Project design document form for small-scale CDM project activities

(Version 07.0)

PROJECT DESIGN DOCUMENT (PDD)	
Title of the project activity	Small Hydro Power Plant Bugres CEEE
Version number of the PDD	6.3
Completion date of the PDD	16/May/2016
Project participant(s)	CEEE-GT and Lumina Engenharia e Consultoria Ltda.
Host Party	Brazil
Sectoral scope and selected methodology(ies), and where applicable, selected standardized baseline(s)	Sectoral Scope 1 – Energy Industries (Renewable / Non-renewable Sources) Large-scale Consolidated Methodology ACM0002: “Grid-connected electricity generation from renewable sources” (version 16.0 EB81/Annex 9)
Estimated amount of annual average GHG emission reductions	5,875 tCO_2e

SECTION A. Description of project activity

A.1. Purpose and general description of project activity

The Small Hydro Power Plant Bugres (hereinafter referred to as “SHPP Bugres”) is an existing power plant in the South region of Brazil and the project activity consists in the capacity addition of 13 MW, with the installation of a new Francis-type turbine and a new synchronous generator in the power plant, resulting in a total installed capacity of 19.20 MW[1].

The project will be performed by its concessionaire, the State Electricity Generation and Transmission Company (CEEE-GT - Companhia Estadual de Energia Elétrica), which is a mixed economy company belonging to the CEEE Group, a public service concessionaire of all electricity distribution in the South-East region of the State of Rio Grande do Sul. The CEEE-GT’s hydroelectric power plants, which are located in two main systems (Jacuí and Salto), sum up an installed capacity of 909.9 MW.

CEEE-GT is responsible for the main installations which compose the State’s Basic Transmission Grid (Rede Básica de Transmissão do Estado), enabling electricity’s supply and transportation to Distribution Concessionaires operating in the State of Rio Grande do Sul. CEEE’s installations and those under its responsibility, made available by the State, have 64 substations with a total capacity of 7,800 MVA.

Scenario existing prior to the implementation of the project activity

The SHPP Bugres started its operations in 1952, with an installed capacity of 11.12 MW, through a project developed considering valleys transposition with the flow of the Santa Cruz River, through an altitude of 700m, regularized successively by Divisa, Blang and Salto’s dams and being conducted to a final discharge in the Santa Maria River. The Figures 1 to 4 shows the SHPP Bugres existing facilities.

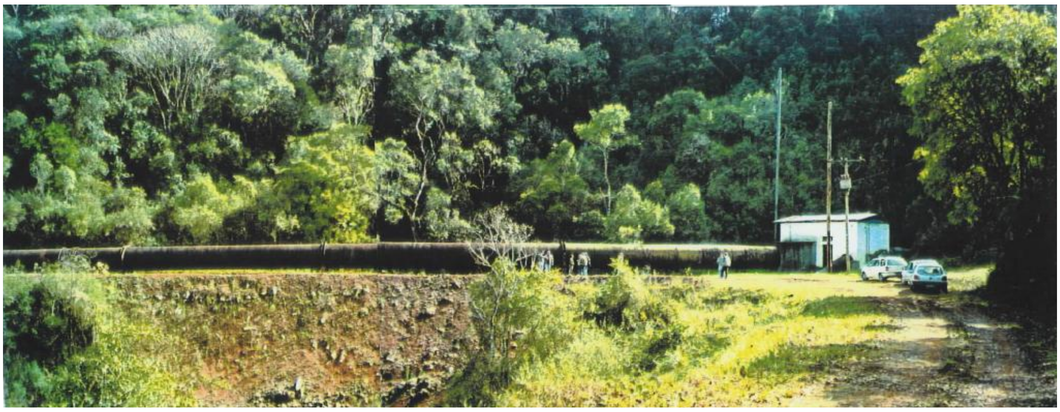


Figure 1 – Adduction canal and valve shelter

[1]Although the project’s current installed capacity is 11.12 MW and the installed capacity of the equipment that will be installed in the project is 13 MW, resulting in a sum of 24.12 MW, the SHPP Bugres electricity generation will be limited by the maximum flow of the project’s adduction tunnel (12.2 m³ / s), as explained in the Project Basic Design. This limitation results in the reduction of the power plant’s current installed capacity from 11.12 MW to 6.20 MW, thus resulting in the project activity’s overall installed capacity of 19.20 MW.

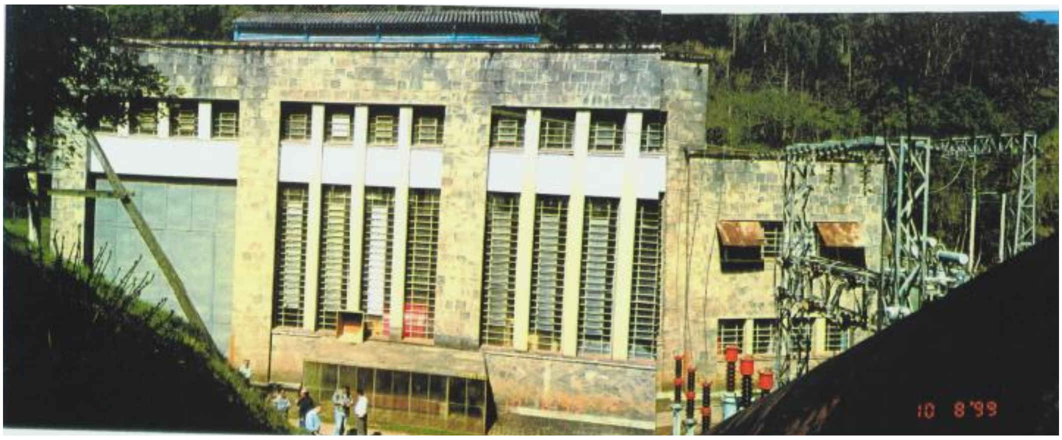


Figure 2 – Power house (upstream view)

Figure 3 – Santa Maria's River leakage canal

Figure 4 – Power house and substation

As defined in Section B.4 of this PDD, in the absence of the SHPP Bugres project activity the existing facility would continue to supply electricity to the grid at historical levels.

The project activity is estimated to deliver an annual average of 5,875 tCO_2 and a total of 41,125 tCO_2 over its renewable crediting period of seven years.

Contribution to sustainable development of the project activity

The proposed project activity reduces greenhouse gas (GHG) emissions that would have occurred otherwise in the absence of the project activity by avoiding electricity generation by fossil fuel sources in the grid. It is important to highlight that future scenario estimations show an increase in the consumption of fossil fuels, based on the Brazilian government's intention of diversifying the energy supply as presented on its latest studies.

Further, 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 SHPP Bugres 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.

Rio Grande do Sul

A.2.3. City/Town/Community etc.

Canela

A.2.4. Physical/Geographical location

The SHPP Bugres is located in the municipality of Canela, in the State of Rio Grande do Sul, as presented in Figure 5. The geographical coordinates of the project's power house are latitude 29°20'35.73" S and longitude 50°41'45.11" W, according CEEE's protocol solicitation sent to the State's Environmental Agency - FEPAM, and are presented in Figure 6. Further, as stated in Section A.1, the project activity is regularized successively by Divisa, Blang and Salto's dams, which have the following geographical coordinates:

Table 1 – Project's dam geographical coordinates
Source: Ordinance #253/2011[2]

Dam	Latitude	Longitude
Divisa	29º17'56'' S	50º34'10'' W
Blang	29º19'33'' S	50º37'01'' W
Salto	29º18'49'' S	50º40'41'' W

Figure 5 – Canela Geographical Location
Source: http://pt.wikipedia.org/wiki/Canela_(Rio_Grande_do_Sul)

[2] Ordinance issued by the Water Resources Department of the State's Environmental Secretary (from the Portuguese *"Departamento de Recursos Hídricos da Secretaria do Meio Ambiente do Estado do Rio Grande do Sul*"), issued on 15/Sep/2011.

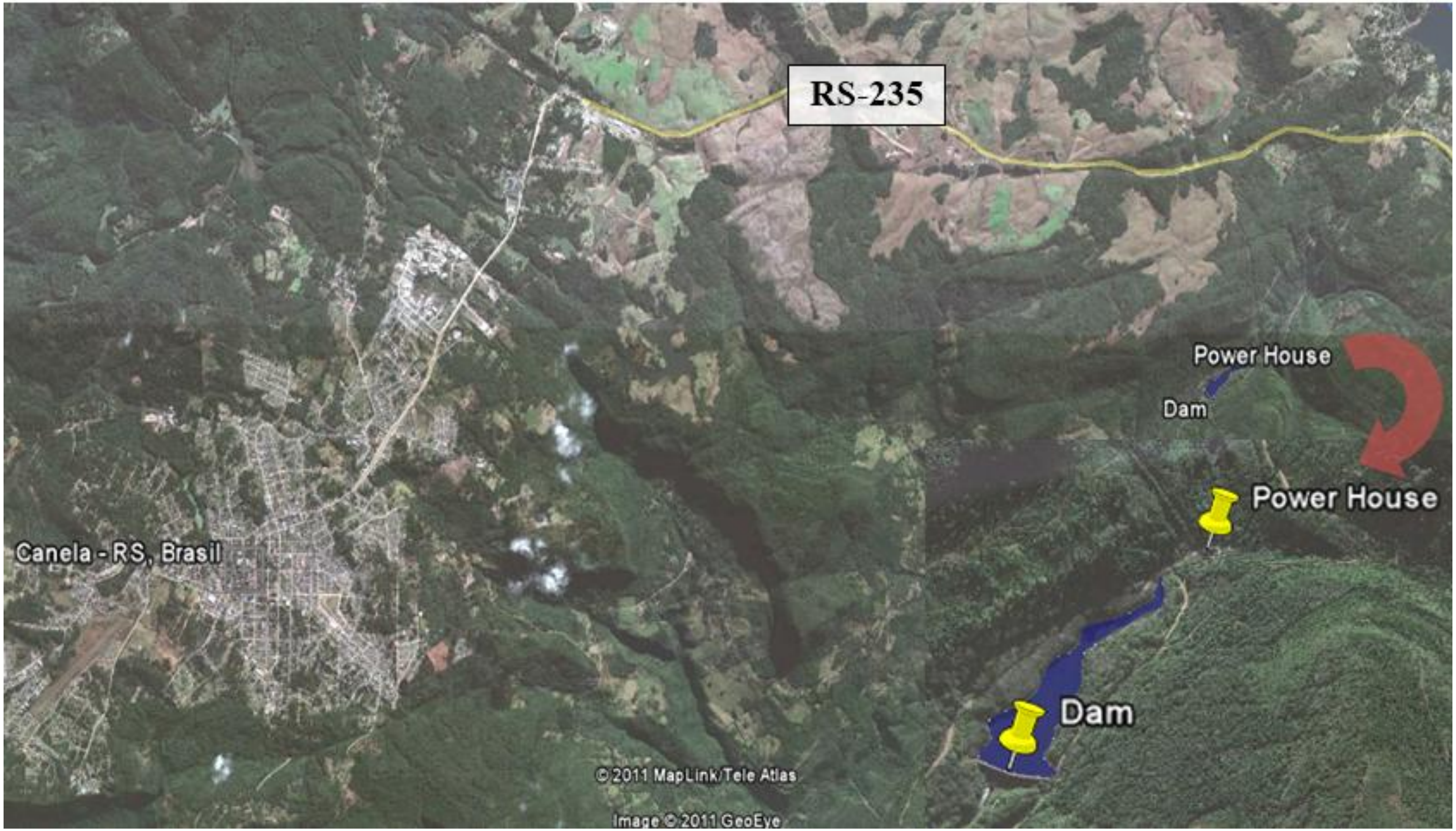


Figure 6 – Project's Geographical Location
Source: Google Earth

A.3. Technologies and/or measures

The CDM considers small power plants – for Type I projects – those with a capacity output until 15 MW. Considering that the project activity will have a total installed capacity of 19.20 MW, the project is considered of large scale.

The equipment and technology to be employed in the project activity have been successfully applied to similar projects in Brazil and around the world and the project complies with Brazilian regulations for SHPP projects. In addition, the project comprises national equipment and, thus, there is no technology or know-how transference to the Host Party for the application of the project. The general arrangement of the SHPP Bugres is shown in the figure below:

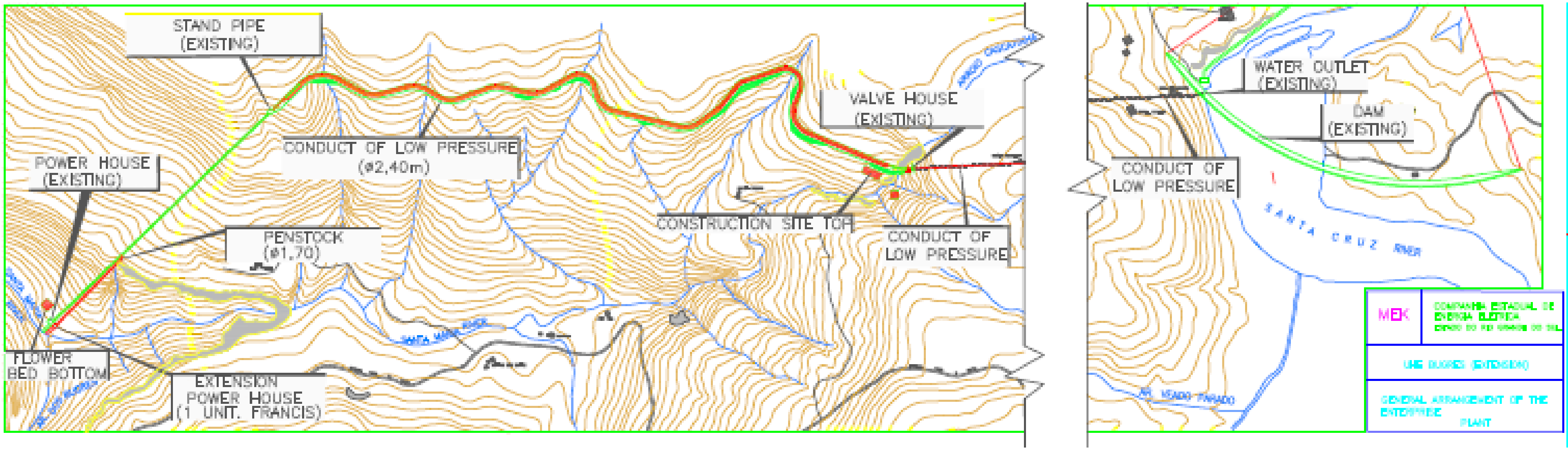


Figure 7 – Project's general arrangement

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

The SHPP Bugres first started its operations in 1952 exploring the renewable hydrological potential of the Santa Cruz River, with the regularization of three dams: Salto; Blang; and Divisa. The valley transposition was done through a tunnel 2,080m long and with a diameter of 2.2m. The installed capacity of the original project plant is 11.12 MW, with a total reservoir of 12.65 km² (which corresponds to Salto, Blang and Divisa reservoirs).

As justified in section B.4 of this PDD, the project's baseline scenario is the continuation of the existing situation, meaning that in the absence of the project activity, the electricity would continue to be generated by the existing plant and delivered to the 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 proposed capacity addition project activity will add 13 MW in the SHPP Bugres with a Francis-type turbine and a synchronous generator. Although the project's current installed capacity of 11.12 MW, the SHPP Bugres generation will be limited by the project's adduction canal maximum flow capacity (12.2 m³/s), as justified in the project's Basic Design which was made available to the DOE.

SHPP Bugres Project Basic Design provides the limitation of the plant's adduction canal, by implanting an additional adduction and forced canal. This limitation aims the best operation of the new 13 MW equipment with a better performance and lower O&M costs.

Thus, due to this limitation, the current power plant's capacity will be reduced from 11.12 MW to 6.20 MW, resulting in a total installed capacity of 19.20 MW to the project activity. The Brazilian National Electric Energy Agency (ANEEL) authorized SHPP Bugres operation with an overall installed capacity of 19.20 MW in its Resolution #397 of 12/Aug/2033.

Moreover, the project has an estimated load factor is 26.92%, based in an assured energy of 3.5 MW average, which was calculated by a third party contracted by project participants. The company MEK was responsible for the elaboration of the project's Basic Design, which is available to the DOE.

The SHPP Bugres existent substation will have its power expanded in 13.5 MVA, with the installation of a three-phase 10.5/13.5 MVA transformer of 60 Hz and 6.6 – 69 kV, ONAN/ONAF. This transformer and other associated equipment will be installed in the bay, which is currently occupied by the TR-3 transformer (5/6.25 MVA).

Equipment to be installed at the project site:

- Turbines: 1 (one) Francis, horizontal axis
- Generators: 1 (one) Synchronous, horizontal axis

Since there will be no increase in the area of the existing reservoirs, there is no project emissions of CH4 from the reservoirs. The only GHG emission considered are baseline CO2 emissions from electricity generation in fossil fuel fired power plants in the grid that are displaced due to the project activity.

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

Table 2 – Project's main technical aspects

PARAMETER	PROJECT DATA	REFERENCE
Current Installed Capacity (MW)	11.12	Equipment plate.
Additional Installed Capacity (MW)	13.00	Project's Basic Design, page 13
Current Assured Energy (MW average)	10	ANEEL Resolution #169/2001[3]
Additional Assured Energy (MW average)	3.50	Project's Basic Design, page 13
Annual Additional Generation (MWh)	30,660	Calculated based in the project's additional average energy.
Current Reservoirs Area (km^2)	12.65	Installation License #230/2010-DL, valid until 04/March/2014.
Reservoir Increase (km^2)	-	There will be no increase in the project's reservoirs area.
Waterfall (m)	183.12	Project's Basic Design, page 13
Average Flow per turbine (m^3/s)	8.00	Project's Basic Design, page 13
New Adduction Channel Length (m)	1,111.70	Project's Basic Design, page 13

Table 3 – Project's main equipment and technical characteristics

TURBINE	
Type	Francis, horizontal axis
Nominal Unit Power	13 MW
Synchronous rotation	600 rpm
Net Fall	183.12 m
Nominal Unit Flow	8 m^3/s
Top Efficiency	90%
GENERATOR	
Unit Nominal Power	13.45 MVA
Synchronous Rotation	600 rpm
Nominal Tension	6.6 kV
Power Factor	0.9

[3] In Brazil, the assured energy designed for SHPPs is defined by the Brazilian Electricity Regulatory Agency – ANEEL (http://www.aneel.gov.br), which is an autarchy under special conditions linked to the Brazilian Mines and Energy Ministry. ANEEL's main responsibility is regulating and supervising electricity generation, transmission and distribution in the country.

A.4. Parties and 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 A (host)	Private entity – CEEE-GT Public entity – Lumina Engenharia e Consultoria 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

- EB81/Annex 9 – Large-scale Consolidated Methodology ACM0002: “Grid-connected electricity generation from renewable sources” (version 16.0);
- 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 detailed information on the methodologies mentioned above, please visit the following link: http://cdm.unfccc.int/methodologies/PAmethodologies/approved.

B.2. Applicability of methodology and standardized baseline

The large-scale consolidated methodology ACM0002 version 16.0 is applicable to grid-connected renewable energy power generation project activities that (a) install a Greenfield power plant; (b) involve a capacity addition to (an) existing plant(s); (c) involve a retrofit of (an) existing operating plant(s)/units; (d) involve a rehabilitation of (an) existing plant(s)/unit(s); or (e) involve a replacement of (an) existing plant(s)/unit(s).

The methodology is also only applicable under the following conditions:

- The project activity may include renewable energy power plant/unit of one of the following types: hydro power plant/unit with or without reservoir, wind power plant/unit, geothermal power plant/unit, wave power plant/unit or tidal power plant/unit;

- In the case of capacity additions, retrofits, rehabilitations or replacements (except for wind, solar, wave or tidal power capacity addition projects the existing plant/unit 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 expansion, retrofit, or rehabilitation of the plant/unit has been undertaken between the start of this minimum historical reference period and the implementation of the project activity.

The proposed project activity is the capacity addition (b) of a hydro power plant/unit that started commercial operation prior to the start of a minimum historical reference period of five years. In addition, the project’s existing power plant will continue to operate after the implementation of the

project activity and no capacity addition or retrofit of the plant was undertaken between the minimum historical reference period and the implementation of the project activity.

The methodology also states that 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 the reservoir(s) is increased and the power density, calculated using equation (3), is greater than 4 W/m^2; or

- The project activity results in new single or multiple reservoirs and the power density, calculated using equation (3), is greater than 4 W/m^2; or

- The project activity is an integrated hydro power project involving multiple reservoirs, where the power density for any of the reservoirs, calculated using equation (3), is lower than or equal to 4 W/m^2, all of the following conditions shall apply:

  (i) The power density calculated using the total installed capacity of the integrated project, as per equation (4), is greater than 4 W/m^2;
  (ii) Water flow between reservoirs is not used by any other hydropower unit which is not a part of the project activity;
  (iii) Installed capacity of the power plant(s) with power density lower than or equal to 4 W/m^2 shall be:

  a. Lower than or equal to 15 MW; and
  b. Less than 10 per cent of the total installed capacity of integrated hydropower project.

The project activity will be implemented in an existing multiple reservoir with no change in its volume, since the adduction canal has a flow limitation that has to be respected for safety reasons.

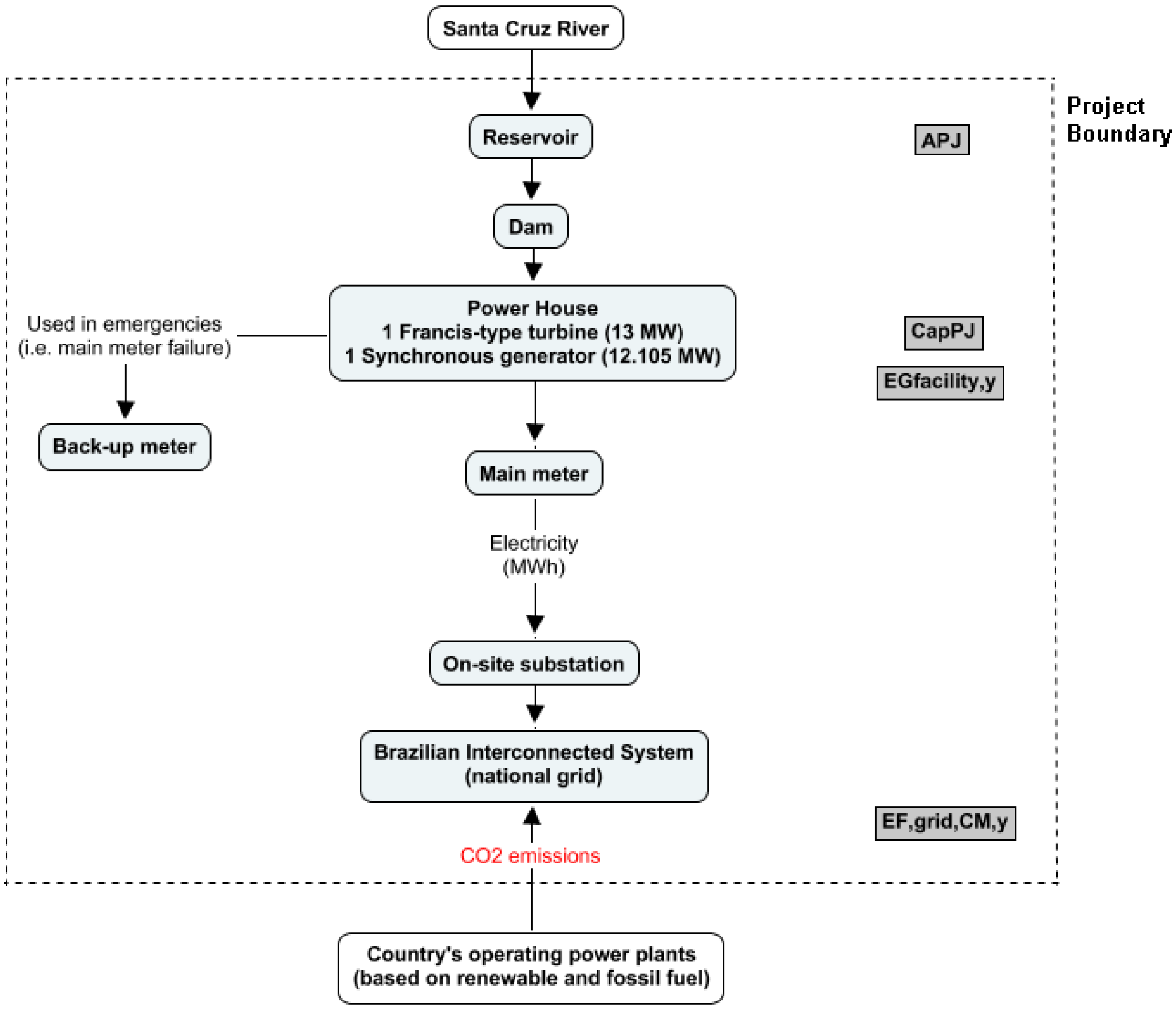
In the case of capacity additions, the ACM0002 states that the baseline scenario is the existing facility that would continue to supply electricity to the grid at historical levels, until the time at which the generation facility would likely be replaced or retrofitted ($DATE_{BaselineRetrofit}$), and electricity delivered to the grid by the added capacity 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”. From that point onwards, the baseline scenario is assumed to correspond to the project activity, and no emission reductions are assumed to occur.

As justified in section B.4, the project’s baseline scenario is the continuation of the current situation, i.e. to use the power generation equipment that was already in use prior to the implementation of the project activity and undertaking business as usual maintenance.

Therefore, the approved methodology ACM0002 “Consolidated baseline methodology for grid-connected electricity generation from renewable sources”, version 16.0, is applicable to the project activity.

B.3. Project boundary

	Source	GHGs	Included?	Justification/Explanation
Baseline scenario	CO_2 emissions from electricity generation in fossil fuel fired power plants that are displaced due to the project activity	CO_2	Yes	Main emission source
		CH_4	No	Minor emission source
		N_2O	No	Minor emission source
Project scenario	For geothermal power plants, fugitive emissions of CH_4 and CO_2 from non-condensable gases contained in geothermal steam.	CO_2	No	Minor emission source
		CH_4	No	Minor emission source
		N_2O	No	Minor emission source
	CO_2 emissions from combustion of fossil fuels for electricity generation in solar thermal power plants and geothermal power plants	CO_2	No	Minor emission source
		CH_4	No	Minor emission source
		N_2O	No	Minor emission source
	For hydro power plants, emissions of CH_4 from the reservoir	CO_2	No	Minor emission source
		CH_4	No	There will be no increase in the area of the existing reservoirs, therefore the project emissions are zero.
		N_2O	No	Minor emission source



B.4. Establishment and description of baseline scenario

According to the latest version of the methodology ACM0002 (version 16.0), if the project activity is a capacity addition to existing grid-connected renewable energy power plant/unit, the baseline scenario is the existing facility that would continue to supply electricity to the grid at historical levels, until the time at which the generation facility would likely be replaced or retrofitted ($DATE_{BaselineRetrofit}$), and electricity delivered to the grid by the added capacity 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". From that point onwards, the baseline scenario is assumed to correspond to the project activity, and no emission reductions are assumed to occur.

According to ACM0002, the baseline emissions include only CO2 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:
BEy = Baseline emissions in year y (tCO_2);
EGPJ,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);
EFgrid,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 is calculated in a transparent and conservative manner as 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".

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[4]. 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[5]. Therefore, the CM emission factor for the grid will be used to calculate the emission reductions of the project.

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

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

B.5. Demonstration of additionality

Early consideration of CDM and continuing CDM activity

The “Guidance on the Demonstration and Assessment of Prior Consideration of the CDM”, version 4, EB62 indicates "that 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 06/Feb/2012, which was received in 07/Feb/2012 and to the Brazilian DNA on 10/Nov/2011.

It is important to notice that on the UNFCCC website the project is listed under the title “SHPP Bugres CEEE”, which was an abbreviation of the current project activity title “Small Hydro Power Plant Bugres CEEE”.

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

Table 6 – Relevant dates for the project activity

EVENT	DATE	DETAILS
CEEE’s Bidding announcement for companies interested on developing CDM project activity for SHPP Bugres	03/Nov/2010	Previous consideration of CDM.
Lumina’s proposal to develop CDM project activity for SHPP Bugres	10/Jan/2011	Previous consideration of CDM.
Lumina’s and CEEE’s agreement to develop CDM project activity for SHPP Bugres	**01/Mar/2011**	**Shareholders decision to develop the project activity.** **Investment decision date.**
Brazilian DNA Communication	10/Nov/2011	Previous consideration of CDM.
EB/CDM Communication	06/Feb/2012	Previous consideration of CDM.
EB/CDM Receipt of PPs Communication	07/Feb/2012	-
Bidding Announcement for EPC contract	01/Dec/2013	Date when CEEE’s Licitation for implementing the project activity will be announced.
EPC signing estimative	01/Mar/2014	**Starting date of the project activity.**

According to the Glossary of CDM Terms, the starting date of a project activity is “the earliest date at which either the implementation or construction or real action of a project activity begins” which is commonly the date when PPs commits to significant expenses related to the effective implementation or construction of the project activity.

Considering that SHPP Bugres project activity still hasn’t acquired its new equipment since CEEE’s will first publish a Bidding Announcement for contracting a company to sign an EPC contract. Thus, the signature of this contract will be the project’s starting date since it will be the point with no return for developing the project activity. The Bidding Announcement is due to 01/Dec/2013 and the EPC contract signature is estimated to 01/Mar/2014, as can be verified in CEEE’s work schedule in “CAR18 – Bugres Work Schedule.pdf” and which will be the project’s starting date.

Additionality

As per ACM0002, version 16.0, 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, as follows:

- 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 Barriers 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 of SHPP Bugres is not the first-of-its-kind.

Step 1: Identification of alternatives to the project activity

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

The project consists in a capacity addition to an existing electricity generation facility that supplies it to the grid. The identification of alternative baseline scenarios only considered two alternatives since project's owner only develop hydroelectric projects like SHPP Bugres. As said before, CEEE-GT's core business is to invest in renewable energy generation, with low environmental impacts and GHG emissions.

Two scenarios were identified as potential alternatives to the proposed project activity:

- **Alternative 1: The project activity not undertaken as a CDM project activity**
  This option complies with the Brazilian legislation and does not face any technical barriers. However, according to the Investment Analysis in section B.5, this alternative is not financially attractive and cannot be considered as a feasible baseline scenario.

- **Alternative 2: Continuation of the current situation (no project activity or other alternatives undertaken)**
  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 on section B.4 generate financial/economic benefits other than CDM related income, since 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 analyse 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 "Guidelines on the Assessment of Investment Analysis" (version 05, EB62, Annex 5) and the "Tool for Demonstration and Assessment of Additionality" offers 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*

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 CDM EB in its 61st meeting defined that 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.

Project participants calculated a project IRR and, thus, chose to calculate a WACC as benchmark for comparison to the expected return of the project activity. Generally, the WACC is defined as:

$$WACC = k_e * r_e + k_d * r_d * (1 - T)$$

Where:

WACC	Weighted Average Capital Cost
ke	Weight of equity
re	Cost of Equity
kd	Weight of debt
rd	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:

Cost of equity (Re)

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

$$Re = Rf + \beta \times (Rm - Rf)$$

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 (NTN-C) with a maturity in 2031 was used. The benchmark was calculated considering the NTN-C average from January 2006 to December 2010.

The historic values of NTN-C bonds can be verified in the website in http://www.tesouro.fazenda.gov.br and the values between 2006 and 2010 are as follows:

Table 7 – NTN-C bonds value

Year	NTN-C
2006	21.43%
2007	22.67%
2008	10.45%
2009	15.99%
2010	24.58%
5-year average	**19.02%**

In order to calculate the risk free rate in real terms, the inflation rates of the country were subtracted from 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 2006 and 2010 are as follows:

Table 8 – Inflation annual rates

Year	Inflation rate
2006	3.84%
2007	7.74%
2008	9.80%
2009	(1.71%)
2010	11.31%
5-year average	**6.20%**

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 5-year average of the values calculated by the corporate finance professor Mr. Aswat Damodaran[6]. 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 2006 and 2010 are as follows:

Table 9 – BETA annual average rates

Year	BETA (average rate)
2006	0.89
2007	1.04
2008	Not available
2009	0.73
2010	0.68
5-year average	**0.83**

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 5-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 2006 and 2010 are as follows:

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

Table 10 – Market risk premium annual average rate

Year	Rm – Rf (average rate)
2006	8.66%
2007	7.79%
2008	9.50%
2009	7.50%
2010	8.00%
5-year average	**8.29%**

Thus, the cost of equity (Re) is:

Re = Rf + β x (Rm – Rf)

Re = 12.82% + 0.83% * 8.29%

Re = 12.82% + 6.88%

Re = 19.70%

Cost of debt (Rd)

The cost of debt (Rd) is calculated as follows:

Rd = a + b + c

Kd: Cost of debt
a:Financial costs
b: BNDES Fee;
c: Spread (credit risk rate)

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[7] 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[8]. The average value between 2006 and 2010 is 6.60%.
b) Bank remuneration: 0.9% for power plants except fossil-fuel fired thermal ones[9]; 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%[10]. This rate is a margin to cover non-performing loans. Project participants adopted the average value of 1.785% in a conservative manner.

Also, it finances up to 70% of the total investment usually with a 16-year amortization period[11].

Therefore, the cost of debt can be taken as:

rd = 6.60% + 0.9% + 1.785%

rd = 9.29%

and ke and kd are respectively 30% and 70% as defined by BNDES[12].

Brazilian tax regulations allow for two modalities called presumed and actual profit. Companies like CEEE-GT, with annual gross revenue above a certain limit must use the actual profit regulations under which there is a 25% rate for the income tax plus 9% for a social contribution.

The WACC is, therefore, 10.20%.

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, is available to the DOE, DNA and EB/CDM.

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[7] www.bndes.gov.br/SiteBNDES/bndes/bndes_pt/Institucional/Apoio_Financeiro/Produtos/FINEM/energia_eletrica_geracao.htm

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

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

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

[11] http://www.bndes.gov.br/SiteBNDES/bndes/bndes_pt/Institucional/Sala_de_Imprensa/Noticias/2010/energia/20100809_energias_alternativas.html

[12] As defined by BNDES at:
http://www.bndes.gov.br/SiteBNDES/bndes/bndes_pt/Institucional/Apoio_Financeiro/Produtos/FINEM/energia_eletrica_geracao.html

Table 11 – Project's basic financial parameters

Parameter	Project data	Reference
Additional Installed capacity (MW)	13	Project's Basic Design, page 13
Additional Annual On-grid Supply (MWh)	30,660	Calculated based on additional energy of 3.5 MWavg
Project lifetime (years)	23 years (until 07/Jul/2035)	ANEEL Concession Contract #25/2000
Energy auction price (R$/MWh)	67.31	Brazilian Energy Auction of 17/Dec/2010.
Total investment (R$)	22,000,000.00	CEEE's Assessment Report
O&M Costs (R$/MWh)	2.73	SHPP Bugres O&M historic average cost sourced from CEEE's information
Insurance	0.30%	Energy and Mines Ministry Public Hearing on Proinfa, July 2003, p. 8[13]
IRR (%)	7.23	Cash Flow Spreadsheet

No salvage value was applied in the cash flow analysis since as per the Brazilian regulation given in the Water Code (Código das Águas), Article 165[14]:

> *"At the expiry of the concessions all construction techniques, regularization and derivation, principal and accessory, the raceways water, the penstocks and discharge channels and leakage, as well as the machinery for the production and processing of energy and transmission and distribution lines revert to the Union, to the States or to the municipalities, as the area that is subject to the watercourse.*
>
> *Single paragraph. When the use of hydropower is intended for public federal, state or municipal use, the facilities mentioned in this Article shall revert:*
>
>> *a) for the Union in the case of federal public services, whatever the owner of the source of energy used;*
>>
>> *b) for the state, in the case of state services in rivers other than the federal domain, in which case they will revert to the Union;*
>>
>> *c) for the municipality, in the case of municipal services or individuals in rivers other than the domain of the Union or the States.*

Therefore, considering that SHPP Bugres is of Rio Grande do Sul State use, at the end of the concession period defined by ANEEL's Concession Contract (already made available to the DOE) the power plant facilities shall revert to the State without any compensations. Thus, the residual value is not applicable to the project's case and it wasn't applied in its cash flow.

The IRR (Internal Rate of Return) of the project activity without the benefit from the CERs sale is lower than the WACC rate for the period. Therefore, the SHPP Bugres is not the most financially attractive option, once its IRR is 7.23%, which is lower than the selected benchmark WACC of 10.20%.

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 favourable indicator (e.g. lower IRR) than the benchmark, then the CDM project activity cannot be considered as financially attractive.

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[13] Available at http://www.inee.org.br/down_loads/forum/Parecer%20INEE%20Proinfra.pdf

[14] Source: http://www.planalto.gov.br/ccivil_03/decreto/d24643.htm

Thus, the SHPP Bugres 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;
- Energy auction price; and
- Electricity generation.

The impact on the project IRR is shown below, when the four 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 5.

Sensitivity Analysis of project IRR, without the CDM benefits

Table 12 – Total Investment

Variation	IRR	R$tho
-28.65%	10.20%	15,697.00
-20%	9.13%	17,600.00
-10%	8.10%	19,800.00
-5%	7.64%	20,900.00
0%	7.23%	22,000.00
5%	6.84%	23,100.00
10%	6.48%	24,200.00
20%	5.83%	26,400.00

Table 13 – O&M Costs

Variation	IRR	R$/MWh
-100%	7.60%	0.00
-20%	7.30%	2.18
-10%	7.26%	2.46
-5%	7.25%	2.59
0%	7.23%	2.73
5%	7.21%	2.87
10%	7.19%	3.00
20%	7.15%	3.28

Table 14 – Energy auction price

Variation	IRR	R$/MWh
-20%	5.27%	53.85
-10%	6.30%	60.58
-5%	6.77%	63.94
0%	7.23%	67.31
5%	7.67%	70.68
10%	8.11%	74.04
20%	8.95%	80.77
35.60%	10.20%	91.27

Table 15 – Electricity Generation

Variation	IRR	MWh/year
-20%	5.36%	24,528.00
-10%	6.34%	27,594.00
-5%	6.79%	29,127.00
0%	7.23%	30,660.00
5%	7.65%	32,193.00
10%	8.07%	33,726.00
20%	8.88%	36,792.00
37.10%	10.20%	42,034.86

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 investment, a 20% reduction leads to an IRR that is still below the WACC. It is only with a reduction of 28.65% that the project's IRR equals the benchmark. Such a reduction is unlikely to happen. The overall total investment of the project activity as estimated by CEEE in its Assessment Report is R$22,000,000. However, this value was updated by the Eletrobrás Standard Budget Spreadsheet (OPE Eletrobrás) to R$33,840,367.79, dated from December, 2011, which is considerably higher than the value used in the project's cash flow.

O&M Costs: When examining the project's O&M costs, a 20% reduction leads to an IRR that is still below the WACC. Even with a reduction of 100% the project IRR is still below the WACC. The impact of this parameter is therefore insignificant.

Energy Auction Price: The most recent Energy Auction prior to the investment decision date in the country contracted hydroelectricity for a price of

R$67.31/MWh[15] (dated on 17/Dec/2010). Adding another 20% to this price raises it to R$80.77/MWh and the resultant IRR is still below the WACC. It is only with an increase of 35.60% that the project's IRR equals the benchmark (R$91.27/MWh). Such an increase is unlikely to happen. Energy auctions carried out by the national electricity market regulator, CCEE, where utilities must buy their future demand, support the argument that this increased price is unlikely. The table below shows the average price resulting in each auction and how in the last two years the prices have been decreasing consistently. Furthermore, as justified in the investment sensitivity analysis, the project's investment already exceeded the original estimation and is now of R$33,840,367.79. With this investment, the project's IRR would equal the benchmark only with a price of R$134.35/MWh. As presented in the table below, this is unlikely to happen since the average energy prices have been decreasing in the last years.

Table 16 – Energy auction prices
Source: http://www.epe.gov.br/leiloes/Paginas/default.aspx?CategoriaID=6801

Auction	New Energy		Auction Adjustment		Renewable Energy	
	Auction Date	R$/MWh	Auction Date	R$/MWh	Auction Date	R$/MWh
1	16/Dec/2005	139.00	-	-	-	-
2	29/Jun/2006	134.42	01/Jun/2006	Postponed	-	-
3	10/Oct/2006	138.00	29/Sep/2006	No deals	-	-
4	26/Jul/2007	136.00	29/Mar/2007	No deals	-	-
5	16/Oct/2007	131.49	28/Jun/2007	No prices	01/Jun/2007	137.32
6	17/Sep/2008	131.44	27/Sep/2007	138.25	-	-
7	30/Sep/2008	146.00	19/Jun/2008	141.78	-	-
8	27/Aug/2009	-	23/Sep/2008	145.67	-	-
9	21/Dec/2009	Cancelled	20/Feb/2009	-	-	-
10	30/Jul/2010	99.48	-	-	-	-
11	-	-	-	-	26/Aug/2010	133.56
12	17/Dec/2010	67.31	-	-	-	-
13	-	-	-	-	18/Aug/2011	99.61
14	17/Aug/2011	102.07	-	-	-	-
15	-	-	-	-	20/Dec/2011	102.18

Energy Generated: With a 20% increase in the project's electricity generation, the project's IRR is still below the WACC. It is only with an increase of 37.10% that the project's IRR equals the benchmark. Such an increase is technically improbable once the estimated electricity generation of SHPP Bugres is based on the project's assured energy, defined as 3.50 MW. An increase in this energy is unlikely to happen once the plant load factor is determined in accordance with historical inflow series including critical periods in hydrological terms.

The sensitivity analysis confirms that the SHPP Bugres is not financially attractive. Therefore, it can be concluded that the project is financially unattractive without the CERs revenues. The project thus faces significant financial barriers without CDM support.

Sub-step 2d is satisfied.

OUTCOME OF STEP 2: As demonstrated throughout step 2, the project's IRR without the benefit of the CDM is lower than the selected benchmark. The sensitivity analysis also

[15] http://www.epe.gov.br/imprensa/PressReleases/20101217_1.pdf

shows that the project is unlikely to become feasible without the benefit of the CDM as well. Therefore, the SHPP Bugres project activity is not financially attractive and faces significant financial barriers without CDM support.

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 “Guidelines on Common Practice” (version 02, EB69, Annex 8), 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.

The following steps are used by the “Guidelines” to define the similar power plants to the proposed project activity:

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

The HPP Bugres will have a total installed capacity of 19.20 MW and, thus, the power plants were only considered if they have a capacity ranging between -50% and +50% regarding the projects additional installed capacity (between 9.75 MW and 28.95 MW).

When this analysis was undertaken, there were 2,746 power plants operating in Brazil, as follows:

Table 1 – Operating power plants in Brazil

Source: ANEEL database[16]

OPERATING POWER PLANTS			
Type	**Quantity**	**Total capacity (MW)**	**%**
CGH	400	239.25	0.2
EOL	85	1,888.28	1.56
PCH	436	4,305.30	3.52
UFV	11	11.58	0.01
UHE	204	82,486.84	65.99
UTE	1,608	34,680.32	27.07
UTN	2	1,990.00	1.66
Total	**2,746**	**125,601.66**	**100**

LEGEND	
CGH	Hydro Generating Central
EOL	Wind Generating Central
PCH	Small Hydro Power Plant
UFV	Photovoltaic Power Plant
UHE	Hydro Power Plant
UTE	Thermal Power Plant
UTN	Thermonuclear Power Plant

[16] Avaliable at: http://www.aneel.gov.br/aplicacoes/capacidadebrasil/capacidadebrasil.cfm.Visited on 11/Jan/2013.

From these, only 195 are in the applicable range of +/- 50% of the project's installed capacity, as follows:

Table 2 – Operating power plants within the project's applicable range

OPERATING POWER PLANTS			
Type	**Quantity**	**Total capacity (MW)**	**%**
CGH	-	-	-
EOL	9	108.80	4.36
PCH	87	1,156.62	46.34
UFV	-	-	-
UHE	-	-	-
UTE	99	1,230.20	49.30
UTN	-	-	-
Total	**195**	**2,495.62**	**100**

OUTCOME OF STEP 1: From the overall 2,746 power plants currently operating in Brazil, only 195 are within the capacity range of the project activity and will be analyzed in this common practice analysis.

- **STEP 2:** Identify similar projects (both CDM and non-CDM) which fulfill all of the following conditions:

a) The projects are located in the applicable geographical area;

As defined in the "Guidelines", the applicable geographical area should be the entire host country.

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.asp.

Therefore, all 195 power plants identified in Table 18 are within the same geographical area as the project activity.

b) The projects apply the same measure as the proposed project activity;

The "Guidelines" define that "measure" is a broad class of greenhouse gas emission reduction activities possessing common features. Four types of measures are currently covered in the framework:

i. Fuel and feedstock switch (example: switch from naphtha to natural gas for energy generation, or switch from limestone to gypsum in cement clinker production);

Not applicable to the project activity case.

ii. Switch of technology with or without change of energy source including energy efficiency improvement as well as use of renewable energies (example: energy efficiency improvements, power generation based on renewable energy);

Not applicable to the project activity case.

i. Methane destruction (example: landfill gas flaring);

Not applicable to the project activity case.

ii. Methane formation avoidance (example: use of biomass that would have been left to decay in a solid waste disposal site resulting in the formation and emission of methane, for energy generation).

Not applicable to the project activity case.

a) The projects use the same energy source/fuel and feedstock as the proposed project activity, if a technology switch measure is implemented by the proposed project activity;

From the 195 power plants presented in Table 18, only 87 are hydro power plants such as the project activity; 9 of those are wind; and 99 are thermal power plants.

Thus, only 87 power plants can be considered similar to the project activity.

b) The plants in which the projects are implemented produce goods or services with comparable quality, properties and applications areas (e.g. clinker) as the proposed project plant;

All plants identified in Table 18 produce services with comparable quality, properties and application areas as the proposed project plant.

c) The capacity or output of the projects is within the applicable capacity or output range calculated in Step 1;

All power plants identified in Table 18 are within the applicable capacity range calculated in Step 1.

d) The projects started commercial operation before the project design document (CDM-PDD) is published for global stakeholder consultation or before the start date of proposed project activity, whichever is earlier for the proposed project activity.

Considering that SHPP Bugres project activity still hasn't acquired its new equipment, CEEE's will first publish a Bidding Announcement for contracting a company to sign an EPC contract. Thus, the signature of this contract will be the project's starting date since it will be the point with no return for developing the project activity. The Bidding Announcement is due to 01/Dec/2013 and the EPC contract signature is estimated to 01/Mar/2014, which will be the project's starting date. However, since the date of the publication of the PDD is 02/Jun/2012 the power plants analyzed in this step were all considered similar to the project activity, since they started their commercial operation until May/2012.

The commercial operation starting date of all the power plants analyzed in this step 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).

Thus, from the 87 hydro power plants identified in Table 18, only two have a commercial operation after the project PDD publication date, leaving 85 power plants for comparison with the project activity.

OUTCOME OF STEP 2: From the overall 87 power plants within the capacity range of the project activity as presented in STEP 1, only 85 fitted the criteria described in STEP 2.

- **STEP 3:** Within the projects identified in Step 2, identify those that are neither registered CDM project activities, project activities submitted for registration, nor project activities undergoing validation. Note their number N_{all}.

From the power plants identified in **STEP 2**, 44 are registered CDM project activities, project activities submitted for registration or project activities undergoing validation. Thus, N_{all} = 41

OUTCOME OF STEP 3: From the overall 85 power plants considered similar to the project activity as presented in STEP 2, 44 are registered, under registration or undergoing validation on the CDM. Thus, N_{all} = 41.

- **STEP 4:** Within similar projects identified in Step 3, identify those that apply technologies that are different to the technology applied in the proposed project activity. Note their number N_{diff}.

As per the "Guidelines", different technologies are those that deliver the same output and differ by at least one of the following:

a) Energy source/fuel (example: energy generation by different energy sources such as wind and hydro and different types of fuels such as biomass and natural gas);

All 41 remaining power plants are hydro power plants such as SHPP Bugres and, therefore, this is not applicable to the project activity case.

b) Feed stock (example: production of fuel ethanol from different feed stocks such as sugar cane and starch, production of cement with varying percentage of alternative fuels or less carbon-intensive fuels);

Not applicable to the project activity case.

c) Size of installation (power capacity)/energy savings;

i. Micro (as defined in paragraph 24 of decision 2/CMP.5 and paragraph 39 of decision 3/CMP.6)

Not applicable for the project activity case.

i. Small (as defined in paragraph 28 of decision 1/CMP.2)

Not applicable for the project activity case.

ii. Large

The CDM considers small power plants – for Type I projects – those with a capacity output until 15 MW. Considering that the project activity will have a total installed capacity of 19.20 MW, the capacity addition project is considered of large scale.

Therefore, from the remaining 41 power plants similar to the project activity, only 13 have a capacity output higher than 15 MW.

a) Investment climate on the date of the investment decision, inter alia:

i. Access to technology

The 13 remaining small hydro power plants that are considered similar to the project activity have the same conditions of access to technology and, therefore, this criteria is not applicable to the project activity case.

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 small hydro power plants 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 wind, biomass and SHPPs connected to the national grid (SIN[17]). 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.

From the remaining 13 small hydro power plants similar to the project activity, 10 have received the benefit from PROINFA, thus leaving 3 small hydro power plants considered similar to the project activity.

ii. Promotional policies

No promotional policies were considered as criteria to the project activity case.

iii. Legal regulations

This analysis only considered those power plants operating as Public Service (SP – *Serviço Público)* such as the project activity. In Brazil, there are three other ways to provide electricity:

- Independent Energy Producers (*Produtor Independente de Energia* – PIE);
- 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[18].

As described in the Electric Power Commercialization Chamber's website[19] (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.

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

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

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

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).

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 3 – Differences between the Brazilian Electric Sector phases

Source: Electric Power Commercialization Chamber's[20]

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 they operation started after March, 2004 in a way that they are all set to the same regulatory framework.

Therefore, from the remaining 3 small power plants similar to the project activity, no power plants fitted the above criteria.

i. Other features, inter alia
    i. Nature of the investment (example: unit cost of capacity or output is considered different if the costs differ by at least 20%).

This criteria was not applied in the analysis of the project activity.

RESULT OF STEP 4: After analysing all power plants throughout Step 4, only two small hydro power plants remained similar to the project activity and, thus, N_{diff} = 41.

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

- **STEP 5:** Calculate factor $F = 1 - N_{diff} / N_{all}$ representing the share of similar projects (penetration rate of the measure/technology) using a measure/technology similar to the measure/technology used in the proposed project activity that deliver the same output or capacity as the proposed project activity.

a) $F = 1 - N_{diff} / N_{all}$

$F = 1 - 41 / 41$

$F = 1 - 1$

$F = 0$

As per the "Tool", the project activity is only a common practice within a sector in the applicable geographical area if the factor F is greater than 0.2 and $N_{all} - N_{diff}$ is greater than 3.

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

OUTCOME OF STEP 5: As demonstrated in the common practice analysis, similar projects to the project activity 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. Without CDM support, the project would not be implemented.

B.6. Emission reductions

B.6.1. Explanation of methodological choices

Project Emissions

According to ACM0002, for most renewable energy 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:

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

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)
$PE_{HP,y}$ = Project emissions from reservoirs of hydro power plants in year *y* (tCO_2e)

The GHG emissions from the SHPP Bugres project activity are zero, once 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 ($PE_{GP,y} = 0$). The emissions from the water reservoirs of the project power plants are also not accounted, once the project's is implemented in an existing multiple reservoir with no change in their volume, as described in Section B.2.

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:

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

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, capacity additions, retrofits, rehabilitations and replacements.

The project activity consists in a capacity addition and, therefore, $EG_{PJ,y}$ calculation is as follows:

c) Capacity additions to an existing renewable energy power plant

The methodology ACM0002 states that in the addition of a new power plant or unit may in some cases affect the electricity generated by the existing plant(s) or unit(s). This applies, for example, in the following situation:

- A new hydro turbine installed at an existing hydro dam may affect the power generation by the existing turbines;
- A new geothermal power unit installed next to an existing geothermal energy based power plant may affect the power generation by the existing plant.

In other situations, the power plant of the existing plant(s) or unit(s) may not be affected. This applies, for example, in the following situation:

- A new solar power plant installed next to an existing solar power plant may not affect the radiation received by the existing power plant and would therefore not affect the power generation of the existing solar power plant.

In the case where the addition of new capacity could affect the electricity generated by existing plant(s) or unit(s), the project participants shall use the approach applied to retrofits and replacements set out in section (b) of the methodology. $EG_{facility,y}$ is the quantity of net electricity generation supplied by the project plant/unit to the grid and is determined as the difference between the quantity of electricity supplied by the project plant/unit to the grid and quantity of electricity delivered to the project plant/unit from the grid.

As per section (b) of ACM0002, it is stated that the power generation of renewable energy projects can vary significantly from year to year, due to natural variations in the availability of the renewable source (e.g. varying rainfall, wind speed or solar radiation).

The use of few historical years to establish the baseline electricity generation can therefore involve a significant uncertainty. The methodology addresses this uncertainty by adjusting the historical electricity generation by its standard deviation. This ensures that the baseline electricity generation is established in a conservative manner and that the calculated emission reductions are attributable to the project activity.

$EG_{PJ,y}$ is calculated as follows:

$$\mathbf{EG_{PJ,y} = EG_{facility,y} - (EG_{historical} + \sigma_{historical}); \text{ until } DATE_{BaselineRetrofit}}$$

And

$$\mathbf{EG_{PJ,y} = 0; \text{ on/after } DATE_{BaselineRetrofit}}$$

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)

$EG_{facility,y}$ = Quantity of net electricity generation supplied by the project plants/units to the grid in year *y* (MWh)

$EG_{historical}$ = Annual average historical net electricity generation delivered to the grid by the existing renewable energy power plants/units that was operated at the project site prior to the implementation of the project activity (MWh)

$\sigma_{histrorical}$ = Standard deviation of the annual average historical net electricity generation delivered to the grid by the existing renewable energy plant that was operated at the project site prior to the implementation of the project activity (MWh)

$DATE_{BaselineRetrofit}$ = Point in time when the existing equipment would need to be replaced in the absence of the project activity (date)

To determine $EG_{historical}$, project participants may choose between two historical periods. This allows some flexibility: the use of the longer time period may result in a lower standard deviation and the use of the shorter period may allow a better reflection of the (technical) circumstances observed during the more recent years.

Project participants may choose among the following two time spans of historical data to determine $EG_{historical}$:

a) The five last calendar years prior to the implementation of the project activity; or
b) The time period from the calendar year following $DATE_{hist}$, up to the last calendar year prior to the implementation of the project, as long as this time span includes at least five calendar years, where $DATE_{hist}$ is latest point in time between:
    i. The commissioning of the plant/unit;
    ii. If applicable: the last capacity addition to the plant/unit; or
    iii. If applicable: the last retrofit or rehabilitation of the plant/unit.

Project participants chose method a) five last calendar years prior to the implementation of the project activity for calculating $EG_{historical}$.

Calculation of $DATE_{BaselineRetrofit}$

In order to estimate the point in time when the existing equipment would need to be replaced/retrofitted in the absence of the project activity ($DATE_{BaselineRetrofi}$), project participants may take into account the typical average technical lifetime of the type equipment, which shall be determined and documented as per the "Tool to determine the remaining lifetime of equipment".

The methodology also states that the point in time when the existing equipment would need to be replaced/retrofitted in the absence of the project activity should be chosen in a conservative manner, i.e. if a range is identified, the earliest date should be chosen.

According to the approved and consolidated baseline methodology ACM0002, in order to estimate the point in time when the existing equipment would need to be replaced/retrofitted in the absence of the project activity ($DATE_{BaselineRetrofit}$), project participants may use the typical average technical lifetime of the type equipment may be determined and documented, taking into account common practices in the sector and country, e.g. based on industry surveys, statistics, technical literature, etc.

Technical literature of different international sources confirms that hydropower plants may have an average technical lifetime up to 100 years.

The International Energy Agency (IEA) is an autonomous organization that works to ensure reliable, affordable and clean energy for its 28 member countries and beyond. Founded in response to the 1973/4 oil crisis, IEA's initial role was to help countries co-ordinate a collective response to major disruptions in oil supply through the release of emergency oil stocks to the markets. While this continues to be a key aspect of its work, the IEA has evolved and expanded. It is at the heart of global dialogue on energy, providing authoritative and unbiased research, statistics, analysis and recommendations. Today, the IEA's four main areas of focus are energy security, economic development, environmental awareness and engagement worldwide.

According to IEA, hydro power plants can have a technical lifetime up to 100 years, due to the fact that hydropower is the most proven, efficient, flexible and reliable source of electricity based on more than a hundred years of experience. Upgrades and refurbishment can readily extend lifetime of plants which contribute to the low cost of electricity from hydropower[21].

The Energy Technology Systems Analysis Programme (ETSAP) is an Implementing Agreement of IEA, also states that small hydropower plants with an installed capacity up to 10 MW and that hydropower plants with more than 10 MW have a technical lifetime up to 100 years[22]. The ETSAP was first established in 1976. It functions as a consortium of member country teams and invited teams that actively cooperate to establish, maintain, and expand a consistent multi-country energy/economy/environment/engineering (4E) analytical capability. Its backbone consists of individual national teams in nearly 70 countries, and a common, comparable and combinable methodology, mainly based on the MARKAL/TIMES family of models, permitting the compilation of long term energy scenarios and in-depth national, multi-country, and global energy and environmental analyses.

The European International Network for Sustainable Energy (INFORSE – Europe) is a network of 80 Non-Governmental Organizations (NGO) that are working for sustainable energy solutions to protect the environment and reduce poverty. INFORSE - Europe is one of the seven regions of the International Network for Sustainable Energy (INFORSE), which is a worldwide NGO network formed at the Global Forum in Rio in 1992. INFORSE has more than 145 member organizations worldwide and works for implementation of sustainable energy solutions by exchange of information, awareness creation, formulation and implementation of strategies, and lobbying of international forums. INFORSE-Europe has 80 members from 35 countries.

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[21] Available at http://www.iea.org/publications/freepublications/publication/Hydropower_Essentials.pdf

[22] Available athttp://www.iea-etsap.org/web/e-techds/pdf/e07-hydropower-gs-gct.pdf

INFORSE - Europe also states that small hydro power plants present an average technical lifetime of more than 70 years, and that experts confirm that this period might be as long as 100 years as well[23].

For further evidence of how hydropower plants can operate for up to 100 years, the following table shows different Brazilian power plants that started its operations in the beginning of the 20th century and that still haven't been retrofitted or that were retrofitted after a long period of operation.

Table 4 – Brazilian hydropower plants that started operations in the beginning of the 20th century

Power Plant	Operation Start	Retrofitted?	Technical Lifetime
Jucu	1909	Retrofitted in 2000	91 years until retrofit
São Joaquim	1911	Retrofitted in 2001	90 years until retrofit
Capão Preto	1911	Retrofitted in 2008	97 years until retrofit
Esmeril	1912	Retrofitted in 1997	85 years until retrofit
Fruteiras	1912	Retrofitted in 2000	88 years until retrofit
Chibarro	1912	Retrofitted in 2008	96 years until retrofit
Gavião Peixoto	1913	Retrofitted in 2007	94 years until retrofit
Coronel Domiciano	1918	Capacity addition in 1995	95 years in operation
Alegre	1920	Retrofitted in 2000	80 years until retrofit
Ijuí	1923	-	90 years in operation
Dourados	1926	Retrofitted in 2002	76 years until retrofit
Marzagão	1927	Capacity addition in 2001	86 years in operation
Capigui	1933	Capacity addition in 1953 and 1955	80 years in operation
Herval	1941	-	72 years in operation
Passo do Inferno	1948	-	65 years in operation
Forquilha	1950	-	63 years in operation
Ijuizinho		-	
		AVERAGE LIFETIME	**83 YEARS**
BUGRES	**1952**	**Capacity addition scheduled**	**61 YEARS**

The power plants presented above that went through a retrofit had its equipment replaced with new ones and those that received a capacity addition continued to operate with their old equipment but with new ones operating with them to complement the electricity generation.

As can be verified in the table above, the hydropower plants analyzed have an average lifetime of 83 years. PPs decided to use this average in a conservative manner to calculate the remaining lifetime of SHPP Bugres.

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[23] Available at http://www.inforse.org/europe/success/SU_H_intro.htm

Considering that the project activity first started its operations in 1952, the remaining lifetime is as follows:

Technical operational average lifetime: 83 years

Current operational lifetime: 61 years

Remaining lifetime: 83 – 61 = 22 years

Thus, $DATE_{BaselineRetrofit}$ is 2035.

All information presented in Table 20 is sourced from the following links:

- **Comissioning dates**

Jucu
http://www.edpbr.com.br/energia/geracao_renovaveis/geracao/espirito_santo/pch_jucu/pch_jucu.asp

São Joaquim
http://cdm.unfccc.int/Projects/DB/SGS-UKL1151788974.93/view

Capão Preto
http://cdm.unfccc.int/Projects/DB/SGS-UKL1151788974.93/view

Esmeril
http://cdm.unfccc.int/Projects/DB/SGS-UKL1151788974.93/view

Fruteiras
http://www.edpbr.com.br/energia/geracao_renovaveis/geracao/espirito_santo/pch_fruteiras/pch_fruteiras.asp

Chibarro
http://cdm.unfccc.int/Projects/DB/SGS-UKL1151788974.93/view

Gavião Peixoto
http://cdm.unfccc.int/Projects/DB/SGS-UKL1151788974.93/view

Coronel Domiciano
http://www.grupoenergisa.com.br/Geracao/energisa/historia.aspx

Alegre
http://www.edpbr.com.br/energia/geracao_renovaveis/geracao/espirito_santo/pch_alegre/pch_alegre.asp

Ijuí
http://www.carlosadib.com.br/elet_fatos.html

Dourados
http://cdm.unfccc.int/Projects/DB/SGS-UKL1151788974.93/view

Marzagão
http://www.iee.usp.br/biblioteca/producao/2002/Teses/Tese_Jose_Roberto.pdf

Capigui
http://www.ceee.com.br/pportal/ceee/archives/Relat%C3%B3rio_de_An%C3%A1lise_Ambiental_CEEE-GT.pdf

Herval
http://www.carlosadib.com.br/elet_fatos.html

Passo do Inferno
http://www.carlosadib.com.br/elet_fatos.html

Forquilha
http://www.carlosadib.com.br/elet_fatos.html

- **Retrofit data**

Jucu
http://www.escelsa.com.br/aescelsa/usinas.asp

São Joaquim
http://cdm.unfccc.int/Projects/DB/SGS-UKL1151788974.93/view

Capão Preto
http://cdm.unfccc.int/Projects/DB/SGS-UKL1151788974.93/view

Esmeril
http://cdm.unfccc.int/Projects/DB/SGS-UKL1151788974.93/view

Fruteiras
http://www.escelsa.com.br/aescelsa/usinas.asp

Chibarro
http://cdm.unfccc.int/Projects/DB/SGS-UKL1151788974.93/view

Gavião Peixoto
http://cdm.unfccc.int/Projects/DB/SGS-UKL1151788974.93/view

Coronel Domiciano
http://www.iee.usp.br/biblioteca/producao/2002/Teses/Tese_Jose_Roberto.pdf

Alegre
http://www.escelsa.com.br/aescelsa/usinas.asp

Dourados
http://cdm.unfccc.int/Projects/DB/SGS-UKL1151788974.93/view

Marzagão
http://www.iee.usp.br/biblioteca/producao/2002/Teses/Tese_Jose_Roberto.pdf

Capigui
http://www.ceee.com.br/pportal/ceee/archives/Relat%C3%B3rio_de_An%C3%A1lise_Ambiental_CEEE-GT.pdf

The table below shows the baseline electricity generation data, calculated from a 5-year historical average as determined by the methodology. The table also shows the date when the SHPP Bugres is expected to start its operations after the capacity addition is concluded. The last column shows the date when the federal concession ends, which is adopted as point in time when the existing equipment would need to be replaced in the absence of the project activity ($DATE_{BaselineRetrofit}$).

Table 5 – Baseline information

Installed Capacity after Capacity Addition (MW)	EG Baseline (MWh)	Standard Deviation ($\sigma_{historical}$)	Expected Operational Start after Capacity Addition	End of Concession
19.20	85,484	1,091	2015	2035[24]

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.

(a) As described in Section B.4, the emission factor is calculated as 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”.

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:

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

[24] http://www.aneel.gov.br/aplicacoes/Contrato/Documentos_Aplicacao/CG0025CEEE.pdf

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 (optional)

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

(b) 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 displaced by the project activity in hour h of year y (MWh)
$EF_{EL,DD,h}$ = CO_2 emission factor for power units in the top of the dispatch order in hour h in year y (tCO_2/MWh)
$EG_{PJ,y}$ = Total electricity displaced by the project activity in year y (MWh)
h = Hours in year y in which the project activity is displacing 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 HPP Bugres, the default value of 50% will be considered for both operating and build margin emission factors.

<u>Leakage</u>

According to the latest version of the methodology ACM0002, 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.

<u>Emission reductions</u>

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_2e)
PE_y = Project emissions in year *y* (tCO_2e)

B.6.2. Data and parameters fixed ex ante

Data / Parameter	$EG_{historical}$
Unit	MWh
Description	Annual average historical net electricity generation delivered to the grid by the existing renewable energy power plant that was operated at the project site prior to the implementation of the project activity.
Source of data	Project activity site
Value(s) applied	Please see table in Appendix 4
Choice of data or Measurement methods and procedures	All electricity generated by SHPP Bugres since its operation start in 1952 up until now have been measured through electricity meters.
Purpose of data	Calculation of baseline emissions.
Additional comment	-

Data / Parameter	$\sigma_{historical}$
Unit	MWh
Description	Standard deviation of the annual average historical net electricity generation delivered to the grid by the existing renewable energy power plant that was operated at the project site prior to the implementation of the project activity.
Source of data	Calculated from data used to establish $EG_{historical}$
Value(s) applied	1,091
Choice of data or Measurement methods and procedures	This parameter is calculated as the standard of the annual generation data used to calculate $EG_{historical}$
Purpose of data	Calculation of baseline emissions.
Additional comment	-

Data / Parameter	$DATE_{BaselineRetrofit}$
Unit	Date
Description	Point in time when the existing equipment would need to be replaced in the absence of the project activity
Source of data	Project activity site
Value(s) applied	2035
Choice of data or Measurement methods and procedures	As per provisions in the methodology above
Purpose of data	Calculation of baseline emissions
Additional comment	-

Data / Parameter	Cap_{BL}
Unit	W
Description	Installed capacity of the hydro power plant before the implementation of the project activity. For new hydro power plants, this value is zero.
Source of data	Project site
Value(s) applied	11,200,000
Choice of data or Measurement methods and procedures	-
Purpose of data	Calculation of baseline emissions
Additional comment	-

Data / Parameter	A_{BL}
Unit	m^2
Description	Area of 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	Project activity
Value(s) applied	12,650,000
Choice of data or Measurement methods and procedures	Topographic survey done by a third party company
Purpose of data	Calculation of baseline emissions
Additional comment	-

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	Emission factor calculation
Purpose of data	Calculation of baseline emissions
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	Emission factor calculation
Purpose of data	Calculation of baseline emissions
Additional comment	-

B.6.3. Ex ante calculation of emission reductions

As demonstrated in Section B.6.1, there are no leakage or project emissions to be accounted as emission reductions calculation. Therefore, the emission reductions are the same as baseline emissions:

$$ER_y = BE_y$$

Where:
ER_y = Emission reductions in year y (tCO_2);
BE_y = Baseline Emissions in year y (tCO_2);

$$ER_y = EG_{BL,y} * EF_{CO2,grid,y}$$

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).

As the Brazilian DNA publishes the Emission Factors of the national grid, the last published[25] EF was used to estimate the projected emission reductions and are as follows:

Average Annual Build Margin Emission Factor (tCO_2/MWh)
2011
0.1056

Average Monthly Emission Factor Operating Margin (tCO2/MWh) – 2011											
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.2621	0.2876	0.2076	0.1977	0.2698	0.3410	0.3076	0.3009	0.2734	0.3498	0.3565	0.3495

*Average operating emission factor in 2010 = 0.291958

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

$$EF_{grid, CM, y} = 0.5 * 0.1056 + 0.5 * 0.291958$$

$$EF_{grid, CM, y} = 0.0528 + 0.145979$$

$$EF_{grid, CM, y} = 0.1987 \ tCO_2/MWh$$

The SHPP Bugres is expected to generate additionally 30,660 MWh; however, considering the effect of the standard deviation historical, the project activity is expected to generate additionally 29,568 MWh, as presented in the following table:

[25] http://www.mct.gov.br/index.php/content/view/303076.html#ancora

Table 6 – Project's expected electricity generation

BASELINE			POWER PLANT		
EG_{hist} (1)	σhist (2)	EG_{hist} + σhist (1) + (2) = (3)	Expected Additional Generation (4)	$EG_{facility,y}$ (1) + (4) = (5)	Additional Electricity (5) – (3)
MWh	MWh	MWh	MWavg	MWh	MWh
85,484	1,091	86,576	30,660	116,144	29,568

Therefore, the project's emission reduction is:

ER_y = 29,568 * 0.1987

ER_y = 5,875 tCO_2/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)
2016	5,875	0	0	5,875
2017	5,875	0	0	5,875
2018	5,875	0	0	5,875
2019	5,875	0	0	5,875
2020	5,875	0	0	5,875
2021	5,875	0	0	5,875
2022	5,875	0	0	5,875
Total	41,125	0	0	41,125
Total number of crediting years	7			
Annual average over the crediting period	5,875	0	0	5,875

B.7. Monitoring plan

B.7.1. Data and parameters to be monitored

Data / Parameter	$EG_{facility,y}$
Unit	MWh
Description	Quantity of net electricity generation supplied by the project plant/unit to the grid in year y
Source of data	Electricity meter(s)
Value(s) applied	116,144
Measurement methods and procedures	There are two meters in the project's substation 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 information is not lost. The precision of the meters is class 0.2% as per the Brazilian regulations ("*Norma Brasileira Medidores Eletronicos de Energia Eletrica (estaticos)"* NBR 14,519). High voltage electricity meter sends generation data to four points: 1. Hydro Plant Operational Control Panel; 2. ONS (National System Operator), via VPN; 3. CEEE-GT control room in Porto Alegre; 4. CCEE (*Camara de Comercializacao de Energia Eletrica*) where monthly totals are used for commercialization billing. Moreover, monthly spreadsheets will be used obtained directly from the meters with their monthly consolidated generation data, which will be confronted with the available generation spreadsheets at the website of CCEE in a monthly basis.
Monitoring frequency	Monthly
QA/QC procedures	Uncertainty level of data is low. The data will be used for calculating the project's emission reductions. The electricity generated will be monitored by the project participants and will be checked by the available datasheets in the CCEE website (information comparison between operation data and CCEE reports available at the ME0001 Report).
Purpose of data	Calculation of baseline emission
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 latest version of the "Tool to calculate the emission factor for an electricity system"
Source of data	CIMGC/ONS
Value(s) applied	0.1987
Measurement methods and procedures	Ex-post emission factor will be calculated by the Brazilian DNA – CIMGC with ONS data. This parameter's 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.
Monitoring frequency	This parameter will be updated according to CIMGC calculations for the SIN.
QA/QC procedures	This data is sourced from an official source and is publicly available. Margin of error is low.
Purpose of data	Calculation of baseline emissions.
Additional comment	This data is available at http://www.mct.gov.br

Data / Parameter	$EF_{grid,OM,y}$
Unit	tCO_2/MWh
Description	Operating margin CO_2 emission factor for the project electricity system in year y
Source of data	CIMGC/ONS
Value(s) applied	0.2919
Measurement methods and procedures	Operating margin emission factor is calculated by CIMGC with 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	This parameter is updated annually according to CIMGC calculations for the SIN.
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	Calculation of baseline emissions.
Additional comment	This data is available at http://www.mct.gov.br

Data / Parameter	$EF_{grid,BM,y}$
Unit	tCO_2/MWh
Description	Build margin CO_2 emission factor for the project electricity system in year y
Source of data	CIMGC/ONS
Value(s) applied	0.1056
Measurement methods and procedures	Build margin emission factor is calculated by CIMGC with ONS data. The $EF_{grid,BM,y}$ formula item will be also monitored and calculated by CIMGC and ONS, with the Dispatch Data of the SIN.
Monitoring frequency	This parameter will be updated annually as per CIMGC calculations for the SIN
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	Calculation of baseline emissions
Additional comment	This data is available at http://www.mct.gov.br

Data / Parameter	Cap_{PJ}
Unit	W
Description	Installed capacity of the hydro power plant after the implementation of the project activity
Source of data	Project site
Value(s) applied	19,200,000
Measurement methods and procedures	The installed capcity of the project is defined by the turbine-generator set and will not be altered. These equipment will be verified to guarantee they haven't been modified.
Monitoring frequency	Once at the beginning of each crediting period
QA/QC procedures	-
Purpose of data	Calculation of baseline emissions
Additional comment	-

Data / Parameter	A_{PJ}
Unit	m^2
Description	Area of the single or multiple reservoir measured in the surface of the water, after the implementation of the project activity, when the reservoir is full
Source of data	Project site
Value(s) applied	12,650,000
Measurement methods and procedures	This value will not be changed and is assessed by the environmental agency which is responsible for giving the project's Operation License. Thus, this parameter will be verified by the Operation License of SHPP Bugres.
Monitoring frequency	Once at the beginning of each crediting period
QA/QC procedures	-
Purpose of data	Calculation of baseline emissions
Additional comment	-

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 quantity of net electricity generation supplied by the project plant/unit to the grid in year y ($EG_{facility,y}$) , 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 – Consolidated baseline methodology for grid-connected electricity generation from renewable sources".

The monitoring procedures for data measurement, quality assurance and quality control is described below. The Grid Emission Factor, which will be applied *ex-post*, is published annually on an hourly basis.

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. Energy generation measurements will be made at two points:

a. At the output of the powerhouse (total energy);
b. At the output of the substation, point of dispatch to national grid, integrated with the substation's control system, this meter transmits energy measurements to:
    a. ONS (National System Operator) – via VPN; and
    c. CCEE (*Câmara de Comercialização de Energia Elétrica*), official regulator of the electricity market, acting as the registry for contracts and transactions. CCEE uses the energy generation information in order to bill the transmission services between generator and end-consumer, among other uses.

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

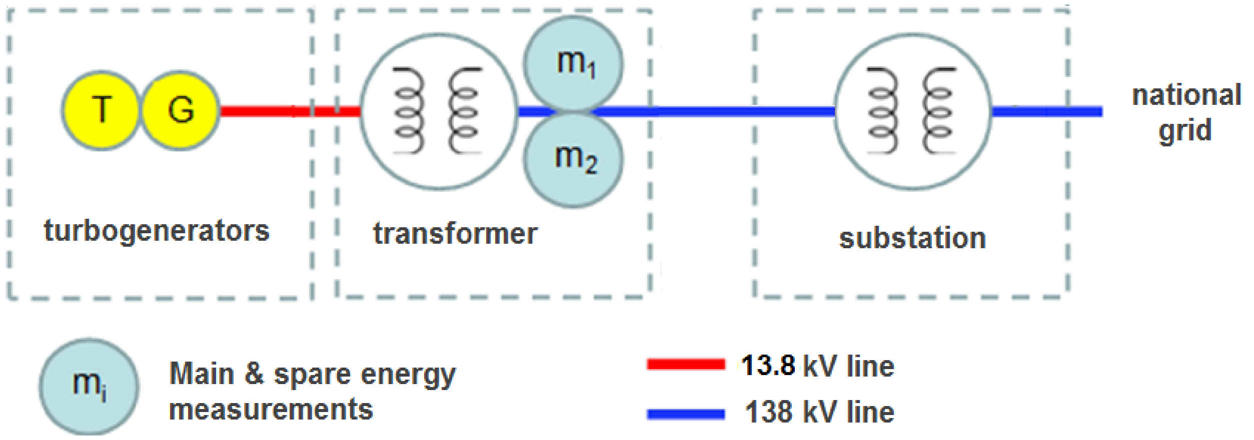

Figure 1 – Simplified unifilar diagram

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.

The project is a run-off-river power plant that will receive new equipment, resulting in a capacity addition which will provide the power plant with more installed capacity, but without any change in its existing reservoirs. The area of the project's reservoirs will not be increased by the capacity addition and will not be changed in the future. The reservoirs area is assessed by the environmental agency which is responsible for giving the project's Operation License. Thus, this parameter will be verified annually by the Operation License of SHPP Bugres.

Management and organization structure

All invoices and other fiscal documents are kept in CEEE-GT's accounting system.

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

The project sponsor will proceed with the necessary measures for electricity control and monitoring. Additionally, using 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

CEEE-GT will be responsible for the maintenance of the monitoring equipment for dealing with possible monitoring data adjustments and uncertainties.

CEEE-GT 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 SHPP Bugres will be done annually.

According to an internal procedure of SHPP Bugres, 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 Change in SHPP Bugres".

B.8. 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: 06/22/2015

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

- Lumina Engenharia e Consultoria Ltda.

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

  Contact person is the company's director Mr. Sergio Ennes, available at sergio.ennes@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

01/Mar/2014

C.1.2. Expected operational lifetime of project activity

23y-0m

C.2. Crediting period of project activity

C.2.1. Type of crediting period

First renewable crediting period

C.2.2. Start date of crediting period

01/Jun/2015 (or project's CDM registration date, whichever occurs later)

C.2.3. Length of crediting period

7y-0m

SECTION D. Environmental impacts

D.1. Analysis of environmental impacts

The environmental impacts caused by the project's activities are considered not significant. The capacity addition that will be performed in the SHPP Bugres will not have any impact on the SHPP's reservoirs area.

The SHPP Bugres meets the environmental requirements for its implantation, as demonstrated in table 23. 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. These impacts are considered in the Project Basic Design Document and are presented below.

Capacity addition in the SHPP Bugres water flow

The SHPP Bugres first started its operations in 1952, and it was conceived under the watershed transposition principle.

The water volume that is transposed from the Salto system has already entered a balanced state regarding its uses and biotic issues, upstream the dams. The eventual increase in the transposition flow is theorical, obtained through a slight optimization in the existent adduction canal's capacity, which is imperceptible at the eye. Therefore, with the current conditions kept, the adduction canal reform will not implicate in the need of a specific environmental study, once there will be no modifications in the already established conditions.

By-Pass

Based on the by-pass valve's lifetime and on the local environmental characteristics, it can be concluded that the watercourse in question is filled by local species of aquatic biota.

The surplus flow rate, which is currently discharged into the thalweg, will be conducted to electricity generation, restoring the *Arroio Cascatinha's* original features. However, the by-pass will not be disabled, and may eventually operate less frequently, i.e. at worst the watercourse will maintain its current environmental characteristics.

Construction site

The area on which the construction site will be located is characterized by the presence of undergrowth plants, without being necessary the deforestation of any areas. Moreover, during its existence, a sanitation plan will be established, considering the treatment and adequate final destination of waste and liquid effluents.

- Area directly affected by pipe implementation

For the implementation of new shielded pipes it will be necessary the removal of a small area of vegetation upstream the powerhouse. This removal will be replaced eventually by compensatory planting of the specimens removed. Along the adduction canal it is not provided any kind of vegetation suppression.

- Deposits and Boot-Off

A small rock volume will be excavated for the deployment of a new adduction canal, which will be fully used in concrete manufacture and containment works. The volume of excavated soil for demotion purposes will be fully used to roads extension. Aiming at the restoration of areas eventually affected, an erosion control and storage of fertile soil layers program will be established.

- Piping storage area

The pipes to be installed at the project site will be stocked along the existing pipe on the access road. There will be no damage to trees during the pipe's moving, given the distance to the grove and the method used for lifting (with trucks equipped with "*munck*" or similar).

- Landfill area

A loan volume of soil, around 7,000 m3, will be purchased from a third party or by exploring a small reservoir located in the CEEE-GT's area.

Final considerations

The environmental impacts caused by the implementation of the SHPP Bugres will be insignificant. It should be highlighted that all actions taken by the project sponsor will consider environmental preservation and propose the mitigation of impacts that might occur.

In the area of the SHPP Bugres 204ha of *eucaliptos* were planted, intercalated with the natural and existing forest, with the maintenance of 4.5ha in exotic native plant nurseries to preserve and recover the Salto System areas.

Therefore, the following can be concluded regarding the implementation of the SHPP Bugres:

- There will be no significant environmental impacts, due to the size and nature of the predicted constructions;
- There will be no interference in the existing reservoirs and dam, after the implementation of the project activity and, thus, the environmental impact shall be considered null, since there will be no increase in the reservoirs area and no modification in its operation regime.

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 7 – SHPP Bugres licenses and permits

DOCUMENT	DATE	DESCRIPTION	RESPONSIBLE ENTITY
Ordinance #278	11/Aug/1999	Establishes the SHPP Bugres electricity generation's concession deadline for 20 more years, from 08/Jul/1995.	ANEEL
Extract of the Electricity Generation Concession Contract #25/2000	12/Apr/2000 until 07/07/2035	Establishes the SHPP Bugres electricity generation's concession and its deadline.	ANEEL
LI 230/2010-DL	05/Mar/2010 until 04/Mar/2014	Renewal of the Installation Permit to SHPP Bugres expansion with the capacity addition of 13 MW.	FEPAM

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 16/Nov/2011 to the agents listed below (copies of the letters and post office confirmation of receipt communication are available upon request). The return receipts of the letters were received between 02/Dec/2011 and 06/Dec/2011.

- 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);
- Rio Grande do Sul State Public Attorney (*Ministério Público Estadual do Rio Grande do Sul*);
- Rio Grande do Sul State Environmental Agency (*Secretaria de Estado do Meio Ambiente do Rio Grande do Sul*);
- Canela's City Hall (*Prefeitura Municipal de Canela – RS*);
- Canela's City Council (*Câmara dos Vereadores de Canela* – RS);
- Canela's Environmental Agency (*Secretaria de Meio Ambiente de Canela* - RS);
- Canela's Comercial Industrial Association (*Associação Comercial Industrial de Canela* – RS).

The PDD of SHPP Bugres is available at the following link:
http://luminaenergia.com.br/

E.2. Summary of comments received

The following comments were received during the global stakeholder consultation for the project activity, dated 01/Jul/2012.

1) DOE to ensure that the PDD values are consistent and ensure that the CDM project is a genuine project.

2) DoE to check the Detailed Project Report and Feasibility Report which is submitted to the other agencies and Banks by Project owner and ensure that the values match with the DPR/FR submitted to DoE also.

3) Careful study must be done so that the DPR/FR is not in different versions made and submitted with different purposes to different agencies, which is totally unacceptable, illegal and unethical.

4) Project owner should show some undertaking letter from bank manager to DoE stating that both DPR's are same. These kinds of letters should not be accepted and entertained by DoE at face value, but must be checked independently. While collecting the DPR/FR from banks and other agencies, all DPR/FR pages should be counter signed by Banks and other agencies so that the real DPR/FR given to other parties by the PP/Consultant is same as the one submitted to DOE.

5) DPR/FR values must be probed fully. DOE must take a written undertaking from the PP/Consultant about the list of parties to whom this DPR/FR is submitted and for what purposes. Then DOE should cross check with all the parties and confirm that the same DPR/FR is submitted to all the parties correctly without any changes. DOE must not accept any reports and undertakings from PP/Consultant. DOE must make independent evaluation and use totally different parties without informing the PP or Consultant to cross check the facts.

6) DOE to write to the party who prepared the DPR/FR which is submitted to the banks and other agencies and the same is verified against the one submitted to the DOE by PP/Consultant.

7) DOE must not entertain this project any more if found the DPR/FR is tamprered with at any point in time. PP can not give different DPR's and FR's. They must submit only the one given to Banks and other agencies while obtaining loans and decision making time.

8) Has the PP considered the CDM revenues while envisaging the project? Without CDM the project was not viable, is it right? This project is having a debt component? Then how bankers or lenders gave the loan? Have the bankers or lenders considered the CDM revenues while agreeing to give loan to this projects? If not this project should be rejected right away by DOE by terminating the contract forthwith. If yes, where is the proof? What is the date of the evidence document from bank? Is this document printed now a days or earlier. DOE to independently check the same. If the document is available from Bank it must be checked from all angles so that it is genuine and not forged and date changed by putting back dated. This is normally done, DOE to be aware of this please. Please check the communication the PP had during that time with banks, emails and postal receipts and the weights and dates mentioned on the receipts. Do not believe in courier bills and receipts since these can be cooked up easily. Insist on government owned postal service receipts only. If the project is fully equity project then on what basis the PP has invested full equity in to the project while considering the CDM revenue? DOE to check the same in detail and bring out the facts. Is there any past record of this PP to invest or not to invest at returns what he is talking about in this project? Proper evidences must be reviewed and digged out by the DOE and take decision on the project based on established facts. Do not

ask documents from PP, DOE to collect the same from different sources to do independent evaluation.

9) Is the project equipment purchased second hand equipment or sourced from cheap foreign sources? If yes, the issue must be probed by DOE since invoices will invariably be inflated and forged. Total project costs mentioned by PP will not be the same as originals. Hence no additionality. These facts must be probed in full by DOE by checking all documents and money transactions along with bank statements and certified accounts by a legally acceptable financial analyst.

10) From DOE side which auditor has done marketing and business development for acquiring this business of validating this project? With whom he or she was co-ordinating at PP or CER buyer? The same person who has done the marketing and business development to acquire the business do validation or participate in any manner what so ever in the validation process? One cannot do like that. It is against the accreditation rules and norms followed since ages. DOE should send auditors from different offices or countries to do this validation audit. DOE must take care of impartiality and accreditation rules. Due to the targets set by the DOE managements auditors are doing marketing and meeting clients and giving promises that the project will be taken care. Is it acceptable and fair? This must be stopped. No auditor should do marketing. Only non-auditing staff should do marketing. DOE to ensure the same please.

11) If applicable only: Is these machines, equipment was a part of any bundle of CDM activity envisaged and developed earlier. DOE to check the same through independent sources also. Once some bundles are non-additional and getting negative validation from a DOE, PP is rolling out the same project as an individual project which is not a CDM project at all. DOE to verify the same from independent sources and also take undertaking in the form of an affidavit from the PP's that any misrepresentation or false statement with respect this would attract strict legal action from UNFCCC and DOE. Furthermore the registered project must be de-registered in case of any future findings contradicting the submissions made by the project owner.

12) DOE to be more careful so that this is a genuine CDM project. What is the exact project cost? The project cost is covering what? Each value considered must be validated with proof. The machinery is second hand purchased or fresh and new from an OEM? In either case DOE to check all the quotations, proposals, purchase orders, invoices, way bills, transport bills, proof of payments like bank statements. DOE to check with banks by way of written confirmation the amount transacted, to whom the money is paid, when the money is paid, is the party paid is the correct party as shown in the purchase orders. It may so happen that the values, party names, dates are fabricated and misrepresented in this project. DOE should terminate their contract for this project immediately. This is the only way out to protect the value of CDM process. If the PP is purchasing second hand or second quality equipment and inflating the purchase order values and invoices, this must be probed thoroughly and real values to taken for additionality calculation. Then I'm sure the additionality is not there at all in such a situation.

13) How is the base line defined in this project? Is Base line hypothetically defined with no proper evidences and proper justification? In such case, DOE cannot take the base line as suggested by the PDD. Please check that there are real emission reductions beyond the real and factual base line. It may so happen that this project qualifies for no CER's. DOE cannot assume values and things as giving by this PP. Whatever values are considered throughout the project in all documents including the real DPR (not the one prepared for CDM, the one given to the banks and others), they must be validated, verified and double checked. Do not ask PP for DPR. Ask the parties who have been given DPR by the PP. Get directly from the bank and others by each page of the DPR and Feasibility report signed. Such document can be considered as a real DPR or FR. UNFCCC CDM process

cannot be degraded by fabricating and misinterpreting the project base line and additionality.

E.3. Report on consideration of comments received

Please see project participants considerations in response to the comments received and mentioned above from the global stakeholder consultation period:

1) DOE to ensure that the PDD values are consistent and ensure that the CDM project is a genuine project.

PP: All values used on the PDD were evidenced with technical documentation elaborated by third parties to the project activity.

2) DoE to check the Detailed Project Report and Feasibility Report which is submitted to the other agencies and Banks by Project owner and ensure that the values match with the DPR/FR submitted to DoE also.

PP: All documentation presented as evidence to the DOE is official and is the same presented to agencies and banks.

3) Careful study must be done so that the DPR/FR is not in different versions made and submitted with different purposes to different agencies, which is totally unacceptable, illegal and unethical.

PP: All documentation presented as evidence to the DOE is official and is the same presented to agencies and banks.

4) Project owner should show some undertaking letter from bank manager to DoE stating that both DPR's are same. These kinds of letters should not be accepted and entertained by DoE at face value, but must be checked independently. While collecting the DPR/FR from banks and other agencies, all DPR/FR pages should be counter signed by Banks and other agencies so that the real DPR/FR given to other parties by the PP/Consultant is same as the one submitted to DOE.

PP: All documentation presented as evidence to the DOE is official and is the same presented to agencies and banks.

5) DPR/FR values must be probed fully. DOE must take a written undertaking from the PP/Consultant about the list of parties to whom this DPR/FR is submitted and for what purposes. Then DOE should cross check with all the parties and confirm that the same DPR/FR is submitted to all the parties correctly without any changes. DOE must not accept any reports and undertakings from PP/Consultant. DOE must make independent evaluation and use totally different parties without informing the PP or Consultant to cross check the facts.

PP: All documentation presented as evidence to the DOE is official and is the same presented to agencies and banks.

6) DOE to write to the party who prepared the DPR/FR which is submitted to the banks and other agencies and the same is verified against the one submitted to the DOE by PP/Consultant.

PP: All documentation presented as evidence to the DOE is official and is the same presented to agencies and banks.

7) DOE must not entertain this project any more if found the DPR/FR is tampered with at any point in time. PP cannot give different DPR's and FR's. They must submit only the one given to Banks and other agencies while obtaining loans and decision making time.

PP: All documentation presented as evidence to the DOE is official and is the same presented to agencies and banks.

8) Has the PP considered the CDM revenues while envisaging the project? Without CDM the project was not viable, is it right? This project is having a debt component? Then how bankers or lenders gave the loan? Have the bankers or lenders considered the CDM revenues while agreeing to give loan to this projects? If not this project should be rejected right away by DOE by terminating the contract forthwith. If yes, where is the proof? What is the date of the evidence document from bank? Is this document printed now a days or earlier. DOE to independently check the same. If the document is available from Bank it must be checked from all angles so that it is genuine and not forged and date changed by putting back dated. This is normally done, DOE to be aware of this please. Please check the communication the PP had during that time with banks, emails and postal receipts and the weights and dates mentioned on the receipts. Do not believe in courier bills and receipts since these can be cooked up easily. Insist on government owned postal service receipts only. If the project is fully equity project then on what basis the PP has invested full equity in to the project while considering the CDM revenue? DOE to check the same in detail and bring out the facts. Is there any past record of this PP to invest or not to invest at returns what he is talking about in this project? Proper evidences must be reviewed and digged out by the DOE and take decision on the project based on established facts. Do not ask documents from PP, DOE to collect the same from different sources to do independent evaluation.

PP: All documentation presented as evidence to the DOE is official and is the same presented to agencies and banks.

The project activity is not feasible without CDM support as evidenced and justified in Section B.5 of the PDD. As justified in this section, the project's IRR is 7.44%, by far lower than the selected benchmark WACC of 11.21%.

Also, a sensitivity analysis was performed to evidence that even with a variation of the project's financial values, it would still need CDM support. As explained in this analysis, even with a variation of at least -33.80% in the overall investment, +49.10 in the energy auction price and +51.30% in the electricity generated to become feasible. All these scenarios were justified in Section B.5 and it was confirmed that such variations are not likely to happen. As for the project's O&M costs, even with a variation of -100% the project's IRR would still be lower than the selected benchmark.

9) Is the project equipment purchased second hand equipment or sourced from cheap foreign sources? If yes, the issue must be probed by DOE since invoices will invariably be inflated and forged. Total project costs mentioned by PP will not be the same as originals. Hence no additionality. These facts must be probed in full by DOE by checking all documents and money transactions along with bank statements and certified accounts by a legally acceptable financial analyst.

PP: As explained in Section A.4.3 of the PDD, The project activity comprises national equipment and, thus, there is no technology or know-how transference to the Host Party for the application of the project.

10) From DOE side which auditor has done marketing and business development for acquiring this business of validating this project? With whom he or she was co-ordinating at PP or CER buyer? The same person who has done the marketing and business development to acquire the business do validation or participate in any manner what so ever in the validation process? One cannot do like that. It is against the accreditation rules and norms followed since ages. DOE should send auditors from different offices or countries to do this validation audit. DOE must take care of impartiality and accreditation rules. Due to the targets set by the DOE managements auditors are doing marketing and meeting clients and giving promises that the project will be taken care. Is it acceptable and fair? This must be stopped. No auditor should do marketing. Only non-auditing staff should do marketing. DOE to ensure the same please.

PP: not applicable.

11) If applicable only: Is these machines, equipment was a part of any bundle of CDM activity envisaged and developed earlier. DOE to check the same through independent sources also. Once some bundles are non-additional and getting negative validation from a DOE, PP is rolling out the same project as an individual project which is not a CDM project at all. DOE to verify the same from independent sources and also take undertaking in the form of an affidavit from the PP's that any misrepresentation or false statement with respect this would attract strict legal action from UNFCCC and DOE. Furthermore the registered project must be de-registered in case of any future findings contradicting the submissions made by the project owner.

PP: not applicable.

12) DOE to be more careful so that this is a genuine CDM project. What is the exact project cost? The project cost is covering what? Each value considered must be validated with proof. The machinery is second hand purchased or fresh and new from an OEM? In either case DOE to check all the quotations, proposals, purchase orders, invoices, way bills, transport bills, proof of payments like bank statements. DOE to check with banks by way of written confirmation the amount transacted, to whom the money is paid, when the money is paid, is the party paid is the correct party as shown in the purchase orders. It may so happen that the values, party names, dates are fabricated and misrepresented in this project. DOE should terminate their contract for this project immediately. This is the only way out to protect the value of CDM process. If the PP is purchasing second hand or second quality equipment and inflating the purchase order values and invoices, this must be probed thoroughly and real values to taken for additionality calculation. Then I'm sure the additionality is not there at all in such a situation.

PP: All documentation presented as evidence to the DOE is official and is the same presented to agencies and banks.

As explained in Section A.4.3 of the PDD, the project activity comprises national equipment and, thus, there is no technology or know-how transference to the Host Party for the application of the project.

Also, as justified in Section B.5, the project's total investment estimated at the investment decision date is R$22,000,000 as per CEEE's Assessment Report. As demonstrated in the sensitivity analysis, a reduction in this value is unlikely to happen considering that the project's investment was defined as R$30,763,970.72 by the Eletrobrás Standard Budget Sheet, which was also made available to the DOE.

13) How is the base line defined in this project? Is Base line hypothetically defined with no proper evidences and proper justification? In such case, DOE cannot take the base line as suggested by the PDD. Please check that there are real emission reductions beyond the real and factual base line. It may so happen that this project qualifies for no CER's. DOE cannot assume values and things as giving by this PP. Whatever values are considered throughout the project in all documents including the real DPR (not the one prepared for CDM, the one given to the banks and others), they must be validated, verified and double checked. Do not ask PP for DPR. Ask the parties who have been given DPR by the PP. Get directly from the bank and others by each page of the DPR and Feasibility report signed. Such document can be considered as a real DPR or FR. UNFCCC CDM process cannot be degraded by fabricating and misinterpreting the project base line and additionality.

PP: As explained in Section B.4, the project's baseline scenario was defined with reference in the approved methodology ACM0002, version 16.0 and since the project is a capacity addition to existing grid-connected renewable power plant/unit, the baseline scenario is the existing facility that would continue to supply electricity to the grid at historical levels, until the time at which the generation facility would likely be replaced or retrofitted (DATEBaselineRetrofit), and electricity delivered to the grid by the added capacity 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". From that point of time onwards, the baseline scenario is assumed to correspond to the project activity, and no emission reductions are assumed to occur.

Also, all emission reductions by the project activity were calculated according to ACM0002 and are all evidenced and justified in Section B.6 of the PDD. All documentation presented as evidence to the DOE is official and is the same presented to agencies and banks.

SECTION F. Approval and authorization

The letter of approval from the Brazilian government was received on May 19th 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	CEEE-GT
Street/P.O. Box	Av. Joaquim Porto Vilanova, 201, 7th floor
Building	-
City	Porto Alegre
State/Region	Rio Grande do Sul
Postcode	91410-400
Country	Brazil
Telephone	-
Fax	-
E-mail	-
Website	www.ceee.com.br
Contact person	
Title	-
Salutation	Mr.
Last name	Mello
Middle name	Augusto Silva da
First name	Marcos
Department	-
Mobile	-
Direct fax	-
Direct tel.	+55 51 3382.5742
Personal e-mail	marcossm@ceee.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	Lumina Engenharia e Consultoria Ltda.
Street/P.O. Box	R. Bela Cintra, 746, cj. 102
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State/Region	Sao Paulo
Postcode	01415-000
Country	Brazil
Telephone	+55 11 3259.4033
Fax	+55 11 3853.0953
E-mail	sergio.ennes@luminaenergia.com.br
Website	www.luminaenergia.com.br
Contact person	
Title	Director
Salutation	Mr.
Last name	Ennes
Middle name	Augusto Weigert
First name	Sergio
Department	-
Mobile	+55 11 8384.0022
Direct fax	-
Direct tel.	+55 11 3259.4033
Personal e-mail	marcossm@ceee.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 Jul/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. CO2 emission factors have been systematically calculated by ONS since Jan/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 analysed 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 analysed 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 behaviour of price difference between regions. This simplified analysis was considered 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 analysed 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 CO2 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:

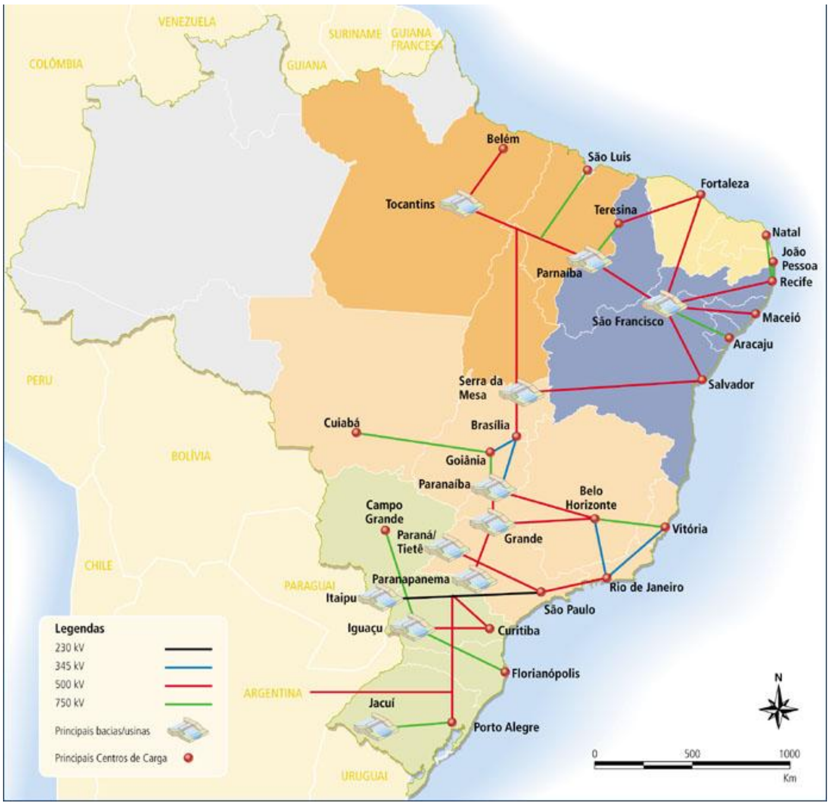

Figure 2 – Brazilian National Interconnected System (SIN)

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

Historical Electricity Generation of the SHPP Bugres

Electricity Generation of the SHPP Bugres (MWh)													
	JAN	**FEB**	**MAR**	**APR**	**MAY**	**JUN**	**JUL**	**AUG**	**SEP**	**OCT**	**NOV**	**DEC**	**TOTAL**
2000									8,118.25	8,189.70	8,023.45	8,145.05	32,476.46
2001	8,249.24	7,420.65	8,158.51	7,918.99	8,332.77	8,117.58	8,502.21	8,377.49	8,119.69	8,287.49	5,024.14	-17.30	86,491.44
2002	4,117.53	7,566.11	8,196.57	7,882.35	8,509.04	8,418.34	8,632.42	8,386.02	7,932.05	8,351.41	7,810.80	7,914.99	93,717.62
2003	7,990.64	6,959.07	8,139.24	7,880.39	8,265.00	7,933.85	8,247.53	8,316.61	7,993.02	8,183.93	7,764.35	7,821.87	95,495.50
2004	8,067.29	6,634.09	4,991.24	2,348.26	5,656.97	7,969.44	8,298.59	8,203.92	7,893.72	8,115.05	7,830.79	8,057.40	84,066.77
2005	7,992.84	4,231.39	1,385.55	4,183.19	7,277.20	7,127.03	8,163.15	8,214.07	8,088.02	8,066.30	7,792.95	8,042.94	80,564.64
2006	7,972.49	7,063.60	6,048.72	3,468.99	0.00	221.15	8,104.23	8,134.17	7,835.71	8,009.04	7,673.40	7,924.00	72,455.51
2007	8,005.07	7,099.59	7,875.55	7,462.75	8,186.25	7,963.61	8,292.80	7,634.72	7,764.32	8,039.31	7,662.98	7,909.19	93,896.16
2008	7,970.13	6,957.41	7,771.48	5,982.22	899.34	6,483.55	8,039.68	8,064.83	7,831.48	7,774.92	7,832.83	7,991.31	83,599.18
2009	7,757.67	7,258.55	7,885.50	7,663.48	6,454.46	3,888.62	4,183.67	7,626.01	7,452.58	7,806.58	7,813.23	8,008.95	83,799.31
2010	7,907.91	7,287.16	7,390.06	7,788.00	7,971.36	7,847.69	8,086.30	8,052.98	7,634.40	8,005.91	7,849.48	7,850.46	93,671.70
2011	7,495.19												7,495.19

EG Baseline 5-year-history before the repowering													AVERAGE
Generation (MWh)	7,922.65	7,133.26	7,394.26	6,473.09	4,702.28	5,280.92	7,341.34	7,902.54	7,703.70	7,927.15	7,766.38	7,936.78	85,484

Standard Deviation (MWh)	**1,091**

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 “Consolidated baseline methodology for grid-connected electricity generation from renewable sources”, version 16.0.

CEEE-GT 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.