Project design document form for CDM project activities

(Version 05.0)

PROJECT DESIGN DOCUMENT (PDD)	
Title of the project activity	Ilha Comprida Hydro Power Plant CDM Project Activity
Version number of the PDD	10.1.1
Completion date of the PDD	31/07/2014 This version is different from 10.1 due to a change in the CDM-PDD-FORM version and the fact that the project activity received its Letter of Approval from the Brazilian Government on July 31st 2014. This information was included in Section F of the PDD. The project's additionality and overall emission reductions were not affected.
Project participant(s)	Ilha Comprida Energia S.A. Carbon do Brasil Consultoria Empresarial Ltda.
Host Party	Brazil
Sectoral scope and selected methodology(ies), and where applicable, selected standardized baseline(s)	Sectoral Scope 1 – Energy Industries (Renwable / Non-renewable sources) Approved Methodology ACM0002 – "Grid-connected electricity generation from renewable sources", version 14.0.0
Estimated amount of annual average GHG emission reductions	35,038 tCO_2e

SECTION A. Description of project activity

A.1. Purpose and general description of project activity

The Ilha Comprida Hydro Power Plant CDM Project Activity (hereinafter referred to as “HPP Ilha Comprida”) will explore the renewable hydrological potential of the Juruena River, located near the cities of Sapezal and Campos de Júlio, both on the west region of the State of Mato Grosso, in the Midwest region of Brazil.

The project activity has an installed capacity of 20.16 MW and is expected to generate an average of 159,607 MWh per year, considering 2 Kaplan-type turbines, with vertical axis, and 2 generators units. The project will be connected to the Brazilian National Interconnected System - SIN[1], the national grid managed by the National System Operator (ONS[2]) – as explained on Annex 3 – Baseline Information -, through the sub-station of Parecis with a transmission line of 138 kV. In the absence of the project activity, the baseline scenario would be the continuation of the current situation; the additional electricity generated under the project would be generated in existing and new grid-connected power plants in the electricity system.

The proposed project activity reduces greenhouse gas emissions (GHG) that would have occurred otherwise in the absence of the project activity by avoiding electricity generation by fossil fuel sources in the operating margin and build margin of the system. It is important to highlight that future scenario estimates show an increase in the consumption of fossil fuels, mainly natural gas, based on the Brazilian government’s intention of diversifying the energy supply as presented in its last studies.

According to the Brazilian Decennial Plan for Electric Energy Expansion (2006-2015)[3], developed by the Energy and Mines Ministry, the reference scenario predicts an increase of 69% in the thermal generation supply between 2006 and 2015, against a 40% increase on hydro generation in the same period. As of December 2015, the predicted thermoelectric power supply provided for the Southeast-Midwest region will be 48% of the Brazilian grid, as shown in the figure below.

The countries within the Latin American and Caribbean region expressed their commitment by achieving a target of 10% of renewable energy in relation to the total energy used in the region. Through an initiative from the Ministers of the Environment in 2002 (UNEP-LAC, 2002), a preliminary meeting was held at the World Summit for Sustainable Development in Johannesburg in the same year and, in the final Implementation Plan, published in the meeting, no specific targets or timeframes were stated; however, its importance was recognized for achieving sustainability in accordance with the Millennium Development Goals[4].

[1] http://www.ons.org.br/conheca_sistema/o_que_e_sin.aspx

[2] http://www.ons.org.br/home/

[3] Brazilian Decennial Plan for Electric Energy Expansion (2006-2015). Available in: http://www.epe.gov.br/PDEE/Forms/EPEEstudo.aspx

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

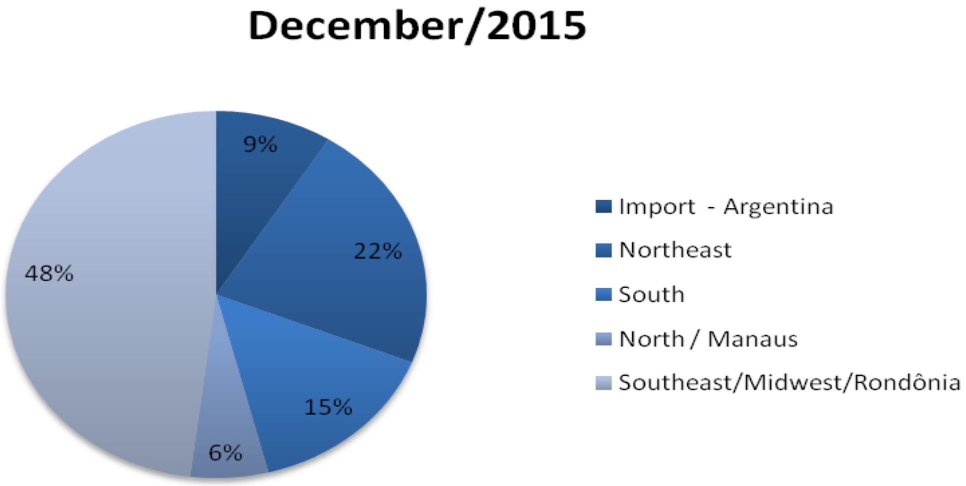

Figure 1 – Thermal Installed Capacity Participation per Subsystem – Reference Scenario
Source: PDE 2006-2015

The Brazilian electric sector privatization process initiated in 1995, when it was undertaken the expectancy of adequate tariffs and better prices for generators. It drew the attention of investors for possible alternatives that were unavailable in the centrally planned electricity market. At the end of the 90's, a strong increase in demand coupled with an under-average increase in installed capacity caused the supply rationing/crisis from 2001/2001. One of the solutions the government offered was flexible legislation favoring small-scale independent electricity producers. Furthermore, occasional eligibility according to the Clean Development Mechanism from the Kyoto Protocol drew investors' attention to hydropower projects.

Scenario existing prior to the implementation of the project activity

The project consists in the installation of a new power plant at a site where no renewable power plant was operated prior to the implementation of the project activity (greenfield plant).

As defined in Section B.4 of this PDD, in the absence of the HPP Ilha Comprida project activity the electricity delivered to the grid would be generated by the operation of grid-connected power plants and by the addition of new generation sources in the Brazilian electricity grid.

The project activity is estimated to deliver an annual average of 35,038 tCO_2e and a total of 245,266 tCO_2e over its renewable crediting period of seven years.

Contribution to sustainable development of the project activity

The proposed project activity aims helping Brazil meet its rising demand for electricity due to the country's economic growth, and to improve the share of renewable electricity sources in the national grid. This renewable and cleaner source of electricity will also have an important contribution to environmental sustainability by reducing GHG emissions by avoiding electricity generation by fossil fuel plants connected to the grid.

The HPP Ilha Comprida will improve the supply of electricity with clean, renewable hydroelectricity while contributing to the regional/local economic development. This development is achieved by reducing our dependence on fossil fuels, thus reducing the amount of pollution and the associated social costs related to it. The project will also contribute towards employment opportunities that will increase in the area where the project is located, for its construction as well as ongoing operation and maintenance of the plant.

A.2. Location of project activity

A.2.1. Host Party

Brazil

A.2.2. Region/State/Province etc.

Mato Grosso

A.2.3. City/Town/Community etc.

Sapezal and Campos de Júlio

A.2.4. Physical/Geographical location

The HPP Ilha Comprida is located on the Juruena River, between the cities of Sapezal and Campos de Julio, both on the west region of the State of Mato Grosso. The location of both cities is presented in Figure 2. According to ANEEL's[5] Dispatch #772 of 17/Oct/2003, the geographical coordinates of the project activity are latitude 13°11'51"S and longitude 58°59'02"W. Figure 3 shows the project location.

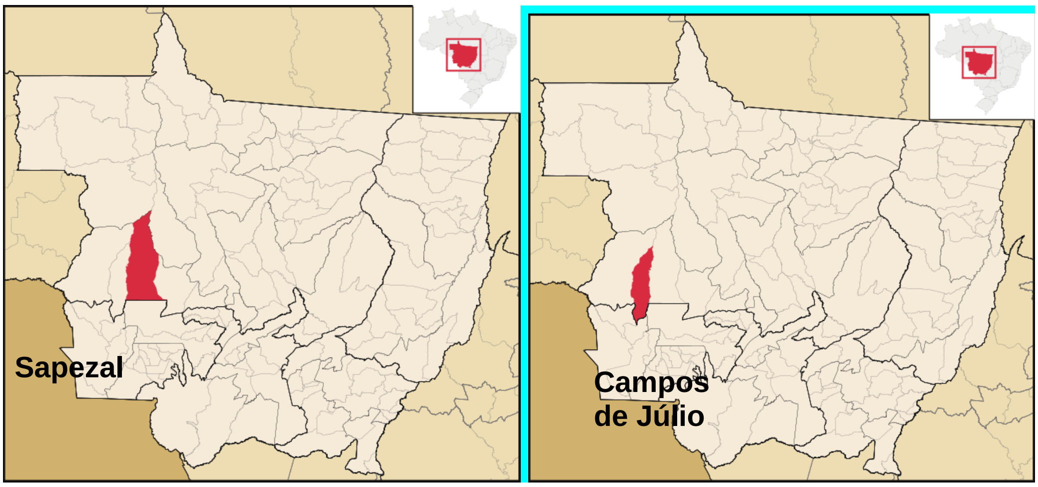

Figure 2 – Sapezal and Campos de Júlio Geographical Location, respectively
Source: http://pt.wikipedia.org/wiki/Ficheiro:MatoGrosso_Municip_Sapezal.svg
http://pt.wikipedia.org/wiki/Ficheiro:MatoGrosso_Municip_CamposdeJulio.svg

[5]ANEEL – Brazilian Electricity Regulatory Agency was created in December 26th, 1996 by Law #9,427 with the mission to provide favorable conditions for the electricity market to develop with a balance between agents and the benefit of society. In its short lifetime, ANEEL has always focused on ensuring balance among the interests of the various sector agents and the consumers, having as its major goal the benefit of society.

Figure 3 – Project's Geographical Location
Source: Google Earth

A.3. Technologies and/or measures

The equipment and technology to be used in the project activity has been successfully applied to similar projects in Brazil and around the world and the project activity complies with Brazilian regulations for HPP projects. Also, the project activity comprises national equipment and, thus, there is no technology or know-how transference. The general arrangement of the HPP Ilha Comprida is shown on Figure 4.

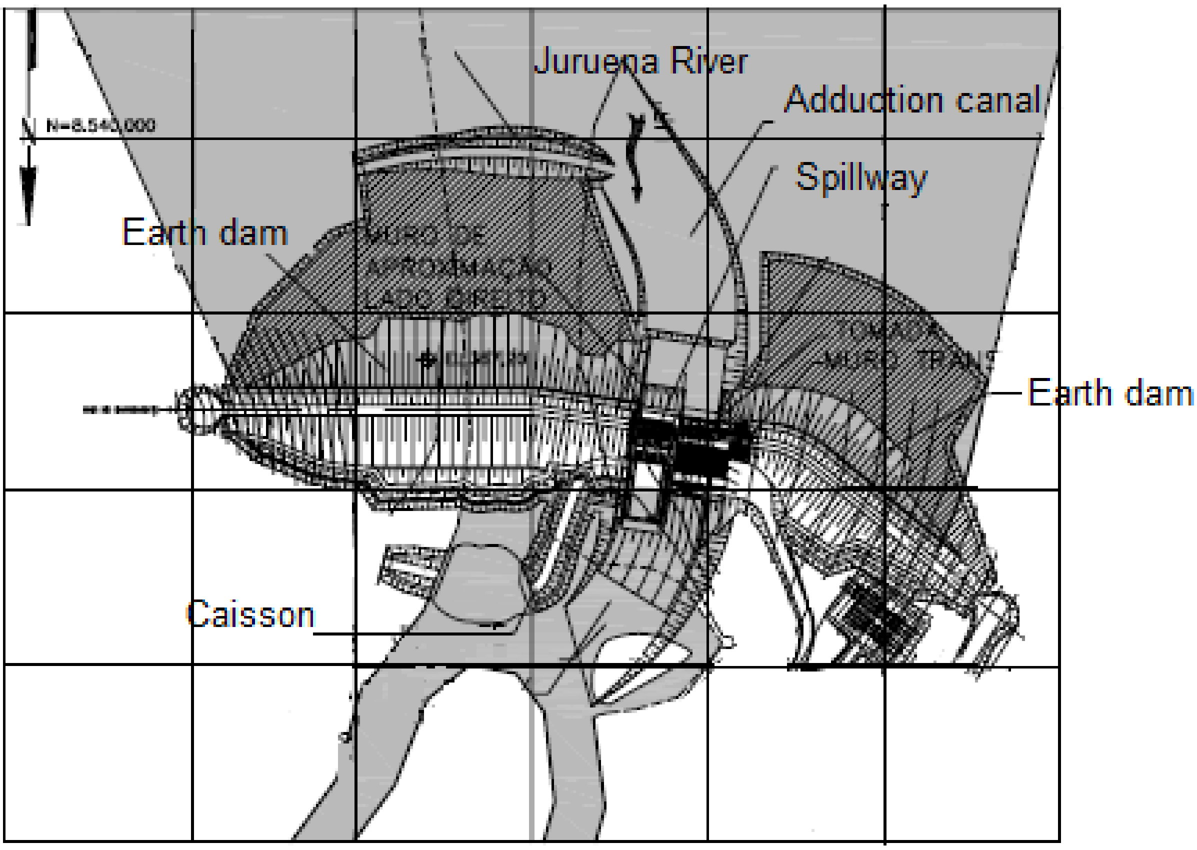

Figure 4 – HPP Ilha Comprida General Arrangement

Description of the project's scenario prior to the implementation of the project activity

The HPP Ilha Comprida consists in the installation of a new power plant at a site where no renewable power plant was operated prior to the implementation of the project activity (greenfield plant).

As justified in Section B.4 of this PDD, the project's baseline scenario is the continuation of the existing situation, where the electricity delivered to the grid would be generated by the operation of grid-connected power plants and by the addition of new generation sources in the Brazilian electricity grid. Therefore, both baseline scenario and the scenario existing prior to the implementation of the project activity are the same.

Description of the project activity

The HPP Ilha Comprida is a greenfield plant that will have an installed capacity of 20.16 MW and will explore the renewable hydrological potential of the Juruena River, with a small reservoir of 2.08 km².

The project's substation will be connected to the Sapezal substation, from which it will be connected to the grid. This substation is also the grid connection point of two other power plants, the HPP Sapezal and HPP Segredo. The electricity is generated by the project activity in a tension of 13.8 kV, which will be elevated in the plant transformer to 138 kV and delivered to grid through the substation of Parecis. The electricity meters will be installed at the output point of the HPP Ilha Comprida.

Equipment to be installed on the project site:

- Turbines: 2 (two) Kaplan, vertical axis
- Generators: 2 (two) Synchronous, vertical axis

The project's equipment will have an estimated operational lifetime of 40 to 60 years. In the manufacturers' datasheet there is no reference to the equipment lifetime, but it is known that hydropower plants may run for as long as 100 years without any change in its equipment. According to the Brazilian Electric Energy Agency (ANEEL – *Agência Nacional de Energia Elétrica*), there are SHPPs running in Brazil for 60 years with the same equipment and in good shape. ANEEL concludes that an operational lifetime of 40 years for SHPP is very acceptable[6].

The project activity has a power density between 4 W/m² and 10 W/m² and, therefore, the emissions of CH_4 from the reservoir are accounted. Additionally, baseline CO_2 emissions from electricity generation in fossil fuel fired power plants in the grid that are displaced due to the project activity are also accounted.

The following tables show the main technical characteristics and equipment of the project activity:

Table 1 – Project's main technical aspects

PARAMETER	PROJECT DATA	REFERENCE
Installed Capacity (MW)	20.16	Purchase Contract #16-2010, of hydro mechanical equipment
Assured Energy (MWavg)	18.22	Consolidated Basic Project
Expected Generation (MWh/year)	159,607	Consolidated Basic Project
Plant Load Factor (%)	90.37	Calculated based on the project's assured energy and installed capacity.
Reservoir Area (km²)	2.08	Consolidated Basic Project
Waterfall (m)	12.55	Consolidated Basic Project
Average Flow per turbine (m³/s)	92.23	Consolidated Basic Project
Low-Voltage Generation (kV)	13.8	Consolidated Basic Project
High-Voltage Generation (kV)	138	Consolidated Basic Project
Adduction Canal Length (m)	235	Consolidated Basic Project

Table 2 – Project's main equipment and technical characteristics

TURBINES	
Type	Kaplan, vertical axis
Units	2
Unit Nominal Flow	92.23 m³/s
Unit Power	10.35 MW
Nominal Rotation	150 rpm
GENERATORS	
Type	Synchronous, vertical axis
Units	2
Nominal Tension	13.8 kV
Nominal Unit Power	11.2 MVA
Power Factor	0.9

[6] Available at page 254 in http://www.aneel.gov.br/aplicacoes/audiencia/arquivo/2006/012/documento/relatorio_vida_util_volume_2.pdf

A.4. Parties and project participants

Table 3 – Project participants

Party involved (host) indicates 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)	Private entity: Ilha Comprida Energia S.A. Private entity: Carbon do Brasil Consultoria Empresarial Ltda.	No.

A.5. Public funding of project activity

There is no public funding from Annex I parties for project activities.

SECTION B. Application of selected approved baseline and monitoring methodology and standardized baseline

B.1. Reference of methodology and standardized baseline

- EB75/Annex 13 - Approved Methodology ACM0002 - "Grid-connected electricity generation from renewable sources" (version 14.0.0);
- EB70/Annex 08 - “Tool for the demonstration and assessment of additionality” (version 07.0.0);
- EB75/Annex 15 - “Tool to calculate Emission Factor for an electricity system” (version 04.0).

For more information about the methodology consult the following link:
http://cdm.unfccc.int/methodologies/PAmethodologies/approved.html

B.2. Applicability of methodology and standardized baseline

The approved methodology ACM0002 version 14.0.0 applies to project activities that include retrofitting, replacement or capacity addition of an existing power plant or construction and operation of a power plant that uses renewable energy sources and supplies electricity to the grid (Greenfield power plant). Thus, the methodology is applicable to grid-connected renewable power generation project activities that (a) install a new power plant at a site where no renewable power plant was operated prior to the implementation of the project activity (greenfield plant); (b) involve a capacity addition; (c) involve a retrofit of (an) existing plant(s); or (d) involve a replacement of (an) existing plant(s).

The methodology is also only applicable under the following conditions:

- The project activity is the installation, capacity addition, retrofit or replacement 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 the case of capacity additions, retrofits or replacements (except for capacity addition projects for which the electricity generation of the existing power plant(s) or unit(s) is not affected): the existing plant started commercial operation prior to the start of a minimum historical reference period of five years, used for the calculation of baseline emissions and defined in the baseline emission section, and no capacity addition or retrofit of the plant has

been undertaken between the start of this minimum historical reference period and the implementation of the project activity.

In case of hydro power plants, at least one of the following conditions must apply:

- The project activity is implemented in an existing single or multiple reservoirs, with no change in the volume of any of the reservoirs; or
- The project activity is implemented in an existing single or multiple reservoirs, where the volume of any of reservoirs is increased and the power density of each reservoir, as per the definitions given in the Project Emissions section, is greater than 4 W/m^2 after the implementation of the project activity; or
- The project activity results in new single or multiple reservoirs and the power density of each reservoir, as per the definitions given in the Project Emissions section, is greater than 4 W/m^2 after the implementation of the project activity.

Also, the methodology states that in case of hydro power plants using multiple reservoirs where the power density of any of the reservoirs is lower than 4 W/m^2 after the implementation of the project activity all of the following conditions must apply:

- The power density calculated for the entire project activity using equation 5 is greater than 4 W/m^2;
- All reservoirs and hydro power plants are located at the same river and where are designed together to function as an integrated project that collectively constitutes the generation capacity of the combined power plant;
- The water flow between the multiple reservoirs is not used by any other hydropower unit which is not a part of the project activity;
- The total installed capacity of the power units, which are driven using water from the reservoirs with a power density lower than 4 W/m^2, is lower than 15 MW;
- The total installed capacity of the power units, which are driven using water from reservoirs with a power density lower than 4 W/m^2, is less than 10% of the total installed capacity of the project activity from multiple reservoirs.

The project is applicable under paragraph (a), once a new power plant at a site where there was no renewable energy power plant operating prior to the implementation of the project activity (greenfield plant) will be constructed, excluding the other alternatives. The project is the installation of a hydro power plant with a run-of-river reservoir, implemented in a single reservoir with a power density higher than 4 W/m^2.

The power density (PD) of the HPP Ilha Comprida is calculated as follows:

$$\boxed{PD = \frac{Cap_{PJ} - Cap_{BL}}{A_{PJ} - A_{BL}}}$$

Where:
PD = Power density of the project activity (W/m^2);
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 single or multiple reservoirs measured in the surface of the water, after the implementation of the project activity, when the reservoir is full (m^2);
A_{BL} = Area of the single or multiple reservoirs measured in the surface of the water, before the implementation of the project activity, when the reservoir is full (m^2). For new reservoirs, this value is zero.

For the HPP Ilha Comprida, the Power Density is demonstrated below:

$$PD = \frac{20{,}160{,}000 - 0}{2{,}080{,}000 - 0}$$

$$PD = \frac{20{,}160{,}000}{2{,}080{,}000}$$

PD = 9.69 W/m²

The project's power density is higher than the eligible limit of 4 W/m² established by the methodology. Therefore, the approved methodology ACM0002 "Grid-connected electricity generation from renewable sources", version 14.0.0, is applicable to the project activity.

B.3. Project boundary

Table 4 – Emission sources included in or excluded from the project boundary

<table>
<tr><th colspan="2">Source</th><th>GHGs</th><th>Included?</th><th>Justification/Explanation</th></tr>
<tr><td rowspan="3">Baseline scenario</td><td rowspan="3">CO_2 emissions from electricity generation in fossil fuel fired power plants that are displaced due to the project activity</td><td>CO_2</td><td>Yes</td><td>Main emission source</td></tr>
<tr><td>CH_4</td><td>No</td><td>Minor emission source</td></tr>
<tr><td>N_2O</td><td>No</td><td>Minor emission source</td></tr>
<tr><td rowspan="9">Project scenario</td><td rowspan="3">For geothermal power plants, fugitive emissions of CH_4 and CO_2 from non-condensable gases contained in geothermal steam.</td><td>CO_2</td><td>No</td><td>Minor emission source</td></tr>
<tr><td>CH_4</td><td>No</td><td>Minor emission source</td></tr>
<tr><td>N_2O</td><td>No</td><td>Minor emission source</td></tr>
<tr><td rowspan="3">CO_2 emissions from combustion of fossil fuels for electricity generation in solar thermal power plants and geothermal power plants</td><td>CO_2</td><td>No</td><td>Minor emission source</td></tr>
<tr><td>CH_4</td><td>No</td><td>Minor emission source</td></tr>
<tr><td>N_2O</td><td>No</td><td>Minor emission source</td></tr>
<tr><td rowspan="3">For hydro power plants, emissions of CH_4 from the reservoir</td><td>CO_2</td><td>No</td><td>Minor emission source</td></tr>
<tr><td>CH_4</td><td>Yes</td><td>Main emission source</td></tr>
<tr><td>N_2O</td><td>No</td><td>Minor emission source</td></tr>
</table>

According to the latest version of the methodology ACM0002, the spatial extent of the project boundary includes the project power plant and all power plants connected physically to the electricity system that the CDM project power plant is connected to.

The spatial extent of the project boundary is depicted in the figure below:

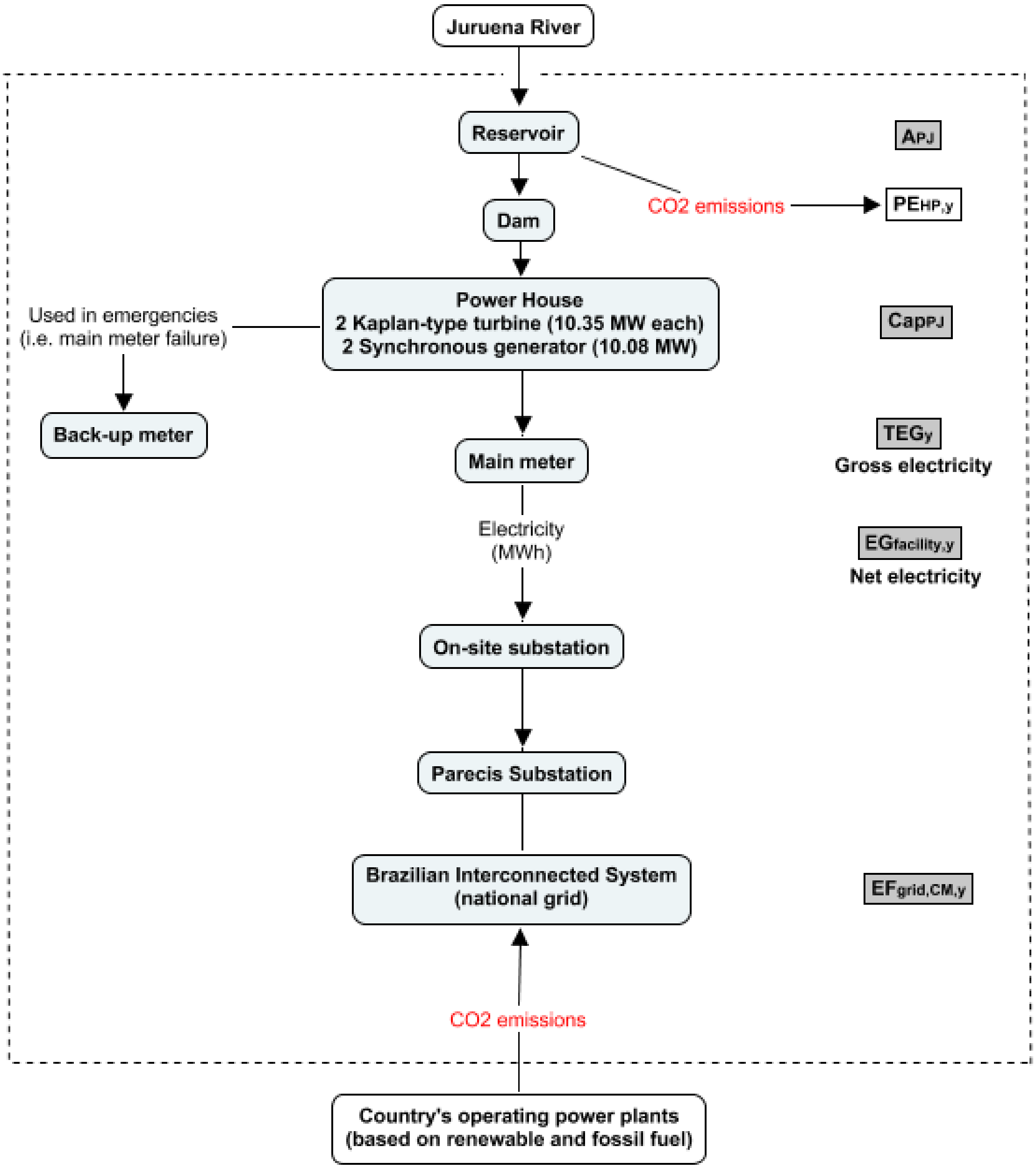

Figure 5 – Project Boundary

As shown in the figure above, the project boundary is the area where the project is located, which contains the area of the reservoir and its dam, the powerhouse which includes the main equipment such as turbines and generators, the hydropower substation and its connection with the grid.

It must be noted that the Brazilian Designated National Authority, the Interministerial Global Climate Change Comission (*Comissão Interministerial de Mudança Global do Clima* - CIMGC) has adopted a single electric system, the Brazilian National Interconnected System (*Sistema Interligado Nacional* - SIN) through the Resolution nº 8, of 26/May/2008[7], under which it was established that the SIN Emission Factor shall be regularly determined and published by the CIMGC.

[7] http://www.mct.gov.br/upd_blob/0024/24719.pdf

B.4. Establishment and description of baseline scenario

According to ACM0002, if the project activity is the installation of a new grid-connected renewable power plant/unit, the baseline scenario is the following:

> Electricity delivered to the grid by the project activity 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 the "Tool to calculate the Emission Factor for an electricity system".

According to ACM0002, the baseline emissions include only CO_2 emissions from electricity generation in fossil fuel fired plants that are displaced due to the project activity. The methodology assumes that all project electricity generation above baseline levels would have been generated by existing grid-connected power plants and the addition of new grid-connected power plants. The baseline emissions are calculated as follows:

$$\mathbf{BE_y = EG_{PJ,y} * EF_{grid,CM,y}}$$

Where:
BE_y = Baseline emissions in year y (tCO_2/yr);
$EG_{PJ,y}$ = Quantity of net electricity generation that is produced and fed into the grid as a result of the implementation of the CDM project activity in year *y* (MWh/yr);
$EF_{grid,CM,y}$ = 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 as follows:

(a) A combined margin (CM), consisting of the combination of operating margin (OM) and build margin (BM) according to the procedures prescribed in the "Tool to calculate the Emission Factor for an electricity system" or;
(b) The weighted average emissions (in tCO_2/MWh) of the current generation mix. The data of the year in which project generation occurs must be used. Calculations shall be based on data from an official source (where available) and made publicly available.

The combined margin Emission Factor of the Brazilian grid is calculated according to the "Tool to calculate the Emission Factor for an electricity system" by the National Science and Technology Ministry[8]. The CO_2 Emission Factors for electricity generation on the grid, necessary for the CM calculation, are calculated based on the generation record of plants centrally dispatched by the National System Operator - ONS[9]. Therefore, the CM Emission Factor for the grid will be used to calculate the emission reductions of the project.

[8] http://www.mct.gov.br/index.php/content/view/72764.html

[9] http://www.ons.org.br/institucional/o_que_e_o_ons.aspx

B.5. Demonstration of additionality

As per the Glossary of CDM Terms, the starting date of a CDM project activity is the earliest date in which either the implementation, construction or real action of a project activity begins.

The project activity's starting date is 17/Dec/2010, date in which the hydro mechanical equipment contract was signed with Andritz Hydro Inepar do Brasil S/A[10].

Early consideration of CDM and continuing CDM activity

According to the Clean Development Mechanism Project Cycle Procedure (version 04.0), "for project activities with a starting date on or after 2 August 2008, the project participant must inform a Host Party designated national authority (DNA) and the UNFCCC secretariat in writing of the commencement of the project activity and of their intention to seek CDM status". Considering this, a letter was sent to the UNFCCC secretariat on 18/Sep/2009, which was received in 11/Dec/2009, and to the Brazilian DNA on 30/Mar/2009.

The following table summarizes the most important and relevant dates for the project activity:

Table 5 – Relevant dates for the project activity

EVENT	DATE
Brazilian DNA Communication	30/Mar/2009
EB/CDM Communication	18/Sep/2009
EB/CDM Receipt of PPs Communication	11/Dec/2009
Starting date of the project activity	17/Dec/2010
PDD Publication at UNFCCC's website	25/Oct/2011

Additionality

As per ACM0002, version 14.0.0, the project's additionality was demonstrated according to the "Tool for the demonstration and assessment of additionality", version 07.0.0, which provides a step-wise approach to demonstrate and assess additionality, including the following:

- Step 0 Demonstration whether the proposed project activity is the first-of-its-kind;
- Step 1 Identification of alternatives to the project activity;
- Step 2 Investment analysis;
- Step 3 Barrier analysis; and
- Step 4 Common practice analysis.

Step 0 Demonstration whether the proposed project activity is the first-of-its-kind

As per the "Tool", this step is optional and, if not applied, it shall be considered that the proposed project activity is not the first-of-its-kind.

Thus, the project activity is not the first-of-its-kind.

[10] Contract #16/2010 IC: Particular Instrument of Equipment, Services and Other Acquisitions

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

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

As demonstrated in Section B.4, as per ACM0002 if the project activity is the installation of a new grid-connected renewable power plant/unit, the baseline scenario is the following:

> Electricity delivered to the grid by the project activity 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 the "Tool to calculate the Emission Factor for an electricity system".

The alternatives considered to the project activity are the following:

- **Alternative 1: The project activity not implemented as a CDM project**

  This option is in compliance with the Brazilian legislation and is not prevented by any technical barriers. However, according to the Investment Analysis in section B.5, this alternative is not financially attractive and cannot be considered a feasible baseline scenario.

- **Alternative 2: Other realistic and credible alternative scenario(s) to the proposed CDM project activity scenario that deliver outputs services (e.g. cement) or services (e.g. electricity, heat) with comparable quality, properties and application areas, taking into account, where relevant, examples of scenarios identified in the underlying methodology**

  The project owner only develops energy plants that use hydroelectricity and, therefore, there are no other realistic and credible alternative scenario(s) available to the proposed CDM project activity.

- **Alternative 3: The continuation of the current situation,** i.e. to use all power generation equipment that was already in use prior to the implementation of the project activity and undertaking business as usual maintenance. The additional power generated under the project would be generated in existing and new grid-connected power plants in the electricity system.

  The electricity would continue to be generated by the present generators operating for the grid. There is no technical or economic barrier to achieve this scenario, which is allowed by Brazilian laws and regulations. Therefore, the only realistic alternative to the Project and hence the baseline is this option.

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

All scenarios identified in Sub-step 1a comply with existing legal framework. As per the "Tool for the demonstration and assessment of additionality", project participants may choose to proceed with Step 2: Investment analysis or Step 3: Barrier analysis.

OUTCOME OF STEP 1: Two different scenarios were identified as plausible alternative baseline scenarios to the project activity and both of them comply with existing legal framework.

Step 2: Investment Analysis

Determine whether the proposed project activity is not:

a) The most economically or financially attractive; or
b) Economically or financially feasible, without the revenue from the sale of certified emission reductions (CERs).

Sub-step 2a: Determine appropriate analysis method

1) Determine whether to apply simple cost analysis, investment comparison analysis or benchmark analysis (Sub-step 2b). If the CDM project activity and the alternatives identified in Step 1 generate no financial or economic benefits other than CDM related income, then apply the simple cost analysis (Option I). Otherwise, use the investment comparison analysis (Option II) or the benchmark analysis (Option III).

The alternatives identified in section B.4 generate financial/economic benefits other than CDM related income, since the project's main revenue comes from electricity generation. A benchmark analysis (Option III) was selected to perform the investment analysis in order to assess and demonstrate project's additionality.

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

In order to analyze investment barriers, the Weighted Average Capital Cost was calculated as a benchmark to be compared with the project's financial indicator, the Internal Rate of Return (IRR).

The "Tool for Demonstration and Assessment of Additionality" offers as guidance on using valid benchmarks:

> *In cases where a benchmark approach is used the applied benchmark shall be appropriate to the type of IRR calculated. Local commercial lending rates or weighted average costs of capital (WACC) are appropriate benchmarks for a project IRR*

And further:

> *Internal company benchmarks/expected returns (including those used as the expected return on equity in the calculation of a weighted average cost of capital - WACC), should only be applied in cases where there is only one possible project developer and should be demonstrated to have been used for similar projects with similar risks, developed by the same company or, if the company is brand new, would have been used for similar projects in the same sector in the country/region.*

Sub-step 2c: Calculation and comparison of financial indicators (only applicable to Options II and III)

The WACC is defined as:

$$\mathbf{WACC = k_e * r_e + k_d * r_d * (1 - T)}$$

Where:

WACC	Weighted Average Capital Cost
k_e	Weight of equity
r_e	Cost of Equity
k_d	Weight of debt
r_d	Cost of debt (Interest rate charged by lenders)
T	Taxes over project (income related taxes)

The model generally accepted by academics and companies to define the risk associated with an investment, and consequently to define the appropriate equity earnings, is the Capital Asset Pricing Model (CAPM), which assesses the minimum return that an asset should offer the investor, based on the non-diversified (or systematic) risk associated with it.

The WACC was calculated post-tax and in real terms. Please see its specific calculation below:

The cost of Equity (Re) using CAPM is defined as follows:

$$\mathbf{Re = Rf + \beta\ x\ (Rm -}$$

Where:
Rf: Risk Free Rate;
β: Investment risk compared to the market;
(Rm – Rf): Market Risk Premium

The risk free rate (Rf) is a theoretical rate of return attributed to an investment with no risks, representing the interest on an investor's money that one would expect from an absolutely risk-free investment over a certain period of time (e.g. government bonds). For the purpose of calculating the risk free rate, the National Treasury Notes – Series C (NTC-C) with a maturity in 2031 was used.

To the Benchmark was considered 6 entire years average (from January 2005 to December 2010) of the
National Treasury Notes – Series C (NTN-C) with maturity in the 2031 year. The NTN-C Brazilian government bonds were used in the WACC calculation as the risk free rate, considering its values for a 6 year period, as per EB 62 Meeting, Annex 5 – Guidelines on the assessment of investment analysis (version 05).

The historic values of the NTN-C bonds can be verified in the website in http://www.tesouro.fazenda.gov.br and the values between 2005 and 2010 are as follows:

Table 6 – NTN-C bonds value

Year	NTN-C
2005	5.24%
2006	21.43%
2007	22.67%
2008	10.45%
2009	15.99%
2010	24.58%
6-year average	**16.73%**

In order to calculate the risk free rate in real terms, the inflation rates of the country were subtracted from the NTN-C bonds. The historic series of the annual inflation rates can be verified in the following link http://www.portalbrasil.net/igpm.htm and the average values calculated between 2005 and 2010 are as follows:

Table 7 – Inflation annual rates

Year	Inflation Rate
2005	1.20%
2006	3.84%
2007	7.74%
2008	9.80%
2009	(1.71%)
2010	11.32%
6-year average	**5.37%**

The investment risk compared to the market (β) is a measure of a stock's price volatility regarding an overall market. In the case of the project activity, β was calculated as a 6-year average of the values calculated by the corporate finance professor Mr. Aswat Damodaran[11]. The values selected to the calculation of such average correspond to the betas of electricity generation companies in Brazil and are available at the website http://pages.stern.nyu.edu/~adamodar/ (please, click on the left menu on "Updated Data" and scroll down until the second table that appears on the page, and select to download the files for "Emerging Markets").

The average beta of such companies in the country between 2005 and 2010 are as follows:

Table 8 – BETA annual average rate

Year	BETA (average rate)
2005	0.80
2006	0.89
2007	1.04
2008	Not available
2009	0.73
2010	0.68
6-year average	**0.82**

[11] http://pages.stern.nyu.edu/~adamodar/

The market risk premium (Rm – Rf) represents the returns investors expect over and above the risk free rate (Rf). This rate was also calculated as a 6-year average and used the values calculated by professor Mr. Aswat Damodaran. The values selected to the calculation of such average correspond to the Brazilian market risk premium, which can be verified in the website http://pages.stern.nyu.edu/~adamodar/ (please, click on the left menu on "Updated Data" and scroll down until the fourth table "Data Sets" and select the files under the topic "Discount Rate Estimation" - "Risk Premiums for Other Markets").

The average of the Brazilian market risk premium between 2005 and 2010 are as follows:

Table 9 – Market Risk Premium annual average rate

Year	Rm - Rf (average rate)
2005	10.20%
2006	8.66%
2007	7.79%
2008	9.50%
2009	7.50%
2010	8.00%
6-year average	**8.61%**

Thus, the cost of equity (Re) is:

Re = Rf + β x (Rm -

Re = 11.36% + 0.82 * 8.60%

Re = 11.36% + 7.05%

Re = 18.41%

BNDES, a state-owned bank, is in practice the only source of finance for infrastructure projects in Brazil. This bank offers long term financing at subsidized cost. According to the bank:

> *Support for solutions to infrastructure problems is of major importance, as this is fundamental to improving the well-being of the Brazilian population. Consequently, it is possible that all citizens gain access to basic services, such as electricity, communications, urban public transport and sanitation. At the same time, the expansion of infrastructure fosters a drop in costs, an increase in productivity, improvement in the quality of goods and services within the production structure, and consolidation of regional integration.*

There is a special line for power generation projects[12] in which the interest rate is the sum of:

a) Financial cost: TJLP (long term interest rate) is the bank's official rate and established quarterly according to the inflation expectation for a given period[13]. The average value in the last 2 years is 6.0%.

b) Bank remuneration: 0.9% for power plants except fossil-fuel fired thermal ones[14]; and

c) Credit risk rate: the Brazilian National Development Bank (*Banco Nacional de Desenvolvimento* – BNDES) defines that the credit risk rate in the country varies between 0 and 3.57%[15]. This rate is a margin to cover non-performing loans and the value applied for the project activity case was 3.57%.

Also, it finances up to 70% of the total investment usually with a 10-year amortization period. Therefore, the cost of debt can be taken as:

$r_d = 6\% + 0.9\% + 3.57\%$

$r_d = 10.47\%$

and k_e and k_d are respectively 30% and 70%.

Brazilian tax regulations allow for two modalities called presumed and actual profit. The project activity uses the presumed profit system.

The WACC is, therefore, 10.36.

The basic parameters for the financial indicators calculation of the project activity and the project's cash flow are presented below. The original spreadsheet which contain sensitive information are being available to the DOE, DNA and EB/CDM.

---

[12] http://www.bndes.gov.br/SiteBNDES/bndes/bndes_pt/Institucional/Apoio_Financeiro/Produtos/FINEM/

[13] www.bndes.gov.br/SiteBNDES/bndes/bndes_pt/Institucional/Apoio_Financeiro/Custos_Financeiros/Taxa_de_Juros_de_Longo_Prazo_TJLP/
index.html

[14] www.bndes.gov.br/SiteBNDES/bndes/bndes_pt/Institucional/Apoio_Financeiro/Custos_Financeiros/Taxa_de_Juros_de_Longo_Prazo_TJLP/

index.html

[15] www.bndes.gov.br/SiteBNDES/bndes/bndes_pt/Institucional/Apoio_Financeiro/Custos_Financeiros/Taxa_de_Juros_de_Longo_Prazo_TJLP/

index.html

Table 10 – Project's basic financial parameters

Parameter	Project data	Reference
Installed capacity (MW)	20.16	Purchase Contract #16-2010 of hydro mechanical equipment
Annual On-grid Supply (MWh)	159,607	Consolidated Basic Project
Project lifetime (years)	20 years and 11 months	ANEEL Resolution #742 of 18/Dec/2002
PPA Price (R$)	125.00	PPA Offer
Total investment (R$)	158,985,229.46[16]	Eletrobras Standard Budget Spreadsheet
IRR (%)	6.92	Cash Flow spreadsheet
O&M Costs (R$/MWh)	7.00	SHPP Divisa O&M Contract #88-2010

The IRR (Internal Rate of Return) of the project activity, without the benefit from the CERs sale, was lower than the WACC rate for the period. Therefore, the HPP Ilha Comprida project activity is not the most financially attractive option, once its IRR is 6.92%, which is lower than the selected benchmark WACC of 10.36%.

As per the "Tool for Demonstration and Assessment of Additionality", if Option III (benchmark analysis) is used and if the CDM project activity has a less favorable indicator (e.g. lower IRR) than the benchmark, then the CDM project activity cannot be considered as financially attractive.

Thus, the HPP Ilha Comprida project activity is not financially attractive.

Sub-step 2c is satisfied.

Sub-step 2d: Sensitivity analysis (only applicable to Options II and III)

In order to show that the conclusion regarding the financial attractiveness is robust to reasonable variations, the following four parameters were selected to perform a sensitivity analysis:

- Total investment;
- O&M Costs;
- PPA (Power Purchase Agreement) price; and
- Electricity generation.

The impact on the project IRR is shown below, when the five parameters fluctuate in the range of -20% to +20%, as per the "Tool for the Demonstration and Assessment of Additionality" Annex: Guidance on the Assessment of Investment Analysis, version 2.

[16] The project's total investment is higher than the market value due to its specific characteristics. The project activity is located in the Amazon Basin, in a region where there are high levels of precipitation that vary between 2,000 and 3,000 mm per year. Also, the region's topography is mainly flat, with few expressive falls resulting that the project has a low water fall for its energetic use. Further, the area also has a great hydrography, presenting a large drainage area of 4.961 km². Consequently, the water inflow of the project is also high. In the project's case, the maximum turbine flow is high in a way that results in a use of almost 90% of the water inflow for producing electricity, with an optimum use of such flow. Thus, the turbines and dam size increase considerably, raising the project's overall investment as well. The high drainage area also interferes in the dam crest length. It is in this context that the project activity uses Kaplan-type turbines in order to provide the best energy use of the river's water inflow. This type of turbine, however, has a much higher cost than other types usually used (i.e. Francis and Pelton), resulting that the overall investment of the power plant is higher than other similar projects build in the country. Further, the high drainage area makes it necessary to increase the dam crest height, making the civil works also more expensive in project's case when compared to other power plants that are located in regions less flat and with a lower drainage area that don't need such big dams to create a reservoir or floodgates enough to support the water inflow that will be transferred. Thus, it is understood that the investment for the construction of the project activity is higher than the market value due to the technicalities of the plant, which seek the best possible arrangement with the difficulties mentioned above. All these criteria make the investment of the power plant more significant due to the need to use specific turbines to generate electricity from high water inflows and low fall heights, and the need for civil works for the construction of larger dams with a length greater than what is usually constructed.

Sensitivity Analysis of project IRR, without the CDM benefits

Table 11 – Investment analysis

Investment		
Variation	**IRR**	**R$**
-21.75%	10.36%	124,405,942.05
-20%	10.03%	127,188,183.56
-10%	8.35%	143,086,706.51
-5%	7.61%	151,035,967.98
0%	6.92%	158,985,229.46
5%	6.28%	166,934,490.93
10%	5.68%	174,883,752.40
20%	4.60%	190,782,275.35

Table 12 – O&M Costs analysis

O&M		
Variation	**IRR**	**R$**
-100%	7.77%	-
-20%	7.09%	5.60
-10%	7.01%	6.30
-5%	6.96%	6.65
0%	6.92%	7.00
5%	6.88%	7.35
10%	6.83%	7.70
20%	6.74%	8.40

Table 13 - PPA analysis

PPA		
Variation	**IRR**	**R$**
-20%	3.84%	100.00
-10%	5.43%	112.50
-5%	6.19%	118.75
0%	6.92%	125.00
5%	7.63%	131.25
10%	8.32%	137.50
20%	9.64%	150.00
25.60%	10.36%	157.00

Table 14 – Electricity Generation analysis

Electricity Generation		
Variation	**IRR**	**MWh/year**
-20%	4.05%	127,685.60
-10%	5.53%	143,646.30
-5%	6.23%	151,626.65
0%	6.92%	159,607.00
5%	7.58%	167,587.35
10%	8.23%	175,567.70
20%	9.48%	191,528.40
27.35%	10.36%	203,259.51

The red lines indicate the break-even points between the project's IRR and the WACC benchmark. Please note that in the fixed and variable costs evaluation, the variation necessary to equal projects IRR with the selected benchmark is extremely elevated. Furthermore, as can be seen, the project's IRR is only higher than the benchmark in the following situations:

Investment reduction: When examining the project's investment, a 20% reduction leads to an IRR that is still below the WACC. The likelihood of the occurrence of such a scenario is improbable.

O&M Costs: When examining the project's O&M costs, a 20% reduction leads to an IRR that is still below the WACC. The likelihood of the occurrence of such a scenario is improbable.

PPA Price: When examining the project's PPA price, a 20% increase leads to an IRR that is still below the WACC. The likelihood of the occurrence of such a scenario is improbable.

Electricity Generated: With a 20% increase in the project's electricity generation, the IRR is still below the WACC and the likelihood of the occurrence of such a scenario is improbable.

The sensitivity analysis confirms that the HPP Ilha Comprida is not financially attractive and thus faces significant financial barriers.

Sub-step 2d is satisfied.

OUTCOME OF STEP 2: As demonstrated throughout step 2, the project's IRR is lower than the selected benchmark. Therefore, the HPP Ilha Comprida project activity is not financially attractive and faces significant financial barriers.

Step 4. Common practice analysis

This step requires the analysis of any other activities that are operational and that are similar to the proposed project activity. According to the "Tool for the demonstration and assessment of additionality" and the "Guidelines on common practice" (version 02.0), projects are considered similar if they are in the same country/region and/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.

Other CDM project activities (registered project activities and project activities which have been published on the UNFCCC website for global stakeholder consultation as part of the validation process) are not to be included in this analysis. It should be provided documented evidence and, where relevant, quantitative information. On the basis of that analysis, it should be described whether and to which extent similar activities have already diffused in the relevant region.

The following steps are used as per the "Tool" to define similar power plants to the proposed project activity:

- **STEP 1:** Calculate applicable output range as +/-50% of the design output or capacity of the proposed project activity.

The HPP Ilha Comprida has an installed capacity of 20.16 MW and, thus, the power plants were only considered if they have a capacity ranging between -50% and +50% regarding the projects' installed capacity (between 10.08 MW and 30.24 MW).

- **STEP 2:** In the applicable geographical area, identify all plants that deliver the same output or capacity, within the applicable output range calculated in Step 1, as the proposed project activity and have started commercial operation before the start date of the project. Note their number Nall. Registered CDM project activities and projects activities undergoing validation shall not be included in this step.

As defined in the "Tool", the applicable geographical area to be analyzed in the common practice analysis covers the entire host country as a default. All the operating power plants in Brazil that were considered in the common practice analysis can be verified in ANEEL's Generation Data Base, available at: http://www.aneel.gov.br/aplicacoes/capacidadebrasil/capacidadebrasil.cfm.

By the time this analysis was developed, there were 2,619 hydro power plants operating in the country[17] that were analyzed in this step, as follows:

[17] Access in 07/05/2012. This number considers 379 Hydro Generating Centrals, 428 Small Hydro Power Plants and 181 Hydro Power Plants, as expressed in Table 15.

Table 15 - Current Brazilian operating power plants
Source: http://www.aneel.gov.br/aplicacoes/capacidadebrasil/capacidadebrasil.cfm

Type	Quantity	Total Capacity (MW)	%
CGH (Hydro Generating Central)	379	224.98	0.19
EOL (Eolic Generating Central)	75	1,615.34	1.29
PCH (Small Hydro Power Plant)	428	4,059.64	3.38
UFV(Photovoltaic Power Plant)	8	5.49	0.00
UHE (Hydro Power Plant)	181	81,943.06	66.65
UTE (Thermal Power Plant)	1,546	32,947.28	26.78
UTN (Thermonuclear Power Plant)	2	1,990.00	1.70
Total	**2,619**	**122,785.80**	**100**

The HPP Ilha Comprida project activity starting date is 17/Dec/2010, date in which the hydro mechanical equipment contract was signed with Andritz Hydro Inepar do Brasil S/A. Therefore, the power plants analyzed were only considered similar to the project activity if they started their commercial operation before 17/Dec/2010.

The commercial operation starting date of all the power plants analyzed in this step[18] were verified in ANEEL's website, available at the following link: http://www.aneel.gov.br/area.cfm?idArea=37 (please, open the files in the "ACOMPANHAMENTO DA EXPANSÃO DA OFERTA DE GERAÇÃO DE ENERGIA ELÉTRICA" title). Those power plants that are not listed on the file were automatically considered in the common practice analysis in a conservative manner.

From the 988 hydro power plants in operation in the country, only 149 fit the criteria stated above. From these, 56 are registered or in validation under the CDM. Thus, N_{all} = 93.

Table 16 – Similar power plants within the criteria established in Steps 1 and 2

Type	Quantity	Total capacity (MW)	%
PCH	64	1,362.11	69.04
UHE	29	610.86	30.96
Total	**93**	**1,972.97**	**100**

The original spreadsheet with all power plants analyzed is available to the DOE.

[18] Available at ANEEL's Generation Data Base, available at: http://www.aneel.gov.br/aplicacoes/capacidadebrasil/GeracaoTipoFase.asp?tipo=0&fase=3. Access in 07/05/2012.

- **STEP 3:** Within plants identified in Step 2, identify those that apply technologies different that the technology applied in the proposed project activity. Note their number Ndiff.

As defined in paragraph 9 of the "Tool", different technologies in the context of common practice are technologies that deliver the same output and differ by at least one of the following (as appropriate in the context of the measure applied in the proposed CDM project and applicable geographical area):

(a) Energy source/fuel

HPP Ilha Comprida generates renewable energy through hydroelectricity. All power plants analyzed in Table 16 generates hydroelectricity as well.

(b) Feed stock: not applicable;

(c) Size of installation (power capacity): micro; small; and large

In Brazil, hydro power plants with an installed capacity ranging between 1 MW and 30 MW are considered small, and those with a capacity above 30 MW are considered large[19]. Therefore, the 29 large hydropower plants presented in Table 16 are not considered similar to the project activity. Thus, only 64 SHPPs remain to be studied as similar to HPP Ilha Comprida.

(d) Investment climate in the date of the investment decision, inter alia:

i. Access to technology;

The SHPPs that are considered similar to the project (presented in Table 16) have the same conditions to access to technology and, therefore, this criteria was not used to establish any differences between them.

ii. Subsidies or other financial flows;

The Brazilian National Development Bank (*Banco Nacional de Desenvolvimento Econômico e Social* - BNDES) is the major provider of long-term loans in the country; it supplies the financing for projects of all sizes. Unlike other countries, long-term loans are scarcely provided by commercial banks, and in general these entities do not have competitive rates when compared to BNDES. Loan conditions are similar for all SHPPs with a small variation in the spread.

In 2002, the Brazilian government launched a program called Incentive Program for Alternative Electricity Sources (*Programa de Incentivo às Fontes Alternativas de Energia Elétrica* – Proinfa). As defined in the Decree #5,025/2004, the Program was established to raise the share of the electricity generated in the country by enterprises based on renewable sources such as eolic, biomass and SHPPs connected to the national grid (SIN[20]). The Program guarantees a safe market established with long term contracts guaranteed by Eletrobrás at attractive prices and a special credit line granted by BNDES. In its first phase, 63 SHPPs adhered with an installed capacity of 1,191 MW. This first phase ended in 2004 and there is no indication that if or when a second phase will open. Proinfa rulings had still another article stating that all revenues coming from any emission reduction scheme, including the CDM/UNFCCC, would revert to the government. There is still pending litigation as some projects counted on both incentives.

Thus, from the remaining 64 SHPPs previously identified as similar to the project activity, 39 received the benefit of Proinfa and were therefore excluded from this analysis, leaving only 25 remaining SHPP to be evaluated as similar to HPP Ilha Comprida.

[19] In Brazil, Small Hydro Power Plants are those with an installed capacity between 1 MW and 30 MW. http://www3.aneel.gov.br/empreendedor/documentos/002_Capitulo_02.pdf

[20] http://www.mme.gov.br/programas/proinfa

iii. Promotional policies;

No promotional policies were considered as criteria to establish differences between the similar power plants to HPP Ilha Comprida.

iv. Legal regulations;

This analysis only considered those power plants operating as Independent Energy Producers (*Produtor Independente de Energia* - PIE) such as HPP Ilha Comprida. In Brazil, there are three other ways to provide electricity:

- Public service (*Serviço Público* – SP);
- Auto electricity production (*Auto Produção de Energia* – APE); and
- Register (*Registro* – REG).

Also, the actual Brazilian regulatory framework for the energy sector was developed between 1994 and 2004, basically in two steps. The first one focused on privatizing and reorganizing the existing structure and in creating regulatory agencies (operational, institutional and market), while the second focused on centralizing planning in order to secure the country's electricity supply, since Brazil suffered a crisis in 2002 when a rationing was enforced due to a severe draught that depleted the main reservoirs in the country, and to speed up the integration of the country's population into the national electric grid[21].

As described in the Electric Power Commercialization Chamber's website[22] (CCEE - *Câmara de Comercialização de Energia Elétrica*), the reform of the Brazilian Electric Sector began in 1993 with the enactment of Law #8,631 which extinguished the equalization of the tariffs that were in effect and created supply contracts between generators and distributors, and which was enhanced by the enactment of Law #9,074 dated of 1995, that created the Independent Producer of Electric Power and the concept of Free Consumers.

In 1996 the Restructuring Project for the Brazilian Electric Sector was implemented (Project RE-SEB), coordinated by the Ministry of Mines and Energy. The paramount conclusions for the project were the need to implement the deverticalization of the electric power companies, that is, to split them up into the generation, transmission and distribution segments, to incentive competition in the segments of generation and commercialization, and to keep the segments of distribution and transmission of electricity under regulation, considered to be natural monopolies under State control. Having been concluded in August of 1998, the RE-SEB Project defined the conceptual and institutional frame of the model to be implemented for the Brazilian Electric Sector.

In 2001, the electric system underwent a serious supply crisis which culminated in an electricity rationing plan. This event generated a series of questionings about the course the electric sector was taking. Purporting to adapt the model being implemented, the Committee for the Revitalization of the Electric Sector Model was instituted in 2002, whose work resulted in an agglomerate of change proposals for the Brazilian electric sector.

Between 2003 and 2004, the Federal Government set the bases for a new model for the Brazilian Electric Sector, supported by Laws #10,847 and #10,848 dated of 15/Mar/2004, and by the Decree #5,163 dated of 30/Jul/2004. In institutional terms, the new model defined the creation of an institution that would become responsible for the long term planning of the electrical sector (Energetic Research Company - EPE), an institution the function whereof was to evaluate on a perennial basis the safety of the supply of electricity (Committee for the Monitoring of the Electric Sector - CMSE).

[21] http://www.aneel.gov.br/aplicacoes/atlas/pdf/02-Aspectos_Institucionais.pdf

[22] http://www.ccee.org.br/cceeinterdsm/v/index.jsp?vgnextoid=3df6a5c1de88a010VgnVCM100000aa01a8c0RCRD

As regards to the electricity commercialization, two ambiences were instituted to execute power purchase and sale agreements - the Regulated Contracting Ambience (ACR), in which participated the Agents for the Generation and Distribution of Electric Power, and the Ambience for Free Contracting (ACL), in which participated the Agents for the Generation, Commercialization, the Importers and Exporters of Electric Power as well as the Free Consumers.

Over this last decade, the Brazilian Electric Sector underwent several changes until the model currently in effect was derived. The table below presents a summary of the major differences between the previous models and the current model, which wound up resulting in changes to the activities to some of the agents for the sector.

Table 17 – Differences between the Brazilian Electric Sector phases
Source: Electric Power Commercialization Chamber's[23]

FORMER MODEL (until 1995)	FREE MARKET MODEL (1995 to 2003)	NEW MODEL (2004 onwards)
Financing using public funds	Financing using public and private funds	
Verticalized companies	Companies classified by activity: generation; transmission; distribution; and commercialization.	Companies classified by activity: generation; transmission; distribution; commercialization; imports; and exports.
Predominantly State-controlled companies	Competition in generation and commercialization.	
Monopolies – No competition	Competition in generation and commercialization	
Captive consumers	Both free and captive consumers	
Tariffs regulated throughout all sectors	Prices are freely negotiated for the generation and commercialization.	In a free environment: prices are freely negotiated for the generation and commercialization. In a regulated environment: auctions and bids for the least tariffs.
Regulated market	Free market	Coexistence between free and regulated market.
Determinative planning: Coordinator Group for the Planning of Eclectic Systems (GCPS).	Indicative planning accomplished by the National Council for Energy Policy (CNPE).	Planning accomplished by the Energy Research Company (EPE).

Taking into account this new regulatory framework, it is only reasonable to consider projects for which the decision making process happened after March of 2004. As PP were unable to find this information for all power plants analyzed in this step, the power plants were only considered similar if their operation started after March, 2004 in a way that they are all under to the same regulatory framework.

From the remaining 25 SHPP still considered similar to HPP Ilha Comprida, only 15 are PIE and, from these, 11 started its operations after March, 2004. Therefore, considering the power plants identified in Table 16, only the SHPPs presented below follow the criteria applied and discussed above:

[23] http://www.ccee.org.br/cceeinterdsm/v/index.jsp?vgnextoid=3df6a5c1de88a010VgnVCM100000aa01a8c0RCRD

Table 18 – Similar power plants within the criteria established in Step 3

Power Plant	Installed Capacity (MW)	Electricity Destination	Type	Operation/Commissioning Start	CDM	Proinfa
Irara	30	PIE	SHPP	Sep/08	N	N
Pai Joaquim	23	PIE	SHPP	Mar/04	N	N
Ombreiras	26	PIE	SHPP	Jul/05	N	N
Salto Três de Maio	20	PIE	SHPP	2010	N	N
Salto Curuá	30	PIE	SHPP	Nov/07	N	N
Unaí Baixo	26	PIE	SHPP	-	N	N
São Francisco	14	PIE	SHPP	Nov/10	N	N
Santa Fé I	30	PIE	SHPP	May/08	N	N
Faxinal II	30	PIE	SHPP	Nov/05	N	N
Mambaí II	12	PIE	SHPP	2008	N	N
Paranatinga II	29.02	PIE	SHPP	Feb/08	N	N

Therefore, N_{diff} = 82.

- **<u>STEP 4:</u>** Calculate factor F = 1 – Ndiff / Nall representing the share of plants using technology similar to the technology used in the proposed project activity in all plants that deliver the same output or capacity as the proposed project activity.

a) $F = 1 – N_{diff} / N_{all}$

$F = 1 – 82 / 93$

$F = 1 – 0.8817$

$F = 0.1183$

As per the “Tool”, the project activity is only a common practice within a sector in the applicable geographical area if both the following conditions are fulfilled:

(a) the factor F is greater than 0.2, and
(b) Nall - Ndiff is greater than 3.

$N_{all} – N_{diff} = 93 – 82$

$N_{all} – N_{diff} = 11$

As presented above, the factor F is not greater than 0.2 and, thus, the HPP Ilha Comprida is not a common practice in the country.

OUTCOME OF STEP 4: As demonstrated in the common practice analysis, similar projects to HPP Ilha Comprida are not broadly observed and commonly made in Brazil and, thus, the project activity is not considered as a common practice in the country.

OUTCOME OF ADDITIONALITY: From all the steps included here in B.5., the conclusion is that the Project is additional and not (part of) the baseline scenario.

B.6. Emission reductions

B.6.1. Explanation of methodological choices

<u>Project Emissions</u>

According to ACM0002, for most renewable power generation project activities, PEy = 0. However, some project activities may involve project emissions that can be significant and these emissions should be accounted as follows:

$$\mathbf{PE_y = PE_{FF,y} + PE_{GP,y} + PE_{HP,y}}$$

Where:
PE_y = Project emissions in year *y* (tCO_2e)
$PE_{FF,y}$ = Project emissions from fossil fuel consumption in year *y*(tCO_2e)
$PE_{GP,y}$ = Project emissions from the operation of geothermal power plants due to the release of non-condensable gases in year *y* (tCO_2e/yr)
$PE_{HP,y}$ = Project emissions from reservoirs of hydro power plants in year *y* (tCO_2e)

There are no emissions from fossil fuel consumption ($PE_{FF,y}$ = 0) nor from the operation of geothermal power plants due to the release of non-condensable gases ($PE_{GP,y}$ = 0).

Emissions from water reservoirs of hydro power plants ($PE_{HP,y}$)

For hydro power project activities that result in new single or multiple reservoirs and hydro power project activities that result in the increase of single or multiple existing reservoirs, project proponents shall account for CH4 and CO2 emissions from the reservoirs, estimated as follows:

a) If the power density of the single or multiple reservoirs (PD) is greater than 4 W/m² and less than or equal to 10 W/m²:

$$\mathbf{PE_{HP,y} = \frac{EF_{Res} * TEG_y}{1000}}$$

Where:
$PE_{HP,y}$ = Project emissions from reservoirs of hydro power plants in year y (tCO_2e)
EF_{Res} = Default Emission Factor for emissions from reservoirs of hydro power plants ($kgCO_2e/MWh$)
TEG_y = Total electricity produced by the project activity, including the electricity supplied to the grid and the electricity supplied to internal load, in year *y* (MWh)

Baseline emissions

Baseline emissions shall include only CO_2 emissions from electricity generation in fossil fuel fired power plants that are displaced due to the project activity.

The methodology assumes that all project electricity generation above baseline levels would have been generated by existing grid-connected power plants and the addition of new grid-connected power plants. The baseline emissions are to be calculated as follows:

$$\boldsymbol{BE_y = EG_{PJ,y} * EF_{grid,CM,y}}$$

Where:
BE_y = Baseline emissions in year *y* (tCO_2)
$EG_{PJ,y}$ = Quantity of net electricity generation that is produced and fed into the grid as a result of the implementation of the CDM project activity in year *y* (MWh)
$EF_{grid,CM,y}$ = 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 (tCO2/MWh)

Calculation of $EG_{PJ,y}$

The calculation of $EG_{PJ,y}$ is different for: greenfield plants, retrofits and replacements; and capacity additions.

Greenfield renewable energy power plants

If the project activity is the installation of a new grid-connected renewable power plant/unit at a site where no renewable power plant was operated prior to the implementation of the project activity (which is the case of HPP Ilha Comprida), then:

$$\boldsymbol{EG_{PJ,y} = EG_{facility,y}}$$

Where:
$EG_{PJ,y}$ = Quantity of net electricity generation that is produced and fed into the grid as a result of the implementation of the CDM project activity in year y (MWh/yr)
$EG_{facility,y}$ = Quantity of net electricity generation supplied by the project plant/unit to the grid in year y (MWh/yr)

Calculation of $EF_{grid,CM,y}$

Baseline emissions shall include only CO_2 emissions from electricity generation in fossil fuel fired power plants that are displaced due to the project activity.

According to the "Tool to calculate the Emission Factor for an electric system", the CO_2 Emission Factor for the displacement of electricity generated by power plants in an electricity system is determined by calculating the combined margin Emission Factor (CM) of the electricity system. The CM is the result of a weighted average of two Emission Factors pertaining to the electricity system: the operating margin (OM) and the build margin (BM). The operating margin is the Emission Factor that refers to the group of existing power plants whose current electricity generation would be affected by the proposed CDM project activity. The build margin is the Emission Factor that refers to the group of prospective power plants whose construction and future operation would be affected by the proposed CDM project activity.
The methodology assumes that all project electricity generation above baseline levels would have been generated by existing grid-connected power plants and the addition of new grid-connected power plants.

As described in Section B.4, the Emission Factor can be calculated as one of the following options:

(a) A combined margin (CM), consisting of the combination of operating margin (OM) and build margin (BM) according to the procedures prescribed in the "Tool to calculate the Emission Factor for an electricity system" or;
(b) The weighted average emissions (in tCO_2/MWh) of the current generation mix. The data of the year in which project generation occurs must be used. Calculations shall be based on data from an official source (where available) and made publicly available.

The combined margin (CM) Emission Factor is a combination of operating margin (OM) and build margin
(BM) Emission Factors according to the procedures described in the "Tool to calculate the Emission Factor for an electric system". The tool indicates that the Emission Factor of the grid is determined by the following six steps:

1. Identify the relevant electricity systems;
2. Choose whether to include off-grid power plants in the project electricity system (optional);
3. Select a method to determine the operating margin (OM);
4. Calculate the operating margin Emission Factor according to the selected method;
5. Calculate the build margin (BM) Emission Factor;
6. Calculate the combined margin (CM) Emission Factor.

Step 1. Identify the relevant electricity systems

The electric system in Brazil has its main subsystem, the Brazilian National Interconnected Power System (SIN) – the national grid -, and several isolated systems, mostly in the Amazon region. Since the project activity generates and delivers electricity to the SIN, this is the relevant electricity system considered.

All data required by the Tool is sourced from the Electric System National Operator (ONS), entity responsible for coordinating and controlling the operation of all generation and transmission installations in the National System. The Brazilian DNA defined this system in its Resolution #8 of 26/May/2008, available at: http://www.mct.gov.br/upd_blob/0024/24719.pdf.

Step 2. Choose whether to include off-grid power plants in the project electricity system

Project Participants followed option I of the “Tool” and no off-grid power plants were included in the project activity electricity system:

- Option I: Only grid power plants are included in the calculation.

Step 3. Select a method to determine the operating margin (OM)

The calculation of the operating margin Emission Factor ($EF_{grid,OM,y}$) can be based on one of the following methods:

(a) Simple OM; or
(b) Simple adjusted OM; or
(c) Dispatch data analysis OM; or
(d) Average OM.

The Brazilian DNA calculates annually the country’s Emission Factor based on the dispatch data analysis OM (c), and therefore PP will follow official data in the Emission Factor calculation.

Step 4. Calculate the operating margin Emission Factor according to the selected method

(c) Dispatch Data Analysis OM

The dispatch data analysis OM Emission Factor ($EF_{grid,OM-DD,y}$) is determined based on the grid power units that are actually dispatched at the margin during each hour h where the project is displacing grid electricity. This approach is not applicable to historical data and, thus, requires annual monitoring of $EF_{grid,OM-DD,y}$.

The Emission Factor is calculated as follows:

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

Where:
$EF_{grid,OM-DD,y}$ = Dispatch data analysis operating margin CO_2 Emission Factor in year y (tCO_2/MWh)
$EG_{PJ,h}$ = Electricity displace 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 electricity
y = Year in which the project activity is displacing grid electricity

The hourly Emission Factor is calculated based on the energy efficiency of the grid power unit and the fuel type used, as follows:

$$EF_{EL,DD,h} = \frac{\sum EG_{n,h} * EF_{EL,n,y}}{\sum EG_{n,h}}$$

Where:
$EF_{EL,DD,h}$ = CO_2 Emission Factor for grid power units in the top of the dispatch order in hour h in year y (tCO_2/MWh)
$EG_{n,h}$ = Net quantity of electricity generated and delivered to the grid power unit n in hour h (MWh)
$EF_{EL,n,y}$ = CO_2 Emission Factor of grid power unit n in year y (tCO_2/MWh)
n = Grid power units in the top of the dispatch
h = Hours in year y in which the project activity is displacing grid electricity

The Brazilian DNA is responsible for providing $EF_{EL,DD,h}$ in order for Project Participants to calculate the operating margin Emission Factor. Thus, this data will be updated annually applying official data published by the DNA, made available at: http://www.mct.gov.br/index.php/content/view/72764.html

Step 5. Calculate the build margin (BM) Emission Factor

Project participants choose option 2 established by the "Tool" to calculate the build margin (BM) Emission Factor, as follows:

- Option 2: For the first crediting period, the build margin Emission Factor shall be updated annually, *ex post*, including those units built up to the year of registration of the project activity or, if information up to the year of registration in not yet available, including those units build up to the latest year for which information is available. For the second crediting period, the build margin emissions factor shall be calculated *ex ante* as described in Option 1 above. For the third crediting period, the build margin Emission Factor calculated for the second crediting period should be used.

The build margin emissions factor is the generation-weighted average Emission Factor (tCO_2/MWh) of all power units m during the most recent year y for which electricity generation data is available, calculated as follows:

$$EF_{grid,BM,y} = \frac{\sum EG_{m,y} * EF_{EL,m,y}}{\sum EG_{m,y}}$$

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 plant 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
y = Most recent historical year for which electricity generation data is available

The Brazilian DNA is responsible for providing the build margin Emission Factor that is used in the calculation of the country's Emission Factor. Thus, this data will be updated annually applying official data published by the DNA, made available at: http://www.mct.gov.br/index.php/content/view/72764.html

Step 6. Calculate the combined margin emissions factor

The calculation of the combined margin (CM) Emission Factor ($EF_{grid,CM,)}$ is based on one of the following methods:

(a) Weighted average CM; or
(b) Simplified CM.

Option (a) weighted average CM is applied as follows:

$$\mathbf{EF_{grid,CM,y} = EF_{grid,OM,y} * W_{OM} + EF_{grid,BM,y} * W_{BM}}$$

Where:
$EF_{grid, BM,y}$ = Build margin CO_2 Emission Factor in year y (tCO_2/MWh);
$EF_{grid, OM,y}$ = Operating margin CO_2 Emission Factor in year y (tCO_2/MWh);
W_{OM} = Weighting for operating margin emissions factor (%);
W_{BM} = Weighting for build margin emissions factor (%).

According to the Tool, the following default values should be used for W_{OM} and W_{BM}:

- Wind and solar power generation project activities: W_{OM} = 0.75 and W_{BM} = 0.25 for the first crediting period and for subsequent crediting periods;
- All other projects: 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, unless otherwise specified in the approved methodology which refers to the tool.

In the case of the HPP Ilha Comprida, the default value of 50% will be considered for both operating and build margin Emission Factors.

Leakage

No leakage emissions are considered. The main emissions potentially giving rise to leakage in the context of electric sector projects are emissions arising due to activities such as power plant construction and upstream emissions from fossil fuel use (e.g. extraction, processing, transport). These emissions sources are neglected.

Emission reductions

Emission reductions are calculated as follows:

$$\mathbf{ER_y = BE_y - PE_y}$$

Where:
ER_y = Emission reductions in year y (tCO_2e)
BE_y = Baseline emissions in year y (tCO_2)
PE_y = Project emissions in year y (tCO_2e)

B.6.2. Data and parameters fixed ex ante

Data / Parameter	w_{OM}
Unit	%
Description	Operating margin weight
Source of data	Tool to calculate the Emission Factor for an electricity system
Value(s) applied	50
Choice of data or Measurement methods and procedures	As defined by the tool for the Emission Factor calculation.
Purpose of data	Baseline emissions calculation.
Additional comment	-

Data / Parameter	w_{BM}
Unit	%
Description	Build margin weight
Source of data	Tool to calculate the Emission Factor for an electricity system
Value(s) applied	50
Choice of data or Measurement methods and procedures	As defined by the tool for the Emission Factor calculation.
Purpose of data	Baseline emissions calculation.
Additional comment	-

Data / Parameter	A_{BL}
Unit	m^2
Description	Area of the single or multiple reservoirs measured in the surface of the water, before the implementation of the project activity, when the reservoir is full.
Source of data	ACM0002 – Grid-connected electricity generation from renewable sources
Value(s) applied	0
Choice of data or Measurement methods and procedures	As per the methodology, for new reservoirs this value is zero.
Purpose of data	Baseline emissions calculation.
Additional comment	-

Data / Parameter	Cap_{BL}
Unit	W
Description	Installed capacity of the hydro power plant before the implementation of the project activity.
Source of data	ACM0002 – Grid-connected electricity generation from renewable sources
Value(s) applied	0
Choice of data or Measurement methods and procedures	As per the methodology, for new reservoirs this value is zero.
Purpose of data	Baseline emissions calculation.
Additional comment	-

Data / Parameter	EF_{Res}
Unit	$kgCO_2e/MWh$
Description	Default Emission Factor for emissions from reservoir
Source of data	Decision by EB23
Value(s) applied	90
Choice of data or Measurement methods and procedures	-
Purpose of data	Baseline emissions calculation.
Additional comment	-

B.6.3. Ex ante calculation of emission reductions

As demonstrated on section B.6.1, there is no leakage to be account on the emission reduction calculation. Therefore, emission reductions are as follows:

$$\boxed{ER_y = BE_y - PE_y}$$

Where:
ER_y = Emission reductions in year y (tCO_2e)
BE_y = Baseline emissions in year y (tCO_2)
PE_y = Project emissions in year y (tCO_2e)

$$\boxed{ER_y = EG_{facility,y} * EF_{CO2,grid,y} - PE_y}$$

Where:
ER_y = Emission reductions in year y (tCO_2);
$EG_{BL,y}$ = Quantity of net electricity supplied to the grid as a result of the implementation of the CDM project activity in year y (MWh);
$EF_{CO2,grid,y}$ = Emission Factor of the grid in year y (tCO_2/MWh);
PE_y = Project emissions in year y (tCO_2e).

As the Brazilian DNA publishes the Emission Factors of the national grid, the last published[24] Emission Factor was used to estimate the projected emission reduction and is as follows:

Average Annual Build Margin Emission Factor (tCO_2/MWh)
2010
0.1404

Average Monthly Emission Factor Operating Margin (tCO2/MWh) - 2010											
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.2111	0.2798	0.2428	0.2379	0.3405	0.4809	0.4347	0.6848	0.7306	0.732	0.7341	0.6348

*Average operating Emission Factor in 2010 calculated by PP based on CIMGC data = 0.4786

As described on section B.6.1, the EF calculation is:

$EF_{grid, CM, y}$ = 0.5 * 0.1404 + 0.5 * 0.4786

$EF_{grid, CM, y}$ = 0.0702 + 0.2393

$EF_{grid, CM, y}$ = 0.3095 tCO_2/MWh

The HPP Ilha Comprida is expected to generate approximately 159,607 MWh/year, and thus as shown on the following table:

Table 19 - Expected annual electricity generation

Installed Capacity (A)	20.16 MW
Annual Hours (B)	8,760
Capacity Factor (C)[25]	0.9037698
Electricity Generation **(A) * (B) * (C)**	159,607.2

Therefore, the project's emission reduction is:

ER_y = 159,607 * 0.3095

ER_y = 49,403 tCO_2/year

[24] http://www.mct.gov.br/index.php/content/view/327118.html#ancora

[25] Coefficient of assured energy per installed capacity.

As explained in section B.6.1, the project activity has a power density between 4 W/m² and 10 W/m² and must therefore consider project emissions ought to be calculated according to the following equation:

$$\mathbf{PE_{HP,y} = \frac{EF_{Res} * TEG_y}{1000}}$$

Where:
$PE_{HP,y}$ = Project emissions from reservoir (tCO_2e)
EF_{Res} = Default Emission Factor for emissions from reservoirs of hydro power plants in year *y* ($kgCO_2e/MWh$)
TEG_y = Total electricity produced by the project activity, including the electricity supplied to the grid and the electricity supplied to internal load, in year *y* (MWh)

The project emissions ($PE_{HP,y}$) for the HPP Ilha Comprida are as follows:

$$PE_{HP,y} = \frac{90 * 159{,}607}{1{,}000}$$

$$PE_{HP,y} = \frac{143{,}646.48}{1{,}000}$$

$$PE_{HP,y} = 14{,}365\ tCO_2e$$

Therefore, the project's emission reductions are as follows:

$$ER_y = 159{,}607 * 0.3095 – 14{,}365$$

$$ER_y = 49{,}403 – 14{,}365$$

$$ER_y = 35{,}038\ tCO_2e/year$$

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

Year	Baseline emissions (t CO_2e)	Project emissions (t CO_2e)	Leakage (t CO_2e)	Emission reductions (t CO_2e)
2015	49,403	14,365	0	35,038
2016	49,403	14,365	0	35,038
2017	49,403	14,365	0	35,038
2018	49,403	14,365	0	35,038
2019	49,403	14,365	0	35,038
2020	49,403	14,365	0	35,038
2021	49,403	14,365	0	35,038
Total	345,821	100,555	0	245,266
Total number of crediting years	7			
Annual average over the crediting period	49,403	14,365	0	35,038

B.7. Monitoring plan

B.7.1. Data and parameters to be monitored

Data / Parameter	$EG_{facility,y}$
Unit	MWh/yr
Description	Quantity of net electricity generation supplied by the project plant/unit to the grid in year y
Source of data	Electricity meter at output of HPP
Value(s) applied	159,607
Measurement methods and procedures	The project's net electricity generated and supplied by the plant to the grid will be measured by two meters located at the power plant output point – one is the main meter and the other is the back-up meter. Both are bi-directional type. When the main meter fails to work normally, the back-up meter starts reading and the electricity measurement data is not lost. The precision of the meters is Class 0.2% as per the Brazilian regulations ("*Norma Brasileira Medidores Eletrônicos de Energia Elétrica (estáticos)* NBR 14,519). High voltage electricity meter sends generation data to the following points: 1. Hydro Plant Operational Control Panel; 2. ONS (National System Operator) – via VPN; 3. CCEE (*Câmara de Comercialização de Energia Elétrica*) where monthly totals are used for commercialization billing. Moreover, it will be used spreadsheets got every month directly of the meters with the hourly generation information, which will be confronted with the available generation spreadsheets at the website of CCEE in a monthly basis. All the electricity dispatched to the grid by the project activity will be monitored online by CCEE. This entity is responsible for the monthly readings and consolidating the electricity generated through the Report MED003.
Monitoring frequency	Monthly
QA/QC procedures	Uncertainty level of data is low. The net electricity generated and supplied by the project activity to the grid will be double checked by internal control and sales receipt or by Electric Energy Commercialization Chamber evidences (mainly the MED003 report). The calibration of the meters will be done every two years, complying with the National System Operator (*Operador Nacional do Sistema* – ONS) regulations.
Purpose of data	Baseline emissions calculation.
Additional comment	-

Data / Parameter	$EF_{grid,CM,y}$
Unit	tCO_2/MWh
Description	Combined margin CO_2 Emission Factor for grid connected power generation in year y calculated using the values published by the Brazilian DNA.
Source of data	Data for $EF_{grid,CM,y}$ calculation is provided by CIMGC/ONS.
Value(s) applied	0.3095
Measurement methods and procedures	Ex-post Emission Factor is calculated by project participants with CIMGC data (which in turn uses ONS data). The $EF_{grid,CM,y}$ formula items, $EF_{grid,BM,y}$ and $EF_{grid,OM,y}$ will also be monitored and calculated by CIMGC and ONS, with the Dispatch Data of the grid system. This value is annually updated according to CIMGC calculations for the SIN.
Monitoring frequency	Annually.
QA/QC procedures	This data is from an official source and is publicly available. Margin of error for the data is low.
Purpose of data	Baseline emissions calculation.
Additional comment	This data is available on the web-site: http://www.mct.gov.br/

Data / Parameter	$EF_{grid,OM,y}$
Unit	tCO_2/MWh
Description	Dispatch data operating margin Emission Factor of the grid in year y.
Source of data	Operating Margin Emission Factor is calculated by project participants with CIMGC data (which in turn uses ONS data). The $EF_{grid,OM,y}$ formula item will be also monitored and calculated by CIMGC and ONS, with the Dispatch Data of the SIN.
Value(s) applied	0.4786
Measurement methods and procedures	Operating Margin Emission Factor is calculated by project participants with CIMGC and ONS data. The $EF_{grid,OM,y}$ formula item will be also monitored and calculated by CIMGC and ONS, with the Dispatch Data of the SIN.
Monitoring frequency	Annually.
QA/QC procedures	This data will be applied in ex-post calculation of the Emission Factor. The data will be annually filled (electronic archive). Data will be archived electronically up to two years after completion of the crediting period.
Purpose of data	Baseline emissions calculation.
Additional comment	This data is available on the web-site: http://www.mct.gov.br/

Data / Parameter	$EF_{grid,BM,y}$
Unit	tCO_2/MWh
Description	Build margin CO_2 Emission Factor of the grid in year y
Source of data	$EF_{grid,BM,y}$ calculation is provided by CIMGC/ONS.
Value(s) applied	0.1404
Measurement methods and procedures	Build Margin Emission Factor is calculated by CIMGC with ONS data. The $EF_{grid,BM,y}$ formula items will be also monitored and calculated by CIMGC and ONS, with the Dispatch Data of the SIN.
Monitoring frequency	Annually.
QA/QC procedures	This data will be applied in ex-post calculation of the Emission Factor. The data will be annually filed (electronic archive). Data will be archived electronically up to two years after completion of the crediting period.
Purpose of data	Baseline emissions calculation.
Additional comment	This data is available on the web-site: http://www.mct.gov.br/

Data / Parameter	TEG_y
Unit	MWh
Description	Total electricity produced by the project activity, including the electricity supplied to the grid and the electricity supplied to internal loads, in year *y*
Source of data	Power plant
Value(s) applied	159,607
Measurement methods and procedures	The total electricity produced by the project activity will be measured continuously by two PM800 series meters, located at the power plant generators.
Monitoring frequency	Monthly
QA/QC procedures	-
Purpose of data	Baseline emissions calculation.
Additional comment	Applicable to hydro power project activities with a power density of the project activity (PD) greater than 4 W/m2 and less than or equal to 10 W/m2.

Data / Parameter	A_{PJ}
Unit	m^2
Description	Area of the single or multiple reservoirs measured in the surface of the water, after the implementation of the project activity, when the reservoir is full
Source of data	Ilha Comprida Energia S.A.
Value(s) applied	2,080,000
Measurement methods and procedures	The project's reservoir surface is defined in its Operation License and will be monitored annually. A technical report from a surveyor will be emitted annually to confirm the parameter.
Monitoring frequency	Annually.
QA/QC procedures	-
Purpose of data	Baseline emissions calculation.
Additional comment	This value will be used to calculate the power density of the reservoir. It has impact on the applicability of the methodology and on the calculation of the Certified Emission Reductions of the project activity.

Data / Parameter	Cap_{PJ}
Unit	W
Description	Installed capacity of the hydro power plant after the implementation of the project activity
Source of data	Ilha Comprida Energia S.A.
Value(s) applied	20,100,000
Measurement methods and procedures	The installed capacity of the project is defined by the turbine-generator set and will not be altered. These equipment will be verified annually to guarantee they haven't been modified.
Monitoring frequency	Annually.
QA/QC procedures	-
Purpose of data	Baseline emissions calculation.
Additional comment	This value will not be altered. This value will be used to calculate the power density of the reservoir. It has impact on the applicability of the methodology and on the calculation of Certified Emission Reductions of the project activity.

B.7.2. Sampling plan

Not applicable.

B.7.3. Other elements of monitoring plan

Data that has to be monitored during the life of the contract of the project is the net electricity generated in the project electricity system in year y or hour h (EG_y) , which the project owner will continuously measure, and the combined margin CO_2 Emission Factor for grid connected power generation in year y ($EF_{grid,CM,y}$), as per the procedures set by the approved monitoring methodology "ACM0002 – Grid-connected electricity generation from renewable sources".

The monitoring procedures for data measurement, quality assurance and quality control are described below. The grid Emission Factor, which will be applied *ex-post*, is published annually.

Monitoring Procedures

The measurement of the electricity generated and delivered to the grid will be done by two three-phases four wire electronic redundant meters which will send data to the grid through a gateway. High voltage electricity meter sends generation data to the following points:

- Hydro Plant Operational Control Panel;
- ONS (National System Operator) – via VPN;
- CCEE (*Câmara de Comercialização de Energia Elétrica*), official regulator of the electricity market, acting as the registry for contracts and transactions. CCEE uses electricity generation information in order to bill the transmission services between generator and end-consumer, among other uses.

The electricity generated by the project activity will be monitored online by CCEE. This entity is responsible for the monthly readings and consolidating the electricity generated through the Report MED003.

The figure below shows the simplified unifilar diagram indicating location of the instruments:

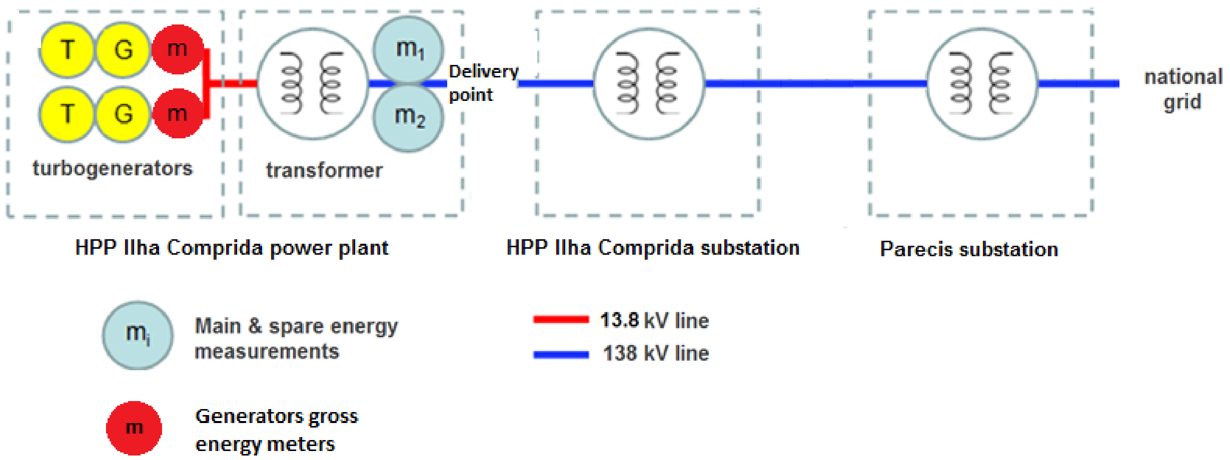

Figure 6 – Simplified unifilar diagram

All the procedures for measuring the electricity are defined by ONS according to “Module 12” of the Grid Procedures document, which provides for measurements with invoice purposes aiming to establish the responsibilities, systematic and deadlines for the development of projects under the Measurements with Invoice Purposes System (“*Sistema de Medição para Faturamento”* – SMF), for the maintenance and inspection of the system and for SMF standard meter readings and certification. The established procedures reflect good monitoring and reporting practices.

Management and organization structure

All invoices and other fiscal documents are kept in Ilha Comprida Energia S.A. accounting system.

The person responsible for data collection and archiving is the project manager, who is the CDM project leader overlooking the registration of the HPP Ilha Comprida.

The project sponsor will proceed with the necessary measures for electricity control and monitoring. Additionally, using the data collected by ANEEL and ONS, it will be possible to monitor the electricity generation of the project and the grid power mix.

Quality Control and Quality Assurance

Calibration

The meters calibration will be done according to ONS’s Sub-Module 12.5 “Work Standards Certification”, which attributes responsibilities regarding standards certification and establishes all necessary activities to guide responsible agents in the SMF (the Invoice Measurement System, or *Sistema de Medição para Faturamento*) maintenance, considering traceability guarantee and work standards calibration with reference to INMETRO’s standards or RBC (the Brazilian Calibration Grid or *Rede Brasileira de Calibração*) laboratories.

When doubts are detected in either the main or spare meter, an order is issued to calibrate, test and repair the meter.

Maintenance and training procedures

Ilha Comprida Energia will be responsible for the maintenance of the monitoring equipment for dealing with possible monitoring data adjustments and uncertainties.

Ilha Comprida Energia is the responsible for the project management as well as for organizing and training of the staff in the appropriate monitoring, measurement and reporting techniques.

Data Archiving

All metering data is stored according to ONS’s Sub-Module 12.4 “Invoice Measurement Data Collection”, which establishes all responsibilities and activities regarding the direct and/or indirect collection of energy generation data, the quality of this energy and the meters in the SMF. The direct collection of electricity related data from the SMF is done through direct access of the meters by the SCDE (the Energy Collection Data System or *Sistema de Coleta de Dados de Energia*).

The SCDE is responsible for the daily collection and treatment of all measurement data, obtained directly from the meters. This system allows the performance of logical inspections with direct access to meters, providing a much more reliable and accurate data.

The frequency of archiving and submitting data related to the HPP Ilha Comprida will be done annually.

According to an internal procedure of HPP Ilha Comprida, all data collected as part of the monitoring plan will be archived electronically and will be kept for 2 years after the last credit issuance. The procedures for data collection and storage are described on the Document: "*Procedure for Control and Archiving of Documents Related to CERs Changes in HPP Ilha Comprida".*

B.7.4. Date of completion of application of methodology and standardized baseline and contact information of responsible persons/ entities

Date of completion of the study on application of the selected methodology: 31/07/2014

Contact information of the person(s)/entity(ies) responsible for the application of the selected methodology:

- Carbon do Brasil Consultoria Empresarial Ltda.

  Located at R. Bela Cintra, 746, cj. 102 – Sao Paulo – SP – Brazil – ZIP 01415-000

  Contact person is the company's director Mr. Clovis Badaro, available at clovis.badaro@luminaenergia.com.br or +55 11 3259.4033.

SECTION C. Duration and crediting period

C.1. Duration of project activity

C.1.1. Start date of project activity

17/12/2010, date in which the hydro mechanical equipment contract was signed with Andritz Hydro Inepar do Brasil S/A.

The Andritz contract was the earliest real action and major financial commitment of project participants regarding the project activity implementation.

C.1.2. Expected operational lifetime of project activity

20y-7m, as stated in ANEEL's Resolution #742 of 18/Dec/2002[26].

C.2. Crediting period of project activity

C.2.1. Type of crediting period

Renewable.

C.2.2. Start date of crediting period

01/01/2015 (or registration in the CDM, whichever occurs later)

C.2.3. Length of crediting period

7y-0m.

[26] Available at: http://www.aneel.gov.br/cedoc/res2002742.pdf

SECTION D. Environmental impacts

D.1. Analysis of environmental impacts

The HPP Ilha Comprida meets all environmental requirements necessary for its implantation, as demonstrated in table 20. Even so, when developing the Project Basic Design Document, the main negative environmental impacts which can occur as a result of the implementation of the project activity were identified and discussed. The HPP Ilha Comprida's Environmental Basic Design proposes a series of impacts prevention and/or mitigation measures to these impacts, which were distributed in 13 Environmental Programs, described below.

The Programs implantation is a direct responsibility of Ilha Comprida Energia S.A., being monitored by an Environmental Monitoring team, whose structure provides experts participation to be contracted for specific activities, while the construction company is responsible for the implantation of all corrective action which might be requested.

1. Limnological and Water Quality Monitoring

This Program will allow the identification, prevention and control of aquatic environment issues during the construction of the HPP Ilha Comprida, also subsidizing the Ichthyofauna Monitoring Program. The water quality pattern in the relevant stretch of the Juruena River before the construction of the power plant will be established and its variation through the construction period will be monitored. All water quality modifications derived from construction activities will be properly identified in time. Further, the presence of vector of waterborne diseases will be investigated in the Epidemiological Monitoring and Vectors Control Program. Phenomenons like thermal stratification, euthrophication and macrophytes growth will also be verified periodically, motivating permanent corrective actions.

2. Hydro and Sedimentological Monitoring

One of the most important aspects of water harvesting process to electricity generation is the reservoir's lifetime, which creates the need to monitor all solid materials sedimentation brought to the reservoir.

Sediment transportation through Rivers and streams occurs naturally by leaching of margins and by rain action, when the soil is transported to the rivers rail. Also, anthropic actions such as margins landslides by riparian suppression, which contribute to increase the siltation of these water bodies.

Therefore, siltation monitoring is fundamental to subsidize maintenance and corrective actions, and also favoring the knowledge of siltation rates and sedimentation. Besides, the knowledge of the sedimented material type allows an evaluation of the hydrodynamic behavior of the dam and the upstream river, helping in the impacts control.

3. Geological, Geotechnical, Erosion Control and Slope Contention Program

Erosive process can occur due the low cohesion soils in the reservoir margins. In a general way, the stability or erodibility of slopes are defined by the following factors:

- Cover soil characteristics;
- Presence of vegetal cover and its characteristics;
- Soil use and occupation, highlighting the construction of access roads.

Erosive processes and slope instabilities can increase siltation risks in the reservoir's margins, resulting in temporary modifications which interfere in water quality and in the Ichthyofauna.

4. Environmental Management and Mineral Regularization of Areas Source of Construction Materials and Deposition Areas of Excess Materials

This program aims the exploration of areas source of construction materials to the implantation of the HPP Ilha Comprida, and to help in the mineral regularization of areas unregulated with their responsible organs.

To the implantation of HPP Ilha Comprida, the areas source of construction materials will consist in two types, the first of clay deposits and the second of gravel. Other materials such as rock and sand will be bought from commercial establishments already established and properly licensed. As it comes to an commercial operation, the regularization of these materials exploration will be verified with DNPM. If it isn't possible to acquire these materials from regularized suppliers, this Program provides the assistance to the enterprising on the regularization of this commerce.

The Program will also consider the procedures of environmental management of deposition areas of excess materials, such as the soil and vegetal material from excavations.

5. Degraded Areas Recovery

The Degraded Areas Recover Program (PRAD – *Programa de Recuperação de Áreas Degradadas*) is an important tool in the mitigation of impacts generated by any enterprise which might modify natural environments, once the Program presents the localization and the actions to recover these areas. However, when an enterprise is done in an environmental safe way, the PRAD becomes a study of easy execution, once all construction, even before it's start, already contemplate this environmental bias, i.e., reflect good engineering practices.

In the final service phase, it will be necessary to implement a comprehensive set of natural regeneration procedures to guarantee the degraded areas recover and the establishment of natural regeneration processes aiming the effective mitigation of impacts and to guarantee that the final situation, after the construction of the power plant, are as close as possible to the situation prior the construction.

6. Ichthyofauna Monitoring

Enterprises that modify waterbodies course, which is the case of HPP Ilha Comprida, consequently modify existing biotic communities, mainly the Ichthyofauna.

Especially for aquatic organisms, there are three factors that play an important role in these communities maintenance: water quality, which has to have appropriate characteristics and physic-chemical properties; riparian vegetation, which compose the food chain start to most aquatic organisms; and hydrological regime, which conditions different aquatic fauna behaviors.

Thus, the Ichthyofauna monitoring is of great importance regarding the minimization of impacts. It's also important to highlight that for environmental licensing purposes, it's necessary to develop a fish rescue program when the reservoir is filled.

7. Epidemiological and Vectors Control Monitoring

The modification in the natural flow of the Juruena River, due to the construction of the HPP Ilha Comprida's reservoir, some environmental impacts may be caused as well as impacts in the influenced area's established communities; it must be considered the existence of inhabited groups around the dam area.

Different insect species can be found in these areas, such as insects of the *Culicidae* and *Psychodidae* families. These species must receive special attention since their relevant under Public Health due to its disease vector characteristic.

Mosquitoes suffer the effects of new factors, in the transformation of lentic environments into lotic ones, as a result of the dam closing. Before this radical change, they survive in their immature phase, in the river's flood plains, usually in slow or stuck backwaters, in lagoons and swamps. With the flooding, all these habitats are almost entirely submerged; however, new environments are created, which are likely to the establishment of new ecological succession and to the rearrangement of a new fauna composition.

Flebotomíneos, whose immatures live in wet soils, usually in shady areas of land, also suffer severe impacts due to deforestation and flooding. They are then dislocated outside the flood plain and tend to readapt to this new environment, in wooded areas on which it must prevail with the new reservoir's water blade.

Further, during the dam construction is important to note the attraction of man labor to the region, usually from distant places and without any information regarding endemic diseases – these can start the introduction of new pathogenic in the area, mainly related to parasitic diseases. Therefore, the construction side and its surroundings, as well as the area where the worker's homes will be installed, must be monitored regarding the risks of vectors presence and the possibility of emergence of diseases.

Thus, the need to collect data regarding sanitary issues, in the influence area of the new reservoir to electricity generation, mainly the ones relative to pathogenic vectors, through hematophagus insects, is justified. Moreover, the collection of these information will allow gathering elements to the application of prevention or corrective actions, if they are needed.

8. Fauna Monitoring

The HPP Ilha Comprida will be implanted in the Juruena River. During the second semester of 2006, wildlife surveys were developed in the region of Alto Juruena as part of the environmental licensing for energetic exploitations in the river, through the hydropower plants Juruena, Cachoeirão and Jesuíta.

Several species were identified, including mammal groups of small, medium and large sizes, bats, birds and herpetofauna. To some species, these data can be representative of the fauna found in the region where the HPP Ilha Comprida will be constructed. According to field studies, the terrestrial fauna is represented by Amazon and *cerrado* species, being considered as a transitional fauna.

9. Florestal Monitoring

This program aims to evaluate the evolution of the conservation degree or structure degradation of different forest fragments intercepted due to the implantation of HPP Ilha Comprida, and to monitor modifications in the vegetation and its surroundings.

10. Reservoir Filling and Fauna and Flora Rescue Plans

Enterprises that modify natural environments cause impact in different ecological niches, mainly those which refer to fauna and flora. Therefore, it’s necessary to develop a Reservoir Filling and a Fauna and Flora Rescue Plan that present, in its activities, the capture and resettlement of wildlife as well as to collect and preserve some flora species that may be more severely affected by removal of vegetation in order to form the power plant’s reservoir.

11. Environmental Education and Social Communication

The federal Law #9,795, of 27/Apr/1999, created the National Environmental Education Policy, which defines environmental education as the “processes through which both individual and collectivity construct social values, knowledge, abilities, attitudes and skills aimed to the environment conservation, common use by people, essential to quality of life and its sustainability” (Art. 1º).

The social communication plan is justified by the construction of electricity generation enterprises, even of small scale, which interfere directly and indirectly in population’s life, modifying its everyday life and generating different expectations and demands as for its implantation and operation. The absence of basic data regarding the enterprise creates the condition to disclose wrong information, creating a general insecurity feeling in a local level. The absence of data tends to work as a complicating factor to execute actions that aims to mitigate impacts caused by the implementation of the power plant.

12. Archaeological, Historical and Cultural Heritage Prospection, Rescue and Preservation

This program was elaborated according to norms and procedures required by Ordinances #07/88 and #230/02 of IPHAN’s, the Brazilian National Historical and Art Heritage Institute, which provide for authorization requests to the development of archaeological researches.

As per the Brazilian Federal Constitution’s article 20 and as per the federal Law #3,924/61, all archaeological goods are considered assets of the Union and shall be studied before any construction might have compromise them.

13. Environmental Control during Construction – Monitoring Manual

To assure the fulfillment of environmental conditions and compromises from the environmental licensing process of the HPP Ilha Comprida, the enterprise shall have an environmental control program aiming the supervision e documentation of the construction of the power plant in details, and the respective application of reasonable mitigative and compensatory measures.

D.2. Environmental impact assessment

The resolution CONAMA Nº 06/1987 establishes that hydropower plants up to 30MW do not need to perform the Environmental Impact Assessment (EIA-RIMA), instead a Basic Environmental Project (PBA) is required.

The national legislation requires the issuance of the following environmental permits:

- Preliminary Permit (*Licença Prévia* or L.P.) – issued during the preliminary phase of the project planning, attesting the environmental viability, and containing basic requirements to be presented during the construction and operation.
- Construction Permit (*Licença de Instalação* or L.I.)
- Operating Permit (*Licença de Operação* or L.O.) – issued before the dam closing

As for the regulatory permits, the proposed project activity has received the licenses and permits:

Table 20 – HPP Ilha Comprida licenses and permits

DOCUMENT	DATE	DESCRIPTION	RESPONSIBLE ENTITY
LO #306,913/2013	02/Jul/2013 until 01/Jul/2016	Operation License for HPP Ilha Comprida	SEMA
LI #61,157/2012	14/Sep/2012 until 28/Apr/2013	Installation License for HPP Ilha Comprida	SEMA
LI #57,835/2010	29/Apr/2010 until 28/Apr/2013	Installation License for HPP Ilha Comprida.	SEMA
LI #1,369/2007-DL	10/Jan/2007 until 03/Apr/2009	Installation License for HPP Ilha Comprida.	SEMA
Authorization Resolution #742/2002	18/Dec/2002	Authorizes the exploration of HPP Ilha Comprida.	ANEEL
LP #217/2002	31/Oct/2002 until 31/Oct/2003	Previous License for HPP Ilha Comprida.	FEMA

SECTION E. Local stakeholder consultation

E.1. Solicitation of comments from local stakeholders

As per Resolution n° 1 of 01/Sep/2003 and Resolution n° 7 of 07/Mar/2008, issued by the Brazilian DNA – Inter-Ministry Commission on Global Climate Change (CIMGC), any CDM projects shall send a letter describing it activities and requesting commentaries by local interested parties. Invitation letters were sent in 14/Jun/2011 to the agents listed below (copies of the letters and post office confirmation of receipt communication are available upon request).

- Federal Public Attorney (*Ministério Público Federal*);
- Brazilian Forum of ONGs and Social Movements for the Development and Environment (*Fórum Brasileiro de ONGs e Movimentos Sociais para o Meio Ambiente e Desenvolvimento* – FBOMS);
- Mato Grosso State Public Attorney (*Ministério Público Estadual do Mato Grosso*);
- Mato Grosso State Environmental Agency (*Secretaria de Estado do Meio Ambiente do Mato Grosso)*;
- Campos de Júlio's City Hall (*Prefeitura Municipal de Campos de Júlio* – MT);
- Campos de Júlio's Council (*Câmara dos Vereadores de Campos de Júlio* – MT);
- Campos de Júlio's Environmental Agency (*Secretaria Municipal de Agricultura e Meio Ambiente de Campos de Júlio* - MT);
- Campos de Júlio's Commercial and Industrial Association (*Associação Comercial e Industrial de Campos de Júlio*).
- Sapezal's City Hall (*Prefeitura Municipal de Sapezal* – MT);
- Sapezal's Council (*Câmara dos Vereadores de Sapezal* – MT);
- Sapezal's Environmental Agency (*Secretaria Municipal de Agricultura e Meio Ambiente de Sapezal* – MT);
- Sapezal's Commercial Association (*Associação Comercial e Empresarial de Sapezal* – MT).

The PDD of the HPP Ilha Comprida is available at in the following link:
http://luminaenergia.com.br

E.2. Summary of comments received

No comments have been received.

E.3. Report on consideration of comments received

No comments have been received.

SECTION F. Approval and authorization

The letter of approval from the Brazilian Government was received on July 31st 2014.

- - - - -

Appendix 1. Contact information of project participants and responsible persons/ entities

Project participant and/or responsible person/ entity	x Project participant ☐ Responsible person/ entity for application of the selected methodology (ies) and, where applicable, the selected standardized baselines to the project activity
Organization name	Ilha Comprida Energia S.A.
Street/P.O. Box	Estrada SZ 01 km 20
Building	-
City	Sapezal
State/Region	Mato Grosso
Postcode	78365-000
Country	Brazil
Telephone	+55 65 3645.5141
Fax	-
E-mail	maggi.energia@grupomaggi.com.br
Website	-
Contact person	
Title	Superintendent
Salutation	Mr.
Last name	Rubert
Middle name	Anselmo
First name	Roberto
Department	-
Mobile	+55 65 9915.8480
Direct fax	-
Direct tel.	-
Personal e-mail	roberto.rubert@grupomaggi.com.br

Project participant and/or responsible person/ entity	**x** Project participant **x** Responsible person/ entity for application of the selected methodology (ies) and, where applicable, the selected standardized baselines to the project activity
Organization name	Carbon do Brasil Consultoria Empresarial Ltda.
Street/P.O. Box	R. Bela Cintra, 746, cj.102 a
Building	-
City	Sao Paulo
State/Region	Sao Paulo
Postcode	01415-000
Country	Brazil
Telephone	+55 11 3259.4033
Fax	-
E-mail	-
Website	-
Contact person	
Title	Director
Salutation	Mr.
Last name	Galvao
Middle name	Badaro
First name	Clovis
Department	-
Mobile	+55 11 8384.0022
Direct fax	-
Direct tel.	-
Personal e-mail	clovis.badaro@luminaenergia.com.br

Appendix 2. Affirmation regarding public funding

There is no public funding for this project activity.

Appendix 3. Applicability of methodology and standardized baseline

Brazilian National Interconnected System Description

In July, 2005, a working group composed by the Ministry of Mines and Energy - MME and the Ministry of Science and Technology - MCT, with the participation of the National Operator of the Electricity System (ONS), was created to make available to CDM project proponents the necessary information for grid connected project activities. According to version 2 of ACM0002 methodology, which was the latest version at the time, the dispatch data analysis was indicated as the most adequate method to calculate Emission Factors, but required detailed hourly information on energy dispatched by each subsystem.

MME, CIMGC and ONS worked together to adjust the methodology to the particular circumstances of the Brazilian electricity system. In order to ensure the transparency of the process, the details of the criteria adopted in the application of the methodology in Brazil were widely disseminated on CIMGC web site on the internet (http://www.mct.gov.br/index.php/content/view/50862.html). Moreover, two meetings were held with specialists and parties interested in developing projects, one in Rio de Janeiro, on 20/Mar/2007, before the disclosure of the outcomes, and another in Brasilia, on 16/Aug/2007, for the discussion of the criteria adopted. The most important issue for project proponents was not the adaptation of the methodology itself but the definition of the number of subsystems in the SIN.

The working group, after discussing relevant issues, proposed the adoption of four subsystems, following the subdivision adopted by the ONS in the dispatch by the SIN, that is, North, Northeast, Southeast/Middle-West and South. CO_2 Emission Factors have been systematically calculated by ONS since January, 2006 and made public on the CIMGC web site. Concomitantly the Inter-ministerial Committee on Global Climate Change (CIMGC, a division of CIMGC) submitted to the CDM Executive Board a detailed description of how the ACM0002 methodology had been applied to Brazil.

The four subsystems structure then adopted differed from the structure adopted by the vast majority of projects already submitted to the CIMGC, which considered only two subsystems (North/Northeast and South/Southeast/Mid-West).

In order to broaden the debate, the CIMGC made a Public Consultation from 07/Dec/2007 to 31/Jan/2008, requesting comments on the criteria adopted for the application of the ACM0002 methodology in Brazil. As a result, 21 submissions were received from several institutions involved with the issue. These contributions criticized mainly the four subsystems structure (which was questioned by all submissions). The adoption of four subsystems was supported by only one submission; the other preferred the adoption of two subsystems or only one subsystem. Other issues addressed were making renewable energy projects viable in different regions, adjusting the ACM0002 methodology to the SIN, and possible definitions regarding transmission constraints under the CDM, among others.

On 25/Feb/2008, a meeting of the working group was held to consider the submissions. As criticism focused mainly on the subsystem structure, the group analyzed the suggested alternatives, which can be grouped into:

1) Four subsystems: North, Northeast; Southeast/Mid-West; South.

2) Two subsystems: North/Northeast; South/Southeast/Mid-West.

3) A single system.

It should be noted that during the Public Consultation period, the Clean Development Mechanism Executive Board approved in Bonn, Germany, a new version (number 7) of the ACM0002 methodology, which indicates a specific methodological tool to calculate the Emission Factor for electricity systems. With regard to the number of subsystems of an electric grid, this tool presented two criteria that could be used to identify significant transmission constraints between two subsystems. Such criteria, which are reproduced below, are neither mandatory nor supplementary, but only possible criteria to identify significant transmission constraints, as suggested in the methodological tool:

a) In case of electricity systems with spot markets for electricity, when there are differences in electricity prices (without transmission and distribution costs) of more than 5% between the systems during 60% or more of the hours of the year.

b) When the transmission line is operated at 90% or more of its rated capacity during 90% or more of the hours of the year.

The working group used alternative (1) – configuration of four subsystems (North; Northeast; Southeast/Mid-West; South) – to verify the possibility of using alternative (2), by means of the analysis of possible transmission constraints between the North and the Northeast, on the one hand, and between the South and the Southeast/Mid-West, on the other, according to the proposed criteria (a) and (b). Simulations were carried out by the ONS and evaluated by the other members of the working group. The findings in this stage were that there were no transmission constraints between the South and Southeast/Mid-West, neither between the North and the Northeast.

Afterwards, an analysis was made to verify if there were transmission constraints between the two subsystems (North/Northeast; South/Southeast/Mid-West). With regard to criterion (a), more or less conservative options were analyzed for the calculations, such as, for instance, the inclusion or not of subsystem South in the calculation of price percentage differences. By means of sensitivity analysis, it was found that according to criteria that reflect more closely the actual operation of the SIN, the time percentage during which prices differed by more than 5% would be 60%, which is within the limit suggested in the calculation tool, thus indicating that there are no significant transmission constraints. In relation to criterion (b) (line saturation), the group did not compared the flow between the subsystems with the rated capacity of transmission between the subsystems because it is a complex procedure, which depends on the configurations of the interconnection system observed during the operation and the direction of the flows between regions. Instead, a simpler analysis was adopted, which consisted in verifying the behavior of price difference between regions. This simplified analysis was considered to be conservative, as it can include constraints beyond the line rated capacity as mentioned in the Executive Board tool. The simulations indicated that in only 70% of the hours of the year there was transmission at 90% or more of the rated capacity. They also indicated that there were no significant transmission constraints. Therefore, a detailed analysis of the flow between the systems along time was not necessary.

The working group met on 28/Apr/2008, at MME, and analyzed the results of the simulations made.

The members of the group agreed by consensus that the current transmission constraints between the subsystems of the SIN are not significant enough to reduce substantially the global benefit of the project, according to the region where it is implemented, being thus advisable to adopt the configuration of a **single electricity system in Brazil.**

This decision shall in no way affect the current configuration used by the ONS in operation planning, as well as energy accounting and price definition as carried out by the Electricity Commercialization Chamber - CCEE, which adopts the subdivision of the SIN into four subsystems. It also highlighted that the technical basis provided by the simulations allows different approaches to be made in each case.

At last, the group pointed out that the evolution process of the SIN should only confirm the decision of adopting a single system to calculate the CO_2 Emission Factor, as the expansion of electricity transmission support between the subsystems will promote gradual reductions in transmission constraints and will enable a project implemented in a given subsystem to produce benefits in the other subsystems of the SIN.

The CIMGC, in its 43rd meeting on 29/Apr/2008, after considering the findings of the working group, decided to adopt a **SINGLE SYSTEM** as the pattern for CDM projects using the tool for calculating Emission Factors to estimate their greenhouse gas reductions.

The map of the National Interconnect System is shown below:

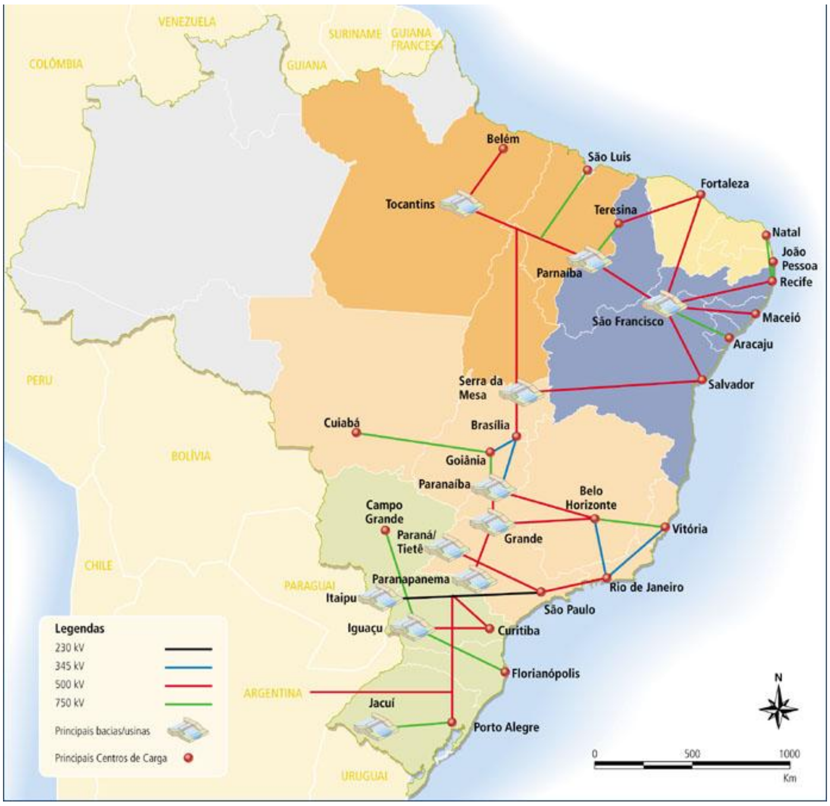

Figure 7 – Brazilian National Interconnected System (SIN)

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

Not applicable.

Appendix 5. Further background information on monitoring plan

The monitoring plan will be executed based on the simplified baseline and monitoring procedures established in the ACM0002 “Grid-connected electricity generation from renewable sources”, version 14.0.0

Ilha Comprida Energia S.A. will be responsible for proceeding with the established procedures and will record the data related to the electricity generated by the renewable technology.

All the procedures that will be used in the monitoring are described on the item B.7.

Appendix 6. Summary of post registration changes

None.

- - - - -