interconnected System (SIN) in a single system.

"Operating Margin *OM* Emission Factor" calculation ($EF_{grid,OM-DD,y}$)

The Emission Factor (OM) calculated by the Dispatch Data Analysis is described below:

$$EF_{grid,OM-DD,y} = \frac{\sum_{h} EG_{PJ,h} \cdot EF_{EL,DD,h}}{EG_{PJ,y}}$$

Where:

$EF_{grid,OM\text{-}DD,y}$ Operating margin CO_2 emission factor in year y (tCO_2/MWh);
$EG_{PJ,h}$ Electricity displaced by the project activity in hour h of year y (MWh);
$EF_{EL,DD,h}$ CO_2 emission factor for power units in the top of the dispatch order in hour h in year y (tCO_2/MWh);
$EG_{PJ,y}$ Total electricity displaced by the project activity in year y (MWh);
h Hours in year y in which the project activity is displacing grid electricity;
y Year in which the project activity is displacing grid electricity.

For effect of Operation Margin emission Factor *ex-ante* calculation, it will be used like a good estimation to the $EF_{grid,OM\text{-}DD,y}$ value, the arithmetic average of the 12 last monthly of the emission factors published by the DNA (ultimate data available: http://www.mct.gov.br/index.php/content/view/333605.html#ancora)

Average Monthly Factor (tCO_2/MWh)												
year	**2011**											
month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
EF	0,2621	0,2876	0,2076	0,1977	0,2698	0,3410	0,3076	0,3009	0,2734	0,3498	0,3565	0,3495

This way, we have that the OM Emission Factor is:

$$\boldsymbol{EF_{grid,OM\text{-}DD,y} = 0.2920}$$

"Build Margin Emission Factor BM" calculation ($EF_{grid,BM,y}$)

According to the used methodology, the Build Margin (BM) Emission Factor, also needs to be calculated, being determined with the formula below:

$$EF_{grid,BM,y} = \frac{\sum_{i,m} EG_{m,y} . EF_{EL,m,y}}{\sum_{m} EG_{m,y}}$$

Where:
$EF_{grid,BM,y}$ Build margin CO_2 emission factor in year y (tCO_2/MWh);
$EG_{m,y}$ Net quantity of electricity generated and delivered to the grid by power unit m in year y (MWh);
$EF_{EL,m,y}$ CO_2 emission factor of power unit m in year y (tCO_2/MWh);
m Power units included in the build margin.

For the build margin emission factor $EF_{grid,BM,y}$ will be adopted the 2011 year value published by the DNA (ultimate data available).

$$\boldsymbol{EF_{grid,BM,y} = 0.1056}$$

"Baseline Emission Factor" calculation ($EF_{grid,CM,y}$)

Finally, the baseline Emission Factor ($EF_{grid,CM,y}$) of the Combined Margin, is calculated through a weighted-average formula, considering both the $EF_{grid,OM-DD,y}$ and the $EF_{grid,BM,y}$ and the weights w_{OM} and w_{BM} (are default 0.5), that gives:

$$EF_{grid,CM,y} = 0.2920 \cdot 0.5 + 0.1056 \cdot 0.5 = 0.1987 \quad (tCO_2/MWh)$$

$$EF_{grid,CM,y} = EF_{CO2,grid,y.}$$

The emissions reduction (**ER**) of this project activity is:

$$ER = BE_y - L_y - PE_y$$

The baseline emissions are proportional to the electricity delivered to the grid throughout the project's lifetime. Baseline emissions are calculated by multiplying the electricity baseline emissions factor ($EF_{grid,CM,y}$) by the electricity generated by the project activity.

$$BE_y = EG_{BL,y} . EF_{CO2,grid,y}$$

The SHP Itaguaçu electricity generation ($EG_{BL,y}$) in the year y is estimated in 74,578.5 MWh/year. Therefore, the baseline emissions will be calculated as follows:

$$BE_y = 74,578.5 \cdot 0.1987 = \mathbf{14,818}\ tCO_2e/\text{ year}$$

To this project, leakages are not considered, thus:
$\boldsymbol{L_y = 0}$

As said previously the project emission is zero:
$\boldsymbol{PEy = 0}$

So, the emission reduction (**ER**) of the project activity is:

$$ER = \mathbf{14,818} - 0 - 0 = \mathbf{14,818\ tCO_2e/year}$$

B.6.4. Summary of ex-ante estimates of emission reductions

Year	Baseline emissions (tCO_2 e)	Project emissions (tCO_2 e)	Leakage (tCO_2 e)	Emission reductions (tCO_2 e)
2013	13,583	0	0	13,583
2014	14,818	0	0	14,818
2015	14,818	0	0	14,818
2016	14,818	0	0	14,818
2017	14,818	0	0	14,818

2018	14,818	0	0	14,818
2019	14,818	0	0	14,818
2020	1,234	0	0	1,234
Total	**103,725**	0	0	**103,725**
Total number of crediting years	7 years, can be renewable for more two periods of 7 years each one.			
Annual average over the crediting period	14,818	0	0	14,818

B.7. Monitoring plan

B.7.1. Data and parameters to be monitored

Data / Parameter	$EG_{Itaguaçu,y}$
Unit	MWh/year
Description	SHP Itaguaçu net electricity delivered to the grid in year y
Source of data	Energy Meters
Value(s) applied	74,578.5
Measurement methods and procedures	The net electricity delivered to the grid will be checked through the energy metering. The datas from the energy meters will be cross checked with the CCEE data bank (Electric Power Commercialization Chamber in Brazil). In case of difference of readings (from CCEE and Itaguaçu) will be considered the lowest for the calculation of CERs from the project. For further details see section B.7.3, item "Data monitoring".
Monitoring frequency	The datas will be filed monthly (electronically) and should be kept for two years after the end of the crediting period or the last issuance of CERs for this project activity, whichever occurs later.
QA/QC procedures	The meters must comply with national standards and industrial regulations to ensure the accuracy. The meters will be sealed for safety after the calibration.
Purpose of data	Calculation of baseline emissions.
Additional comment	

Data / Parameter	$EF_{CO2,grid,,y}$
Unit	tCO_2e/MWh
Description	CO_2 emission factor of the grid electricity in year y
Source of data	Calculated through the data provided by DNA (Designated National Authority). The Brazilian DNA provides the Operating Margin Emission Factor and the Build Margin Emission Factor.
Value(s) applied	0.1987
Measurement methods and procedures	The Emission Factor will be monitored through ex-post calculation, which datas are available by the DNA (Designated National Authority). The Combined Margin is calculated through a weighted-average formula, considering both the $EF_{grid,OM-DD,y}$ and the $EF_{grid,BM,y}$ and the weights w_{OM} and w_{BM} (are default 0.5).
Monitoring frequency	The data will be annually filed (electronic archive) and should be kept for two years after the end of the crediting period or the last issuance of CERs for this project activity, whichever occurs later.
QA/QC procedures	N.A.
Purpose of data	Calculation of baseline emissions.
Additional comment	

Data / Parameter	$EF_{grid,OM-DD,y}$
Unit	tCO_2/MWh
Description	CO_2 Operating Margin emission factor of the grid, in a year *y*
Source of data	Data provided by DNA in year *y*.
Value(s) applied	0.2920
Measurement methods and procedures	The Operating Margin Emission Factor will be collect in the DNA website, which is responsible for this calculation.
Monitoring frequency	The data will be annually filed (electronic archive) and should be kept for two years after the end of the crediting period or the last issuance of CERs for this project activity, whichever occurs later.
QA/QC procedures	N.A.
Purpose of data	Calculation of baseline emissions.
Additional comment	

Data / Parameter	$EF_{grid,BM,y}$
Unit	tCO_2/MWh
Description	CO_2 Build Margin emission factor of the grid, in year *y*
Source of data	Data provided by DNA in year *y*.
Value(s) applied	0.1056
Measurement methods and procedures	The Build Margin Emission Factor will be collect in the DNA website, which is responsible for this calculation.
Monitoring frequency	The data will be annually filed (electronic archive) and should be kept for two years after the end of the crediting period or the last issuance of CERs for this project activity, whichever occurs later.
QA/QC procedures	N.A.
Purpose of data	Calculation of baseline emissions.
Additional comment	

B.7.2. Sampling plan

The datas and parameters monitored in section B.7.1 above are not determined by a sampling approach. The datas are effectively measured.

B.7.3. Other elements of monitoring plan

The project activity procedures for monitoring electricity generation follow the parameters and regulations of the Brazilian energy sector. The National Grid Operator (ONS) and the Electric Power Commercialization Chamber (CCEE) are the entities responsible for the technical requirements of the energy measurement and for the billing. These entities monitoring and approves the energy accurate accounting.

The agent responsible to the measurement system for the billing (SMF from the Portuguese Sistema de Medição para Faturamento) develops the project in accordance with the technical specifications of the measurements for billing, which must include the location of measurement points, panels of measurement, meters and systems for local and remote measurement.

The measurement system shall do the energy measurement and registration. To do that, the meters are installed in the measurement panels, which are located in the control room or measurement cabins. For this system is guaranteed the data inviolability, because the meters are sealed for safety after calibration.

There will have a panel of measurement in the COPEL substation, in the Pitanga city, exclusive for the Itaguaçu SHP, containing two meters (principal and back-up). The panel sends the electricity data dispatched for the grid to CCEE and to Itaguaçu (that may do the reading and monitoring of the datas through its own staff or using a third part equip). See details in the picture below:

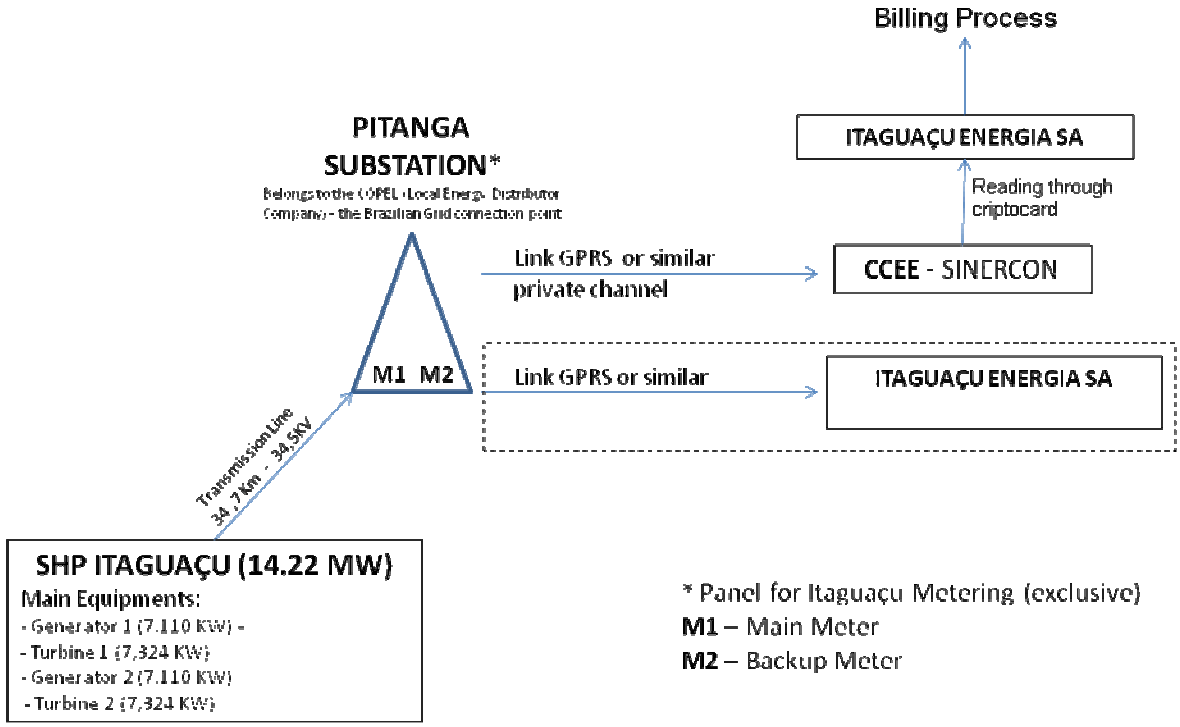


Figure 2 – SHP Itaguaçu connection to the SIN and Electricity monitoring

Data monitoring:

The meters readings are used for the emission reductions. The monitoring steps are as follows:

(1) The data will be measured hourly and recorded monthly;
(2) Spreadsheets containing the electricity delivered to the grid will be generated; the CCEE datas measured will be used to calculate the emissions reduction;
(3) The Itaguaçu will provide Carbotrader the monitored datas from its meters and the CCEE datas measured;
(4) The emission reductions will be managed by the responsible project manager at Carbotrader;

In case of difference of readings (from CCEE and Itaguaçu) will be considered the lowest for the calculation of CERs from the project.

Quality control:

(1) Calibration of meters

The calibration of meters will be conducted by qualified organization that must comply with national standards and industrial regulations to ensure the system accuracy. The periodicity of the calibration will follow the Procedure 12.3[13] of ONS. After calibration, the meters must be sealed for safety. The calibration certificates must be archived with other monitoring records.

[13] http://www.ons.org.br/procedimentos/modulo_12.aspx

The class of accuracy of equipment that will be used in the project activity is under the national standards (NBR 14519 from Associação Brasileira de Normas Técnicas – Brazilian Association of Technical Standards). It can be viewed in the Procedure 12.2[14] of ONS.

(2) Emergency treatment

In case of unavailability of measures from any point of measurement, due to maintenance, commissioning or for any other reason, will be used the methodology to estimate data as the item 14.3 of the Procedure of Commercialization PdC ME.01[15]

Data Management:

All the issues regarding the project activity will be treated by the Itaguaçu Energia S/A Executive Management Sector (to be defined during the plant construction). By now all the SHP construction issue has been conducted by the SHP Board.

An operational structure for the SHP will be assigned and trained before the SHP commercial operation start.

The data will be annually filed (electronic archive) and should be kept for two years after the end of the crediting period or the last issuance of CERs for this project activity, whichever occurs later.

Training Procedures:

All the training necessary for the plant operational team will be provided during the plant construction and during the plant commercial operation. Also a plant operation manual will be created in order to provide assured instructions.
Furthermore, operation, maintenance and calibration procedures will follow the national guidelines set by the National Grid Operator (ONS).

Emission Factors:

The Emission Factor related to this project activity ($EF_{CO2,grid,,y}$,$EF_{grid,OM\text{-}DD,y}$ and $EF_{grid,BM,y}$) as mentioned previously, are provided by the Brazilian DNA and it can be viewed at its website (www.mct.gov.br/clima). Thus, the monitoring of such data will be ex-post through periodic access to data provided by DNA.

SECTION C. Duration and crediting period

C.1. Duration of project activity

C.1.1. Start date of project activity

14/12/2010 Date when the turbines and hydro mechanicals equipments contracts were signed (the first main contracts signed by the Project Participant)

[14] http://www.ons.org.br/procedimentos/modulo_12.aspx
[15] http://www.ccee.org.br/cceeinterdsm/v/index.jsp?vgnextoid=67778d3ef9a3c010VgnVCM1000005e01010aRCRD

C.1.2. Expected operational lifetime of project activity
30 years and 0 months.

C.2. Crediting period of project activity
C.2.1. Type of crediting period
Renewable, being:
01/02/2013 until 31/01/2020 the First crediting Period.
01/02/2020 until 31/01/2027 the Second crediting Period.
01/02/2027 until 31/01/2034 the Third crediting Period.

C.2.2. Start date of crediting period
01/02/2013 (or the registration date, whichever occurs later)

C.2.3. Length of crediting period
7 years and 0 months, can be renewable for more two periods of 7 years and 0 months..

SECTION D. Environmental impacts
D.1. Analysis of environmental impacts
With respect to regulatory permits, Itaguaçu SHP has authorizations emitted by ANEEL:

- Dispatch Nº 405 of 14/05/2004 issued by the ANEEL. Approving the basic project of Itaguaçu SHP.
- Resolution Nº 317 of 01/07/2003 issued by the ANEEL. Authorizing Itaguaçu Energia S/A to establish as an Independent Energy Producer.
- Dispatch Nº 955 of 21/11/2001 issued by the ANEEL. Approving the Simple Inventory Studies of the Pitanga River in the Paraná State.

With respect to environmental permits legislation requires issuing of following licenses:

- **Preliminary License (LP):** preliminary phase of planning activity in which concept and location of enterprise are evaluated. In this phase Environmental Impact Study (EIA) and Environmental Impact Report (RIMA) are analysed, or, depending on the case, the Environmental Control Report (RCA).

- **Installation License (LI):** authorizes implementation of enterprise. In this phase, the Environmental Control Plan (PCA) is analysed, it contains projects for systems of treatment and/or disposing of liquid and atmospheric effluents and solid residue etc.

- **Operation License (LO):** authorizes operation of enterprise after verification of compliance with measures determined in phases of LP and LI.

The Itaguaçu SHP has the following licences to be implemented:

- **LAI 1503/2012** – Environmental Installation License from Paraná Environmental Agency. Issued on 18/05/2012.

- **LAP 30424/2012** – Environmental Preliminary License from Paraná Environmental Agency, issued on 16/05/2012.
- **LAP 1046/2002** – Environmental Preliminary License from Paraná Environmental Agency, issued on 13/11/2002.

The environmental impacts caused by the project activity are considered not significant. The Small Hydropower Plants have as their main feature the construction of a small reservoir.

The Itaguaçu SHP meets all the environmental requirements for its implementation, since it has the Installation Permit issued by the Environmental Agency and meeting ANEEL's norms concerning the display of the simplified hydroelectric inventory studies.

To be issued the Installation Permit, the SHP Itaguaçu Preliminary Environmental Diagnosis was done in order to analyse the undertaking´s implementation area, verifying resulting possible impacts and, lastly, to verify measures to be taken to reduce negative impacts and mitigate or compensate the impacts. Some identified positive impacts, did not deserve optimizing measures due to the fact that they are native to the project's conception whose benefits will be felt as a result of the project´s implementation, i.e. Itaguaçu SHP operation.

A site inspection was performed in addition to the collection of secondary data with the several entities affected by the project in question. This inspection was intended to identify and describe in more deeply the environmental aspects in the area where the Itaguaçu SHP is being installed.

The main environmental impacts identified in the Environmental Diagnosis are: degradation by erosion processes in the areas of loan use, for disposal of rubble, the generation of particulate matter, and water quality. All the measures to mitigate the impacts are covered by the Environmental Diagnosis Report developed.

Positive impacts will be caused by the project, such as the increase in direct and indirect jobs, improvement of public service to the user, improving the operational safety of the electrical system, better quality of energy, riparian forest protection, among others.

The above-mentioned measures will be undertaken together with the SHP construction.

SECTION E. Local stakeholder consultation

E.1. Solicitation of comments from local stakeholders

In accordance to Resolution nº.1, dated 11 September 2003 and Resolution nº7 dated 7 March 2008, of the Inter-Ministry Commission on Global Climate Change (CIMGC), any CDM projects shall send a letter describing the project and request commentaries by local interested parties.

The project activity applies to only one state of the federation, thus, the invitations of comments should be addressed to the following actors involved and affected by the project activities:

- City Hall and City Councils;
- State environmental body and Municipal environmental body;
- Brazilian Forum of NGOs and Environmental and Development Social Movements - http://www.fboms.org.br;
- Community associations;
- State Public Attorney;
- Federal Public Attorney.

In order to satisfy and comply with this ruling the project proponents sent invitation letters describing the project, and requested commentaries by the following interested parties:

- City Hall of Pitanga City;
- City Hall of Boa Ventura de São Roque City;
- City Council of Pitanga City;
- City Council of Boa Ventura de São Roque City;
- Environment Agency of the Paraná State (IAP – Instituto Ambiental do Paraná);
- Environment Agency of the Pitanga City;
- State Public Attorney of the Paraná State;
- Federal Public Attorney;
- Brazilian Forum of NGOs and Environmental and Development Social Movements – FBOMS;
- Rural Workers Union of the Pitanga city and

The interested parties above were invited to present their comments about the project activity. The letters were sent to local stakeholders prior to beginning the process of validation and remain opened for comments from stakeholders.

In the letter forwarded to the stakeholders, they were informed that the Project Design Document, and Annex III to Resolution No. 1 of the Inter-Ministry Commission on the Global Climate Change (CIMGC) are available for viewing on the site of Carbotrader, the participating company in the project activity: www.carbotrader.com in the following links: http://www.carbotrader.com/jun1146a3.pdf and http://www.carbotrader.com/jun1146dcp.pdf. These documents are available for consultation on the website and updated according to the latest or current version.

E.2. Summary of comments received

The Federal Public Attorney sent a letter number 304/2011 – PRM/GP/RGH, in 25 May 2011, requesting the following clarifications:
a) If the project had already been sent to CIMGC
b) Because the pages listed for hosting the PDD and Annex 3 were unavailable
c) If the project has more specific data about their contributions

E.3. Report on consideration of comments received

The Itaguaçu Energia S/A replied the letter mentioned above in 06 June 2011 as follows:
a) In the current stage of the validation process is only necessary to inform the Executive Secretariat of the Interministerial Commission on Global Climate Change about the intention of the project in obtaining revenues from the carbon credit. This communication has been held on 24 January 2011.
b) The web pages were unavailable due to the need for important updates made by the project team Carbotrader (consultant CDM project). To avoid inaccurate information, taken as a precautionary measure to withdraw the project site until its actualization. The links are operating again.
c) More specifics datas on the contribution of the project activity can be seen in Annex 3 available at www.carbotrader.com/jun1146a3.pdf (now working).

SECTION F. Approval and authorization

Not applicable.

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Appendix 1: Contact information of project participants

Organization	Itaguaçu Energia S/A
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State/Region	Paraná
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E-mail	
Website	
Contact person	
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Middle name	
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Appendix 2: Affirmation regarding public funding

There is no public financing for this project activity.

Appendix 3: Applicability of selected methodology

No further information.

Appendix 4: Further background information on ex ante calculation of emission reductions

The CO_2 emission factors resulting from the generation of electricity verified in Brazil's National Interconnected System (SIN) are calculated from the plants power generation records issued centrally by the National Grid Operator, especially in thermoelectric plants. This information is necessary to renewable energy projects connected to the national grid and implemented in Brazil under the Kyoto Protocol's Clean Development Mechanism (CDM).

The baseline emissions are calculated according to the "Tool to calculate the emission factor for an electricity system" version 02.2.1. With this methodology the National Grid Operator (ONS) is tasked with explaining the SIN´s (National Interconnected System) operational practices regulated by the ANEEL to the work group made up by the Ministry of Science and Technology (MCT) and Ministry of Mines and Energy (MME). According to this system, the CO2 Emission Factors applicable to the project activity, will be calculated by the National Grid Operator (ONS) for the single system since May 27, 2008.

More details about baseline development of this project can be found in the link:
http://www.mct.gov.br/index.php/content/view/73318.html.

Appendix 5: Further background information on monitoring plan

Appendix 6: No further information. Summary of post registration changes

Not applicable.

History of the document

Version	Date	Nature of revision
04.1	11 April 2012	Editorial revision to change history box by adding EB meeting and annex numbers in the Date column.
04.0	EB 66 13 March 2012	Revision required to ensure consistency with the "Guidelines for completing the project design document form for small-scale CDM project activities" (EB 66, Annex 9).
03	EB 28, Annex 34 15 December 2006	• The Board agreed to revise the CDM project design document for small-scale activities (CDM-SSC-PDD), taking into account CDM-PDD

		and CDM-NM.
02	EB 20, Annex 14 08 July 2005	• The Board agreed to revise the CDM SSC PDD to reflect guidance and clarifications provided by the Board since version 01 of this document. • As a consequence, the guidelines for completing CDM SSC PDD have been revised accordingly to version 2. The latest version can be found at <http://cdm.unfccc.int/Reference/Documents>.
01	EB 07, Annex 05 21 January 2003	Initial adoption.
Decision Class: Regulatory **Document Type:** Form **Business Function:** Registration		