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

CONTENTS

Annexes

SECTION A. General description of project activity

A.1. Title of the project activity:

SHPP Serra Cavalinhos I – Project Activity.

PDD version number: 03.

Date (DD/MM/YYYY): 06/12/2011.

A.2. Description of the project activity:

The primary objective of SHPP[1] Serra Cavalinhos I – Project Activity (hereafter referred as SCVI) is to help meet Brazil's rising demand for energy due to economic growth and to improve the supply of electricity, while contributing to environmental, social and economic sustainability by increasing renewable energy's share of the total Brazilian (and the Latin America and the Caribbean region's) electricity consumption.

Countries in the Latin America and the Caribbean region have expressed their commitment towards achieving a target of 10% renewable energy of the total energy use in the region. Through an initiative of the Ministers of the Environment in 2002 (UNEP-LAC, 2002), a preliminary meeting of the World Summit for Sustainable Development (WSSD) was held in Johannesburg in 2002. In the WSSD final Plan of Implementation no specific targets or timeframes were stated, however, their importance was recognized for achieving sustainability in accordance with the Millennium Development Goals[2].

SCVI Project consists of the construction of a small hydropower plant with an installed capacity of 25 MW and a reservoir area of 1.50 km^2. It is located between the municipalities of Bom Jesus, Monte Alegre dos Campos and São Francisco de Paulo state of Rio Grande do Sul, South region of Brazil, and it is estimated to become operational in April, 2014.

Brookfield Energia Renovável S/A (BER) is a Brazilian subsidiary of Brookfield Asset Management (BAM). BAM is a Canadian holding company with activities in different sectors: real state, financial market, energy, agribusiness and reforestation. BER was created in January 1998 by Brookfield Asset Management with the objective to increase Brazil's power generating capacity trough the development, construction and operation of small hydro facilities.

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[1] Small Hydroeletric Power Plant

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

This indigenous and cleaner source of electricity will also have an important contribution to environmental sustainability by reducing carbon dioxide emissions that would have occurred otherwise in the absence of the project. The project activity reduces emissions of greenhouse gas (GHG) by avoiding electricity generation by fossil fuel sources (and CO_2 emissions), which would be generating (and emitting) in the absence of the project. The project improves the supply of electricity with clean, renewable hydroelectric power while contributing to the regional/local economic development. These small scale projects provide site-specific reliability and transmission and distribution benefits including:

- increased reliability, shorter and less extensive outages;
- lower reserve margin requirements;
- improved power quality;
- reduced lines losses;
- reactive power control;
- mitigation of transmission and distribution congestion, and;
- increased system capacity with reduced T&D investment.

The Project can be seen as an example of a private sector solution to the Brazilian electricity crisis of 2001, contributing to the country's sustainable development. The Project thus comes to prove that, with the commercialization of CERs, it is viable to develop a distributed generation project in Brazil. This will have a positive effect for the country beyond the evident reductions in GHG.

In addition, BER, the controller company of Serra dos Cavalinhos I Energética S/A respects the social and environmental aspects as integrant part of its activities. According to BER's Environmental Management System (EMS) Manual from 2007, its EMS is based on: Environmental Policy, planning, implementation and operation, verification and corrective actions, EMS analysis by the Board and continuous improvement. BER Environmental Policy is composed by the recognition of the Environmental Management System, legislation compliance, environmental protection, integration with the society, environmental awareness of its employees, pollution prevention, continuous improvement of the environmental performance, prevent, minimize and manage negative impacts.

Although Serra dos Cavalinhos I SHPP[3] alone does not have a major positive impact in the host country given its size, it is without reasonable doubt part of a greater idea. The project contributes to sustainable development since it meets the needs of the present without compromising the ability of future generations to meet their own needs, as defined by the Brundtland Commission (1987). In other words, the implementation of small hydroelectric power plants ensures renewable energy generation, reduces the national electric system demand, avoids negative environmental impact caused by the construction of fossil fuel thermo power plants, and drives the regional economy, increasing quality of life in local communities.

BER´s local employment policy will also enhance local development trough job creation during the project´s implementation phase and its operation, the project will also generate tax revenue, employees' salaries and package of benefits such as social security and life insurance. Therefore, indisputably the project has reduced negative environmental impacts and has developed the regional economy, resulting, consequently, in better quality of life. In other words, environmental sustainability

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[3] Small Hydroelectric Power Plant.

combined with social and economic justice, definitely, contributes to the host country's sustainable development. Some contributions were done by the project sponsor to local events in the region where the project is located, such as: "*Filó a Cultura Esquecida*" and "*VI Festa da Gila 2011*". One of the goals of these events is to rescue the regional culture through the music, dance and gastronomy.

Prior to the implementation of the project activity there was no small hydropower plant or other project activity operational in the same location of Serra dos Cavalinhos I Project. In the absence of the project activity all the energy would be supplied by the interconnected grid. Hence, the baseline scenario and the scenario without the project activity are the same.

A.3. Project participants:

Table 1 – Party(ies) and private/public entities involved in the project activity

Name of Party involved (*) ((host) indicates a host Party)	Private and/or public entity(ies) Project participants (*) (as applicable)	Kindly indicate if the Party involved whishes to be considered as project participant (Yes/No)
Brazil (host)	Serra dos Cavalinhos I Energética S/A (Private entity)	No
	Brookfield Energia Renovável S/A[4] (Private entity)	
	Ecopart Assessoria em Negócios Empresariais Ltda. (Private entity)	
(*) In accordance with the CDM modalities and procedures, at the time of making the CDM-PDD public at the stage of validation, a Party involved may or may not have provided its approval. At the time of requesting registration, the approval by the Party(ies) involved is required.		

Detailed contact information on party(ies) and private/public entities involved in the project activity listed in Annex 1.

A.4. Technical description of the project activity:

A.4.1. Location of the project activity:

A.4.1.1. Host Party(ies):

Brazil.

[4] Former Brascan Energética S.A.

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

State of Rio Grande do Sul, South Region of Brazil.

A.4.1.3. City/Town/Community etc:

Bom Jesus, Monte Alegre dos Campos and São Francisco de Paula cities.

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

SCVI is located between the municipalities of Bom Jesus, Monte Alegre dos Campos and São Francisco de Paula, Rio Grande do Sul state, South region of Brazil (Figure 1). Project´s geographic coordinates are 28º 47’ 44,5’’ S and 50º 43’ 46,8’’ W for the Dam and 28º 47’ 44,5’’ S and 50º 43’ 46,8’’ W for the Power House.

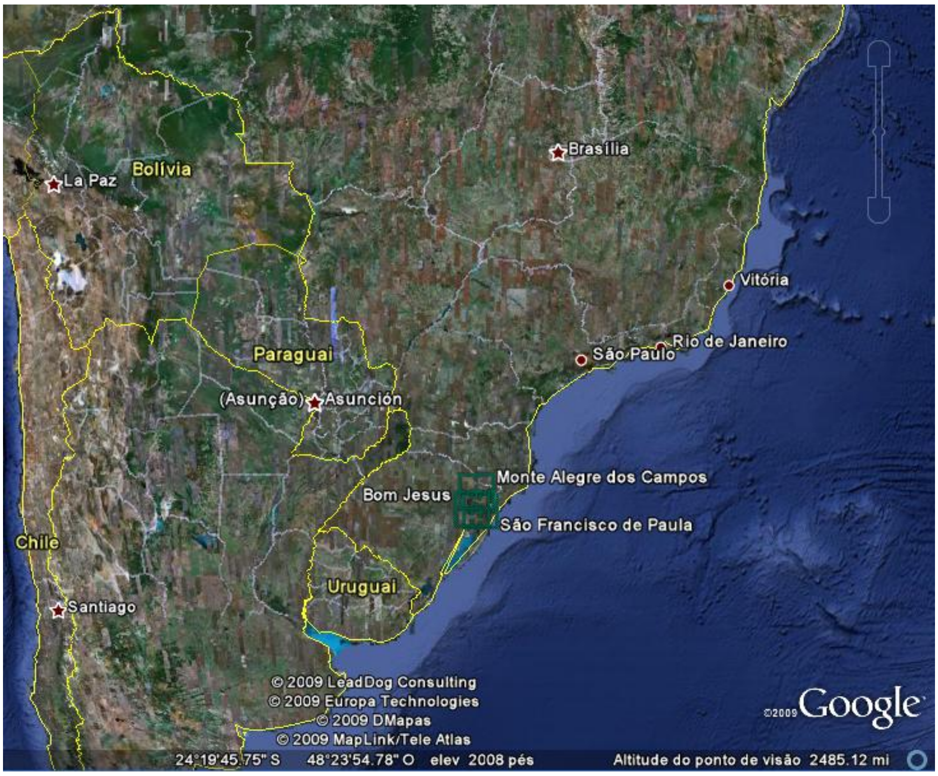

Figure 1 - Political division of Brazil presenting the municipalities of Bom Jesus, Monte Alegre dos Campos and São Francisco de Paula in the state of Rio Grande do Sul (Source: Google Earth, 2010)

Bom Jesus[5] has 11,843 inhabitants, 2,626 km^2 and is distant 237 km from Porto Alegre, capital of the state of Rio Grande do Sul, and São Francisco de Paula[6] has 21,278 inhabitants and an area 3,274 km^2.

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

Type: Energy and Power.

Sectoral Scope: 1 – Energy industries (renewable - / non-renewable sources).

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

By legal definition of the Brazilian power regulatory agency (ANEEL – *Agência Nacional de Energia Elétrica*), Resolution nr. 652, issued on December 9th, 2003[7], small hydro must have installed capacity greater than 1 MW, but not more than 30 MW, and have a reservoir area less than 3 km^2, which is the case of SCVI.

Serra dos Cavalinhos I Small Hydro Power Plant Project is a run-of-river plant located in Antas River with installed capacity of 25 MW. Serra dos Cavalinhos I SHPP is classified as a new hydroelectric project, according ACM0002 - "*Consolidated baseline methodology for grid-connected electricity generation from renewable sources*", with a reservoir of 1.50 km^2 which results in a minimum environmental impact.

Run-of-river projects, as it is SCVI's case, do not include significant water storage, and must therefore make complete use of the water flow. A typical run-of-river scheme involves a low-level diversion dam and is usually located on swift flowing streams (Figure 2).

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[5] Available at CityBrazil website http://citybrazil.uol.com.br/rs/bomjesus/index.php (Accessed 17/06/ 2010).

[6] Available at CityBrazil website http://citybrazil.uol.com.br/rs/sfranciscopaula/index.php (Accessed on 17/06/2010).

[7] ANEEL – *Agência Nacional de Energia Elétrica*. Resolução Nr. 652, de 9 de Dezembro de 2003. Available at < http://www.aneel.gov.br/cedoc/res2003652.pdf>

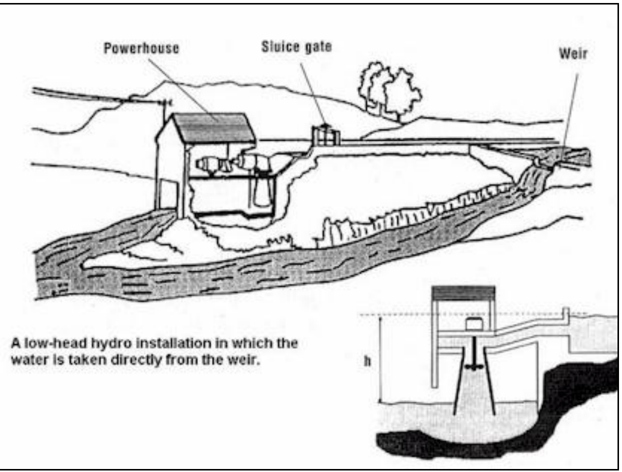

Figure 2 - Schematic view of run-of-river power plant

Table 2 – Das Antas' river monthly average flow at the project location.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Average 1941 to 2008 (m^3/s)	59.5	84.2	62.7	57.6	68.7	81.5	100.8	109.2	128.6	114.0	73.9	56.6

As can be seen by the monthly average river flow´s at the project activity location from 1941 to 2008 (Table 2). Summer (December 21 to March 20) is the dry season in the region. With the numbers in the table the average dry season flow rate is $65.75\ m^3/s$, which is even higher than the minimum flow required for the operation of the two turbines ($2 \times 15.5\ m^3/s = 31\ m^3/s$).

Another way to characterize run-of-river power plants comes from the definition of the World Commission of Dams (WCD, 2000):

"Run-of-river dams. *Dams that create a hydraulic head in the river to divert some portion of the river flows. They have no storage reservoir or limited daily poundage. Within these general classifications there is considerable diversity in scale, design, operation and potential for adverse impacts."*

In the case of Serra dos Cavalinhos I SHPP, the days of poundage at maximum volume of the dam during the dry season: 1 day. Then, to the understanding or the project participants, the SCVI can be considered a run-of-river power plant according to all the presented criteria.

The technology employed at the project is established in the energy sector, Kaplan turbines are widely used among hydro power plants (Figure 3). They are well suited to situations in which there is a low head and a large amount of discharge. The adjustable runner blades enable high efficiency even in the range of partial load, and there is little drop in efficiency due to head variation or load[8].

[8] Source: The Worlds of David Darling, 2009 (http://www.daviddarling.info/, accessed on 17/06/2010).

Figure 3 - Example of a Kaplan turbine[9]

The equipment and technology utilized by Serra dos Cavalinhos I Small Hydropower Plants Project Activity have been successfully applied to similar projects in Brazil and around the world. The equipments´ Manufactures have been in Brazil for some decades and no equipment was imported in order to implement the project activity. Technical description of the facility follows:

Table 3 - Technical configuration of Serra dos Cavalinhos I SHPP

	Description	SCVI
SHPP	Installed capacity (MW)	25
	Reservoir area (km^2)	1.5
	Estimated assured energy (MWmed/year)	15.2
	Plant load factor	0.608
Turbines	Type	Kaplan S
	Quantity	2
	Nominal power (MW)	12.82
	Lifetime (years)	40
	Year of manufacture	2011
	Manufacturer	ALSTON POWER
Generators	Type	Triphasic, synchronous
	Quantity	2

[9] Source: Ossberger Water Power Engineering (http://www.waterpower-engineering.co.uk/ossberger.html), accessed on 17/06/2010.

	Nominal power (MVA)	13.88
	Power Factor	0.9
	Lifetime (years)	30
	Year of manufacture	2011
	Manufacturer	ALSTON POWER
	Expected efficiency of the generator group (turbine, couplings and electricity generator)	90%

As mentioned earlier on section A.2., prior to the implementation of the project activity there was no small hydropower plant or other project activity operational in the same location of Serra dos Cavalinhos I Project. In the absence of the project activity all the energy would be supplied by the interconnected grid. Hence, the baseline scenario and the scenario without the project activity are the same, and the GHG (CO_2) emissions in the baseline scenario are represented by the emissions from the operational plants connected to the National grid.

The monitoring equipment involved in the project activity is related to the electricity measurement (directly involved in the emission reductions generated by the project) and the water level in the project reservoir (as required by ACM0002). Furthermore, the installed capacity of the project and the CO_2 emission factor of the grid shall also be monitored as required by ACM0002, however, there is no need of monitoring equipment for these parameters.

There will be meters (principal and backup) specified by CCEE to measure the net electricity. Regarding the water level, the monitoring can be made by using a metallic ruler or by the installation of an electronic device (monitoring made through dipsticks or floats). More information related to the monitoring parameters and equipment involved is presented in section B.7 of this PDD.

Regarding the project activity, the table above specifies that the small hydro power plant installed capacity is 25 MW and the reservoir area 1.5 km^2. It results in 16.6 W/m^2 of power density. Hence, there is no project emission since the power density is greater than 10 w/m^2.

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

The emission factor estimated from the data published by the Brazilian DNA and used to estimate the Emission Reductions by the plant is equal to 0.3095 tCO_2e/MWh. Please refer to Annex 3 for details on the calculation of the emission factor used in the *ex-ante* estimative. The results are presented in the table below.

Table 4 - Project Emission Reductions Estimation

Years	Annual estimation of emission reductions in tonnes of CO_2e
Year 1 - (2014)*	31,049

Year 2 - (2015)	41,210
Year 3 - (2016)	41,210
Year 4 - (2017)	41,210
Year 5 - (2018)	41,210
Year 6 - (2019)	41,210
Year 7 - (2020)	41,210
Year 8 - (2021)**	10,161
Total estimated reductions (tonnes of CO2e)	**288,470**
Total number of crediting years	7
Annual average over the crediting period of estimated reductions (tonnes of CO2e)	41,210

*starting on 01st April
**until 31th March

A.4.5. Public funding of the project activity:

There is no recourse to any public funding by the PPs in the proposed project activity. The project proponents hereby confirm that there is no divergence of Official Development Assistance (ODA) to the proposed project activity.

SECTION B. Application of a baseline and monitoring methodology

B.1. Title and reference of the approved baseline and monitoring methodology applied to the project activity:

ACM0002 - "*Consolidated baseline methodology for grid-connected electricity generation from renewable sources*" (Version 12.2.0).

- *"Tool to calculate the emission factor for an electricity system"* (version 2.2.1);
- *"Tool for the demonstration and assessment of additionality"* (version 6.0.0);
- *"Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion"* (version 2.0.0).
- *"Combined tool to identify the baseline scenario and demonstrate additionality"* (version 3.0.1);

The tools *to identify the baseline scenario and demonstrate additionality* and *to calculate project or leakage CO_2 emissions from fossil fuel combustion* are not applicable to the project activity, and therefore are not used.

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

The applicability conditions of ACM0002 are all fulfilled by the proposed project activity as further detailed below.

According to this methodology, it *is applicable to grid-connected renewable power generation project activities that (a) install a new power plant at a site where no renewable power plant was operated prior to the implementation of the project activity (greenfield plant); (b) involve a capacity addition; (c) involve a retrofit of (an) existing plant(s); or (d) involve a replacement of (an) existing plant(s).*

The proposed project activity comprises a Greenfield plant corresponding to option a). The methodology also provides the following conditions:

– *The project activity is the installation, capacity addition, retrofit or replacement of a power plant/unit of one of the following types: hydro power plant/unit (either with a run-of-river reservoir or an accumulation reservoir), wind power plant/unit, geothermal power plant/unit, solar power plant/unit, wave power plant/unit or tidal power plant/unit;*

The proposed project activity is the installation of a new small hydro power plant.

– *In the case of capacity additions, retrofits or replacements (except for wind, solar, wave or tidal power capacity addition projects which use Option 2: on page 10 to calculate the parameter* $EG_{PJ,y}$*): the existing plant started commercial operation prior to the start of a minimum historical reference period of five years, used for the calculation of baseline emissions and defined in the baseline emission section, and no capacity expansion or retrofit of the plant has been undertaken between the start of this minimum historical reference period and the implementation of the project activity;*

Not applicable. The proposed project activity does not correspond to a capacity addition, retrofit or replacement.

In case of hydro power plants:

– *One of the following conditions must apply:*

o *The project activity is implemented in an existing single or multiple reservoirs, with no change in the volume of any of reservoirs; or*

o *The project activity is implemented in an existing single or multiple reservoirs, where the volume of any of reservoirs is increased and the power density of each reservoir, as per definitions given in the Project Emissions section, is greater than 4* W/m^2*; or*

o *The project activity results in new single or multiple reservoirs and the power density of each reservoir, as per definitions given in the Project Emissions section, is greater than 4* W/m^2.

The proposed project activity presents power density greater than 4 W/m^2, as presented below (for more details please refer to section B.6.3): 16.67 W/m^2.

In case of hydro power plants using multiple reservoirs where the power density of any of the reservoirs is lower than 4 W/m² all the following conditions must apply:

– *The power density calculated for the entire project activity using equation 5 is greater than 4 W/m²;*

– *Multiple reservoirs and hydro power plants located at the same river and where are designed together to function as an integrated project that collectively constitute the generation capacity of the combined power plant;*

– *Water flow between multiple reservoirs is not used by any other hydropower unit which is not a part of the project activity;*

– *Total installed capacity of the power units, which are driven using water from the reservoirs with power density lower than 4W/m², is lower than 15 MW;*

– *Total installed capacity of the power units, which are driven using water from reservoirs with power density lower than 4W/m², is less than 10% of the total installed capacity of the project activity from multiple reservoirs.*

Not applicable.

Finally, the methodology has the following restrictions – *i.e.* project activities may not be applicable in the following cases:

– *Project activities that involve switching from fossil fuels to renewable energy sources at the site of the project activity, since in this case the baseline may be the continued use of fossil fuels at the site;*

– *Biomass fired power plants;*

– *Hydro power plants that result in new single reservoir or in the increase in an existing single reservoir where the power density of the power plant is less than 4 W/m².*

The project is still applicable for the use of ACM0002 since it does not correspond to any of the restriction listed above.

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

According to ACM0002 methodology, "*the spatial extent of the project boundary includes the project power plant and all power plants connected physically to the electricity system that the CDM project power plant is connected to*". It encompasses the physical, geographical site of the hydropower generation source, which is represented by the respective river basin of the project close to the power plant facility, as well as the interconnected grid (Figure 4). On May 26th, 2008, the Brazilian Designated

Authority published Resolution nr 8 defining the Brazilian Interconnected Grid as a single system comprising the fifth regions of the country[10].

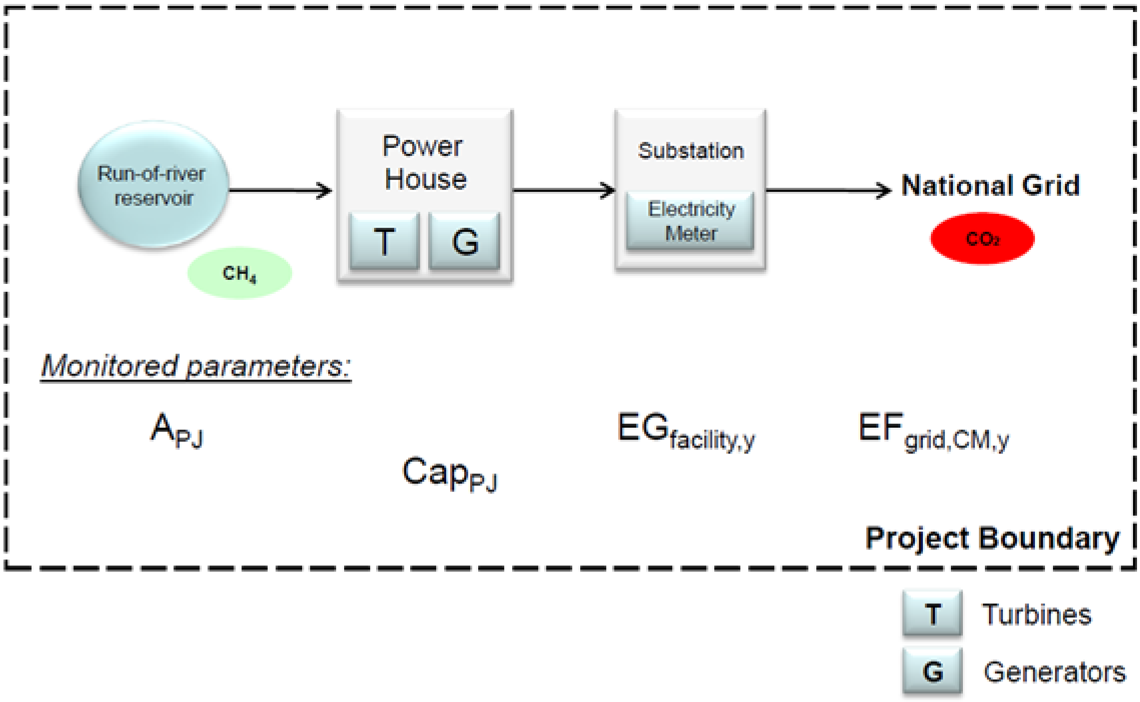

Figure 4 - Project Boundary of the project activity

The greenhouse gases and emission sources included in or excluded from the project boundary are shown in the below table.

Table 5 – Sources and gases included in the project boundary

	Source	Gas	Included ?	Justification/Explanation
Baseline	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 Activity	For geothermal power plants,	CO_2	No	Not applicable.

[10] CIMGC's Resolution nr 8 from May 26th, 2008 available at: <http://www.mct.gov.br/upd_blob/0024/24719.pdf>.

	fugitive emissions of CH_4 and CO_2 from non-condensable gases contained in geothermal steam	CH_4	No	Not applicable.
		N_2O	No	Not applicable.
	CO_2 emissions from combustion of fossil fuels for electricity generation in solar thermal power plants and geothermal power plants	CO_2	No	Not applicable.
		CH_4	No	Not applicable.
		N_2O	No	Not applicable.
	For hydro power plants, emissions of CH_4 from the reservoir	CO_2	No	Minor emission source.
		CH_4	No	Minor emission source. Considering the plant´s power density is greater than 10 W/m^2, there are no project emissions from the reservoir involved in the project activity.
		N_2O	No	Minor emission source.

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

There are no retrofits, replacements and/or capacity additions involved in the project activity. Serra dos Cavalinhos I project consists of a new grid-connected power plant. Hence, according to ACM0002 the baseline scenario is the following:

> *"Electricity delivered to the grid by the project activity would have otherwise been generated by the operation of grid-connected power plants and by the addition of new generation sources, as reflected in the combined margin (CM) calculations as described in the "Tool to calculate the emission factor for an electricity system".*

In the absence of the project activity, all the energy would be obtained from the interconnected grid. Hence, the baseline scenario is identified as the continuation of the current (previous) situation of electricity supplied by the grid emitting large quantities of carbon dioxide (CO_2) would be emitted to the atmosphere. According ANEEL (2010) [11], 69.39 % of the Brazil's installed capacity is composed by hydropower plants and 25.03 % by thermal power stations (see step 04, section B.5).

B.5. Description of how the anthropogenic emissions of GHG by sources are reduced below those that would have occurred in the absence of the registered CDM project activity (assessment and demonstration of additionality):

Until the time of validation, there were no events related to the project´s implementation beginning, contracts were not signed, and no actions "*on which the project participant has committed*

[11] Agência Nacional de Energia Elétrica (ANEEL). Banco de Informações de Geração (BIG). Available at: <http://www.aneel.gov.br/aplicacoes/capacidadebrasil/capacidadebrasil.asp>, accessed on 17/06/2010.

expenditures related to the implementation or related to the construction of the project activity[12]" were taken. Project Proponent informed their intention to seek CDM status to the Host Party and the UNFCCC secretariat in a Letter of Prior Consideration sent on 22/08/2008. The Brazilian DNA confirmed the reception of the Prior Consideration letter from Project Participant on 05/12/2008 and the UNFCCC Secretariat on 28/01/2009. Nevertheless such notifications is not required, furthermore the project´s starting date is foreseen to occur only after the project´s registration. Considering that the "*Project participants shall choose the starting date of a crediting period to be after the date the first emission reductions are generated by the CDM project activity",* the starting date of the project activity is expected to occur on 01/04/2012, date in which PP foresees that the EPC will be signed.

For the demonstration of additionality, the proposed baseline methodology refers to the Additionality Tool (version 6.0.0 is the most recent one at the time PDD is being developed) approved by the Executive Board. The tool considers some important steps necessary to determine whether the project activity is additional and to demonstrate how the emission reductions would not occur in the absence of SCVI Project. The application of the above mentioned tool is described in the next paragraphs.

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

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

Scenario 1: The alternative to the project activity is the continuation of the current (previous) situation, which is the supply of electricity by the National Interconnected System (**SIN**, *from the Portuguese "Sistema Interligado Nacional"*).

Scenario 2: The proposed project activity undertaken without being registered as a CDM project activity.

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

Both alternatives, the project activity and the alternative scenarios are in compliance with all regulations according the following entities:

- National Electric System Operator (ONS from the Portuguese *Operador Nacional do Sistema Elétrico*);
- Electricity Regulatory Agency (ANEEL from the Portuguese *Agência Nacional de Energia Elétrica*);
- The Chamber of Electrical Energy Commercialization (CCEE from the Portuguese *Câmara de Comercialização de Energia Elétrica*);
- Mines and Energy Ministry (MME from the Portuguese *Ministério de Minas e Energia*);

[12] Glossary of CDM terms (version 05). Available at: <http://cdm.unfccc.int/Reference/Guidclarif/glos_CDM.pdf>.

- Rio Grande do Sul Environmental Agency (from the Portuguese *FEPAM - Fundação Estadual de Proteção Ambiental Henrique Luiz Roessler*).

SATISFIED/PASS – Proceed to Step 2

Step 2. Investment analysis

Sub-step 2a. Determine appropriate analysis method:

Additionality is demonstrated through an investment benchmark analysis; option III of the Additionality Tool. Options I and II are not applicable to the proposed project activity. All evidence supporting the discussion presented below was supplied to the DOE.

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

The financial indicator identified for Serra dos Cavalinhos I CDM Project Activity is the project IRR. The IRR here presented is compared to the appropriate benchmark of the electrical sector, which is the Weighted Average Cost of Capital – WACC.

Weighted Average Cost of Capital (WACC)

The weighted-average cost of capital (WACC) is a rate used to discount business cash flows and takes into consideration the cost of debt and the cost of equity of a typical investor in the sector of the project activity. The benchmark can be applied to the cash flow of the project as a discount rate when calculating the net present value (NPV) of the same, or simply by comparing its value to the internal rate of return (IRR) of the project. The WACC considers that shareholders expect compensation towards the projected risk of investing resources in a specific sector or industry in a particular country.

The WACC calculation is based on parameters that are standard in the market, considers the specific characteristics of the project type, and is not linked to the subjective profitability expectation or risk profile of this particular project developer. The WACC of the sector as of the project's financial analysis decision date was of 11.45%.

Each assumption made and all data used to estimate the benchmark have been presented to the DOE. The spreadsheet used for calculation of the WACC has also been provided to the DOE.

$$WACC = Wd \times Kd + We \times Ke\text{, where:}$$

We and **Wd** are, respectively, the weights of equity and debt typically observed at the sector. **We** is of 30.8%, and **Wd** of 69.2%. These numbers derive from the typical leverage of similar projects in the sector in Brazil, based on the rules for available long term loans from Brazilian Development Bank (from the Portuguese *Banco Nacional de Desenvolvimento Econômico e Social – BNDES*)[13]. BNDES is the major provider of long-term loans in the country; it supplies the financing for small to large scale

[13] Available at BNDES' website: <http://inter.bndes.gov.br/english/conditions.asp>.

projects. Long-term loans are scarcely provided by commercial banks, and in general, these entities do not have competitive rates compared to the BNDES.

Kd is the cost of debt, which is observed in the market related to the project activity, and which already accounts for the tax benefits of contracting debts. **Kd** is of 6.18%, and also derives from long term loans applied to the sector in Brazil, and therefore is based on BNDES financing endeavour credit line's interest rates.

Ke is the cost of equity, estimated through the Capital Asset Pricing Model (CAPM). **Ke** is of 23.31%. **Ke** derives from a risk free rate plus the market risk premium adjusted to the sector through Beta. The risk-free rate, the market risk premium, and the Beta have been calculated based on publicly available data and presented to the DOE.

Plugging these numbers into WACC formulae:

$$WACC = 0.692 \times 6.18\% + 0.308 \times 23.31\% = 11.45\%$$

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

The cash flow of the project activity, containing the calculation of the project IRR of the project activity was provided to the DOE in a separate annex to this CDM-PDD. The relevant assumptions made are in accordance with the *Guidelines on the Assessment of Investment Analysis* (EB 62, Annex 5).

Project IRR, as presented to the DOE, is 8.73%. This number shows that the IRR of the project is lower than the WACC of the sector – 11.45% – the benchmark. Hence, it is evident that the project activity is not financially attractive to the investor (Table 6).

Table 6 – Comparison between Project's IRR and WACC of the sector

Project	IRR (%)	WACC (%)
SCV I SHPP	8.73	11.45

The analysis is dated on August 22nd, 2008, the table below presents the more significant values considered in the spreadsheet as well as the reference documentation.

Table 7 – Main parameters included in the project cash flow

Parameter	Value (thousands)	Reference documentation
Total Investment Cost	BRL 160,362	Total Cost Estimative from Robota Engenharia. The applied value can be crosschecked with Brookfield SHPP implementation cost projection for 2010 based on the company´s experience, by the project´s insurance policy, the signed contracts and audited

		balance sheet all references presents a higher investment cost, the applied value was the most conservative.
O&M costs	BRL 8.45/MWh	Based on PP´s experience, this value can be crosschecked with a historical database, and by sector references (SHPP Eletrobrás Study).
Transmission and tributary Costs	TUSD: BRL 1.50/kW/month ANEEL Fee: 1.52/kW/year	In accordance with ANEEL resolution # 452 / 2007 In accordance with ANEEL resolution # 3731 / 2007
Energy price	BRL 144.74 /MWh	Based on the first alternative auction´s price held on 18.06.2007 (BRL 134,99/MWh) and Inflation-Adjusted by IPCA in the referred period (7,22 %).
Amount of electricity dispatched to the grid per year	133,152 MWh/year	Based on the assured energy value (15.20 MW_{med}) established by Optimized Project´s design.
Taxes	PIS: 0.65% COFINS: 3% Social Taxes:1.08% (9% of 12%) IRPJ: 2% (25% of 8%)	PIS: Law nr. 10,637, December 31st, 2002 COFINS: Law nr. 10,833, December 29th, 2003. Law nr. 8,981, January 20th, 1995 Law nr. 9,430, December 27th, 1996
Depreciation	3.33% (30 years)	ANEEL Resolution nr. 44 dated March 17th, 1999 (items 35 and 85 of this resolution).
Fair Value	BRL 2,617	Calculated at the financial analyses spreadsheet. Included at the end of the assessment period as a cash inflow in the final year.

		Fair value inclusion on the cash flow is a conservative measure since the full value of the capital expenditure had not been consumed. The value considers the total construction value and the depreciation amount accounted in the cash flow.

Sub-step 2d: Sensitivity analysis

The sensitivity analysis, as established by the "*Guidelines on the Assessment of Investment Analysis*" (EB 62, Annex 5), is to be conducted considering variables that constitute more than 20% of either total project costs or total project revenues, including initial investment costs. Hence, variations will be done increasing project's revenues (sale of electricity and plant load factor), reducing investment expenses, and reducing operation and maintenance costs.

Also according to the guidelines, "*variations in the sensitivity analysis should at least cover a range of +10% and -10%, unless this is not deemed appropriate in the context of the specific project circumstances*". Therefore, financial analyses were performed altering each of these parameters by 10%, although such variation is clearly not expected, and assessing what the impact on the project IRR would be. Results of the sensitivity analysis are shown in the below table.

Table 8 – Results of the sensitivity analysis.

SCV I SHPP	Variation	IRR	WACC
Original IRR	-	8.73	11.45
Tariff increase	+10%	9.89	
Plant load factor increase, or energy output increase	+10%	9.82	
O&M Cost reduction	-10%	8.80	
Investment reduction	-10%	9.81	

A typical investor of the sector would not be attracted in investing in the project since the IRR is lower than the benchmark. That would be the case even when a positive variation of 10% would occur in energy prices or load factor, or a negative variation of 10% would occur in total costs or in total investments of the project, as presented in the table above.

SATISFIED/PASS – Proceed to Step 3

Step 3. Barrier analysis

Not applicable.

Step 4. Common practice analysis

According to the methodological tool "Demonstration and assessment of additionality", "*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*".

Based on the definition presented above, the tool provides a stepwise approach to be applied while conducting the common practice in order to identify similar projects to the proposed CDM Project Activity. Furthermore, the tool establishes that this approach shall be used if the proposed CDM Project Activity complies with one of the measures listed below:

(a) Fuel and feedstock switch;

(b) Switch of technology with or without change of energy source (including energy efficiency improvement as well as use of renewable energies);

(c) Methane destruction;

(d) Methane formation avoidance.

Considering the measures presented above, Serra dos Cavalinhos I project activity applies option (b) since the project consists of a switch from grid electricity generation to electricity generation from water source (hydropower plants)[14].

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

Applying the output range of +/-50% in Serra dos Cavalinhos I project, only plants with installed capacity between 12.5 MW and 37.5 MW were considered.

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

In order to conduct the analysis of Step 2, the PPs considered the definitions of geographical area and output as presented in the methodological tool "Demonstration and assessment of additionality".

(i) Output

The additionality tool defines output as "*goods or services with comparable quality, properties and application areas (e.g. clinker, lighting, residential cooking)*". Therefore, in the case of Serra dos Cavalinhos I project, the output considered is the renewable electricity generated by grid-connected hydropower power plants.

[14] Analogously to the example presented in Annex 8 of the EB 62.

(ii) Applicable geographical area

The additionality tool states:

> "*Applicable geographical area covers the entire Host Country as a default; if the technology applied in the project is not country specific, then the applicable geographical area should be extended to other countries*".

The technology to be used in the project activity is not country specific. Nevertheless, some important aspects regarding the technology shall be considered. Brazil has an extension of 8,514,876.599 square kilometres[15] (with over 4,000 km distance in the north-south as well as in the east-west axis) and 6 distinct climate regions: sub-tropical, semi-arid, equatorial, tropical, highland-tropical and Atlantic-tropical (humid tropical). Considering the distinct climate conditions, precipitation varies from 500 to more than 3,000 mm/year[16]. These varieties of climate obviously have strong influence in the technical aspects related to a small hydropower plant implementation *since meteorological events have strong influence in hydrologic process*[17]. *"Climate affects all major aspects of the electric power sector from electricity generation, transmission and distribution system to consume demand for power"*[18].

Considering the state where Serra dos Cavalinhos I is located – Rio Grande do Sul -, it has an extension of 268,781.896 square kilometres[19]. This demonstrates that, Rio Grande do Sul is considered large and physical and climatological differences can influence the implementation of small hydropower plants. However, the Project Participants decided to analyze projects located in the same state of the proposed project activity for conservativeness reasons.

An evidence of the climate regional distinctiveness can be noted by the spot price value division into sub-markets (South, Southeast/Midwest, Northeast, and North), known as Settlement Price for the Differences ("PLD" from the Portuguese *Preço de Liquidação das Diferenças*). PLD is used to price the purchase and the sale of electricity in the short term market.

Nevertheless the climate conditions are not the only distinguishing feature among the several Brazilian regions. The tariff applied for electricity distribution system uses the Distribution System Use Tariff (in a free translation from the Portuguese *Tarifa de Uso do Sistema de Distribuição - TUSD*) which varies depending on the state where the power plant is connected to. TUSD is established by specific regulation provided by ANEEL and has strong impact in the financial analysis of a project. Just for reference, from the second semester of 2010, TUSD in Paraná state (located in the same region of Rio

[15] Available at: http://www.ibge.gov.br/english/geociencias/cartografia/default_territ_area.shtm.

[16] Public information available at *Instituto Nacional de Metereologia – INMET*'s website. Gráfico de normais climatológicas (1961-1990): <http://www.inmet.gov.br/>.

[17] PINTO, J. A. Climatic indicators study for long term prediction in the river flow of Alto São Francisco basin (in a free translation from the Portuguese *Estudo de indicadores climáticos para a previsão de longo termo de vazões na bacia do Alto São Francisco*). Universidade Federal de Minas Ferais: Belo Horizonte, 2005. Available at: <http://www.smarh.eng.ufmg.br/defesas/20D.PDF>.

[18] VESELKA, T. D. Balance power: A warming climate could affect electricity. Geotimes. Earth, energy and environment news. American Geological Institute: August, 2008. Available at: < http://www.agiweb.org/geotimes/aug08/article.html?id=feature_electricity.html>.

[19] Public information available at IBGE's website: <http://ibge.gov.br/>,

Grande do Sul) was BRL 2.65/kW[20] and Rio Grande do Sul state was BRL 3.01/kW[21] (more higher than Paraná).

Furthermore, each state has a specific environmental agency responsible to determine the technical standards required to obtain all environmental licenses, with regional regulations and distinct administrative process established by each state region.

Therefore, when evaluating the different climate conditions of each region, the specific environmental regulatory framework of each state, the energy price subdivision per markets and different values of TUSD applied at each Brazilian state, it's clear that the National territory does not consist of the same "comparable environments" as required by the tool "Demonstration and assessment of additionality". Undoubtedly, these differences among the Brazilian states (climate, energy price, transmission/distribution costs and environmental legislation) have technical, financial and regulatory impacts for the implementation of hydropower plants. Therefore, it is reasonable to consider only projects located in Rio Grande do Sul state as similar to the proposed project activity.

Considering the definitions presented above, only electricity generated by grid-connected hydropower plants located in Rio Grande do Sul state and whose installed capacity are between the range of 12.5 MW and 37.5 MW (as calculated in the Step 1 above) were listed. Furthermore, CDM projects were excluded from this analysis.

Table 9 – Grid-connected hydropower plants from 12.5 MW to 37.5 MW installed capacity in Rio Grande do Sul (without CDM incentives)

Project	Installed power (kW)	Type	PROINFA
Linha Emília	19,500	Small	X
Cotiporã	19,500	Small	X
Caçador	22,500	Small	X
José Barasuoul (Ex. Linha 3 Leste)	14,335	Small	-
Esmeralda	22,200	Small	X
São Bernardo	15,000	Small	X

Source: ANEEL (2011)[22], UNFCCC (2011)[23] and Eletrobrás (2011)[24]

Considering the table above, $N_{all} = 6$.

[20] ANEEL Resolution nr. 1,015 issued on June 22nd, 2010. Available at: <http://www.aneel.gov.br/cedoc/reh20101015.pdf>.

[21] ANEEL Resolution nr. 1,074 issued on October 19th, 2010. Available at: <http://www.aneel.gov.br/cedoc/atreh20101074.pdf>.

[22] ANEEL (2011). Banco de informações de Geração (BIG). Summary – Minas Gerais state. Agência Nacional de Energia Elétrica. Acessed on January 10th, 2012. Information available at: <http://www.aneel.gov.br/aplicacoes/ResumoEstadual/CapacidadeEstado.asp?cmbEstados=MG:MINAS GERAIS>.

[23] UNFCCC (2011). Project Activities. Validation. United Nations Framework Convention on Climate Change. Available at <http://cdm.unfccc.int/index.html>.

Step 3: Within plants identified in Step 2, identify those that apply technologies different that the technology applied in the proposed project activity. Note their number N_{diff}.

According to the additionality tool, different technologies are technologies that deliver the same output and differ by at least one of the following (as appropriate in the context of the measure applied in the proposed CDM project and applicable geographical area):

(a) Energy source/fuel;

(b) Feed stock;

(c) Size of installation (power capacity):

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

  (ii) Small (as defined in paragraph 28 of Decision 1/CMP.2);

  (iii) Large.

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

  (i) Access to technology;

  (ii) Subsidies or other financial flows;

  (iii) Promotional policies;

  (iv) Legal regulations;

(e) Other features, inter alia;

  (i) Unit cost of output (unit costs are considered different if they differ by at least 20%).

Considering the information above, the Project Participants identified the following types of technologies that differ from the proposed project activity:

(a) Size of installation (power capacity):

- Micro (as defined in paragraph 24 of Decision 2/CMP.5 and paragraph 39 of Decision 3/CMP.6);
- Small (as defined in paragraph 28 of Decision 1/CMP.2);
- Large.

According to the Brazilian regulation, small scale hydropower plants are defined as plants with installed capacities between 1MW and 30MW and reservoir areas smaller

[24] ELETROBRÁS (2011). Centrais Elétricas Brasileiras S/A. Programs and setorial funds. Proinfa. Contracted projects and addendum signed (from the Portuguese *relação de empreendimentos contratados e extratos de contratos e termos aditivos celebrados*). Available at: <http://www.eletrobras.com/elb/data/Pages/LUMISABB61D26PTBRIE.htm>.

than 3km2[25]. Since Serra dos Cavalinhos I project is inserted in the context of the Brazilian legislation, it is reasonable to compare the project activity with other small hydropower plants according to the Host Country definition of small scale power plants (and not to the CDM-EB definition of small scale).

Considering explanations above, no large scale hydropower plants (*i.e.* installed capacity over 30MW and reservoir areas greater than $3km^2$) were considered in this common practice analysis. Therefore, the technology that delivers the same output of Serra dos Cavalinhos I project - in the context of the measure and applicable geographical area of the project - is the electricity generation by grid-connected small hydropower plants. Large scale hydropower plants shall be considered as having different technology to the proposed project activity.

Table 10 – Grid-connected hydropower plants from 12.5 MW to 37.5 MW installed capacity in Rio Grande do Sul (without CDM incentives)

Project	Installed power (kW)	Type	PROINFA
Linha Emília	19,500	Small	X
Cotiporã	19,500	Small	X
Caçador	22,500	Small	X
José Barasuoul (Ex. Linha 3 Leste)	14,335	Small	-
Esmeralda	22,200	Small	X
São Bernardo	15,000	Small	X

Source: ANEEL (2011)[26], UNFCCC (2011)[27] and Eletrobrás (2011)[28]

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

- (i) Promotional policies

The Alternative Electricity Sources Incentive Program (in a free translation from the Portuguese *Programa de Incentivo às Fontes Alternativas de Energia Elétrica – PROINFA*) was created through the Law nr. 10,438 dated April 26th, 2002. Among others, one of the initiative's goals is to increase the renewable energy sources share in

[25] *ANEEL – Agência Nacional de Energia Elétrica. Resolution nr. 652, issued on December 9th, 2003.*

[26] ANEEL (2011). Banco de informações de Geração (BIG). Summary – Minas Gerais state. Agência Nacional de Energia Elétrica. Acessed on January 10th, 2012. Information available at: <http://www.aneel.gov.br/aplicacoes/ResumoEstadual/CapacidadeEstado.asp?cmbEstados=MG:MINAS GERAIS>.

[27] UNFCCC (2011). Project Activities. Validation. United Nations Framework Convention on Climate Change. Available at <http://cdm.unfccc.int/index.html>.

[28] ELETROBRÁS (2011). Centrais Elétricas Brasileiras S/A. Programs and setorial funds. Proinfa. Contracted projects and addendum signed (from the Portuguese *relação de empreendimentos contratados e extratos de contratos e termos aditivos celebrados*). Available at: <http://www.eletrobras.com/elb/data/Pages/LUMISABB61D26PTBRIE.htm>.

the Brazilian electricity market, thus contributing to a greater environmental sustainability. In order to achieve such goals, the Brazilian government has designated the federal state-owned power utility Eletrobrás (Centrais Elétricas Brasileiras S/A) to act as the primary off-taker of electric energy generated by alternative energy facilities in Brazil, by entering into long-term Power Purchase Agreements with alternative energy power producers, at a guaranteed price of at least 80% of the average energy supply tariff charged to ultimate consumers. In addition, Brazilian Decree nr. 5,025 dated March 30^{th}, 2004, which regulates the Law nr. 10,438, states that PROINFA aims for the reduction of greenhouse gases as established by the United Nations Framework Convention on Climate Change (UNFCCC) under Kyoto Protocol, contributing to the sustainable development. Therefore, the program is clearly a "Type E-" policy.

▪ Considering explanations above, projects which have been participating in PROINFA cannot be compared with projects which do not receive this type of incentive. Since Serra dos Cavalinhos I does not receive PROINFA incentive, PROINFA projects shall be considered as having different technology to the proposed project activity.

▪ **Table 11 – Grid-connected hydropower plants from 12.5 MW to 37.5 MW installed capacity in Rio Grande do Sul (without CDM and/or PROINFA incentives)**

Project	Installed power (kW)
José Barasuol (Ex. Linha 3 Leste)	14,335

▪ (ii) Legal regulations

- Electricity sector framework

Until the beginning of the 1990's, the energy sector was composed almost exclusively of state-owned companies. From 1995 onwards, due to the increase in international interest rates and the lack of state investment capacity, the government started the privatization process. However, by the end of 2000 results were still modest. Although further initiatives, aiming to improve electric generation in the country, were taken between the 1990's and 2003, they did not attract new investment to the sector. In 2003, the recently elected government decided to fully review the electricity market institutional framework in order to boost investments in the electric energy sector. Market rules were changed and new institutions were created such as Energetic Research Company (in a free translation from the Portuguese *Empresa de Pesquisa Energética – EPE*) – an institution responsible for the long term planning of the electricity sector with the role of evaluating, on a perennial basis, the safety of the supply of electric power – and Chamber for the Commercialization of Electric Power (CCEE) – an institution responsible for the management of electric power commercialization within the interconnected system. This new structure was approved by the House of

Representatives and published in March of 2004[29]. Given the new regulatory framework, the Project Participants considered only projects which started operation from April of 2004 onwards. Projects that started operations before the new electricity framework shall be considered as having different technology to the proposed project activity.

In make an in-depth analysis, the Project Participants observed that José Barasuol (Ex. Linha 3 Leste) small hydropower plant started operation in December 2003, *i.e.* before the new electricity sector framework[30].

Considering information above, $N_{diff} = 6$.

Step 4: Calculated factor $F = 1-N_{diff}/N_{all}$ representing the share of plants using technology similar to the technology used in the proposed project activity in all plants that deliver the same output or capacity as the proposed project activity. The proposed project activity is 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.

Since $N_{diff} = 6$ and $N_{all} = 6$:

$N_{all} - N_{diff} = 0 < 3$ and,

$F = 1- N_{diff} / N_{all} = 0 < 0.2$

Therefore, Serra dos Cavalinhos I project activity is not a common practice.

Spreadsheet with complete research for the common practice analysis is available with the Project Participants and was presented to DOE during validation.

SATISFIED/PASS – Project is ADDITIONAL

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

Baseline Emissions

Baseline emissions are calculated using the annual generation (project annual electricity dispatched to the grid) times the CO_2 average emission rate of the estimated baseline and correspond to the CO_2 emissions that are displaced as a consequence of the project activity, calculated as follows:

Equation 1

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[29] http://www.planalto.gov.br/ccivil_03/_ato2004-2006/2004/lei/l10.848.htm

[30] José Barasuol (Ex. Linha 3 Leste) small hydropower plant started operation in December 2003. Information available at: < http://www.aneel.gov.br/cedoc/dsp20031045.pdf >.

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

Where,

BE_y = Baseline emissions in year *y* (tCO_2/yr);

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

$EF_{grid,CM,y}$ = Combined margin CO_2 emission factor for grid connected power generation in year *y* calculated using the latest version of the "Tool to calculate the emission factor for an electricity system" (tCO_2/MWh).

And considering that the present project activity consists of a "*installation of a new grid-connected renewable power plant/unit at a site where no renewable power plant was operated prior to the implementation of the project activity"*, then:

$$EG_{PJ,y} = EG_{facility,y}$$ **Equation 2**

Where:

$EG_{PJ,y}$ = Quantity of net electricity generation that is produced and fed into the grid as a result of the implementation of the CDM project activity in year y (MWh/yr);

$EG_{facility,y}$ = Quantity of net electricity generation supplied by the project plant/unit to the grid in year y (MWh/yr).

In order to calculate combined margin CO_2 emission factor, in accordance with to the methodological tool "*Tool to calculate the emission factor for an electricity system*" (version 2.2.1), the subsequent six steps were followed:

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) emissions factor.

- **STEP 1 -** Identify the relevant electricity systems

According to the tool, "*If the DNA of the host country has published a delineation of the project electricity system and connected electricity systems, these delineations should be used. If such delineations are not available, project participants should define the project electricity system and any connected electricity system and justify and document their assumptions in the CDM-PDD*".

Brazilian DNA has published the Resolution nr. 8 issued on 26th May, 2008 that defines the Brazilian Interconnected Grid as a single system that covers all the five macro-geographical regions of the country (North, Northeast, South, Southeast and Midwest). Hence, this figure will be used to calculate the baseline emission factor of the grid.

- **STEP 2 -** Choose whether to include off-grid power plants in the project electricity system (optional).

Project participants may chose between the following two options to calculate the operating margin and build margin emission factor:

Option (i): only grid power plants are included in the calculation;

Option (ii): both grid power plants and off-grid power plants are included in the calculation.

Option I of the tool is chosen, which is to include in the calculation only grid power plants[31].

- **STEP 3 -** Select a method to determine the operating margin (OM)

The calculation of the operating margin emission factor ($EF_{grid,OM,y}$) is 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 made available the operating margin emission factor calculated using option c – Dispatch data analysis OM. Detailed information on the methods and data applied can be obtained in the DNA's website[32].

- **STEP 4 -** Calculate the operating margin emission factor according to the selected method

The dispatch data analysis OM emission factor ($EF_{grid,OM\text{-}DD,y}$) is determined based on the power units that are actually dispatched at the margin during each hour *h* where the project is displacing

[31] According to the Resolution nr. 8 issued on 26th May, 2008 by the Brazilian DNA, the Brazilian Interconnected Grid was defined as a single system that covers all the five macro-geographical regions of the country. Hence, no off-grid power plants are included in the emission factor of the electricity system, thus step 2 was not chosen.

[32] Site accessed on 17/06/2010; http://www.mct.gov.br/index.php/content/view/4016.html

electricity. This approach is not applicable to historical data and, thus, requires annual monitoring of $EF_{grid,OM-DD,y}$. As consequence it will be calculated ex-post. Only for the purpose of estimative, the numbers of the most recent years will be used.

The $EF_{grid,OM-DD,y}$ will be calculated using the below formulae:

$$EF_{grid,OM-DD,y} = \frac{\sum_h EG_{PJ,h} \cdot EF_{EL,DD,h}}{EG_{PJ,y}}$$ **Equation 3**

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 the year *y* (MWh);

$EF_{EL,DD,h}$ = CO_2 emission factor for grid power units in the top of the dispatch order in hour *h* in year *y* (tCO_2/MWh);

$EG_{PJ,y}$ = Total electricity displaced by the project activity in year *y* (MWh);

h = Hours in year *y* in which the project activity is displacing grid electricity;

y = Year in which the project activity is displacing grid electricity.

As mentioned above, the host country's DNA will provide $EF_{EL,DD,h}$ in order to Project Participants to calculate the operating margin emission factor. Hence, this data will be updated annually applying the number published by the Brazilian DNA. For estimative purposes, the data of the most recent year available in the DNA website will be used.

- **STEP 5** – Calculate the build margin (BM) emission factor

According to the "*Tool to calculate the emission factor for an electricity system*", in terms of vintage of data, project participants can choose between one of the following two options:

Option 1: For the first crediting period, calculate the build margin emission factor *ex ante* based on the most recent information available on units already built for sample group *m* at the time of CDM-PDD submission to the DOE for validation. For the second crediting period, the build margin emission factor should be updated based on the most recent information available on units already built at the time of submission of the request for renewal of the crediting period to the DOE. For the third crediting period, the build margin emission factor calculated for the second crediting period should be used. This option does not require monitoring the emission factor during the crediting period.

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, ir information up to year of registration is not yet available, including those units built 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 mardin emission factor calculated for the second crediting period should be used.

In terms of vintage, **option 2** was chosen. In this sense, the build margin shall be updated annually, *ex post*. The build margin will also be calculated by the DNA. The number is published in the website and for estimative purposes the data for the most recent year will 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 power generation data is available, calculated as follows:

$$EF_{grid,BM,y} = \frac{\sum_m EG_{m,y} \cdot EF_{EL,m,y}}{\sum_m EG_{m,y}}$$ **Equation 4**

Where:

$EF_{grid,BMy}$	= Build margin CO_2 emission factor in year y (tCO_2/MWh);
$EG_{m,y}$	= Net quantity of electricity generated and delivered to the grid by power unit *m* in year y (MWh);
$EF_{EL,m,y}$	= CO_2 emission factor of power unit m in year y (tCO_2/MWh);
m	= Power units included in the build margin;
y	= Most recent historical year for which power generation data is available.

- **STEP 6** – Calculate the combined margin emissions factor.

The calculation of the combined margin (CM) emission factor is based on one of the following methods:

(a) Weighted average CM; or

(b) Simplified CM.

The weighted average CM method (option a) should be used as the preferred option.

The simplified CM method (option b) can only be used if:

- The project activity is located in a Least Developed Country (LDC) or in a country with less than 10 registered CDM projects at the starting date of validation; and
- The data requirements for the application of step 5 above cannot be met.

(a) Weighted average CM

The combined margin emissions factor is calculated as follows:

$$EF_{grid,CM,y} = EF_{grid,OM,y} \cdot w_{OM} + EF_{grid,BM,y} \cdot w_{BM}$$ **Equation 5**

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 of operating margin emissions factor (%);

w_{BM} = Weighting of build margin emissions factor (%).

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 (owing to their intermittent and non-dispatchable nature) 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,6 unless otherwise specified in the approved methodology which refers to this tool.

Since Serra dos Cavalinhos I is a small hydropower plant project, the weights used for the operating and build margin are 0.50 for both.

(b) Simplified CM

The combined margin is calculated using equation 5 above with the following conditions:

- w_{BM} = 0;
- w_{OM} = 1.

Under the simplified CM, the operating margin emission factor ($EF_{grid,OM,y}$) must be calculated using the average OM (option (d) in step 3 of the "Tool to calculate the emission factor for an electricity system).

Thus, for the Serra dos Cavalinhos I project, the combined margin calculation is based on method a) from the provided by the tool.

<u>Project emissions (PE_y)</u>

The proposed project activity may involve project emissions that can be significant. In this sense, according to the selected CDM methodology these emissions shall be accounted for as project emissions by using the following equation:

$$PE_y = PE_{FF,y} + PE_{GP,y} + PE_{HP,y}$$ **Equation 6**

Where:

PE_y = Project emissions in year *y* (tCO_2e/yr);

$PE_{FF,y}$ = Project emissions from fossil fuel consumption in year *y* (tCO_2/yr);

$PE_{GP,y}$ = Project emissions from the operation of geothermal power plants due to the release of non-condensable gases in year *y* (tCO_2e/yr);

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

Emissions from fossil fuel combustion ($PE_{FF,y}$)

Considering that there is no fossil fuel combustion in the proposed project activity, $PE_{FF,y}$ = 0 tCO_2/year.

Emissions from the operation of geothermal power plants due to the release of non-condensable gases ($PE_{GP,y}$)

Considering that the proposed project activity consists on the construction of a small hydropower plant, there are no emissions of non-condensable gases from the operation of geothermal power plants. Therefore, $PE_{GP,y}$ = 0 tCO_2/year.

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

According to ACM0002, new hydropower projects that result in new single or multiple reservoirs, shall account for project emissions, estimated as follows:

a) If the power density of the single or multiple reservoirs (*PD*) of power plant is greater than 4 W/m^2 and less than or equal to 10 W/m^2:

$$PE_{HP,y} = \frac{EF_{Res} \cdot TEG_y}{1000}$$ **Equation 7**

Where:

$PE_{HP,y}$ = Project emissions from water reservoirs (tCO_2e/yr);

EF_{Res} = Default emission factor for emissions from reservoirs of hydro power plants in year *y* ($kgCO_2e/MWh$);

TEG_y = Total electricity produced by the project activity, including the electricity supplied to the grid and the electricity supplied to internal loads, in year *y* (MWh).

(b) If the power density of the project activity (*PD*) is greater than 10 W/m^2: $PE_{HP,y} = 0$

The power density of the project activity (*PD*) is calculated as follows:

$$PD = \frac{Cap_{PJ} - Cap_{BL}}{A_{PJ} - A_{BL}}$$ **Equation 8**

Where:

PD = Power density of the project activity, in W/m^2;

Cap_{PJ} = Installed capacity of the hydro power plant after the implementation of the project activity (W);

Cap_{BL} = Installed capacity of the hydro power plant before the implementation of the project activity (W). For new hydro power plants, this value is zero;

A_{PJ} = Area of the single or multiple reservoirs measured in the surface of the water, after the implementation of the project activity, when the reservoir is full (m^2);

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

Leakage emissions (LE_y)

No leakage emissions are considered.

Emission reductions (ER_y)

According the selected approved methodology ACM0002, emission reductions are calculated as follows:

$$ER_y = BE_y - PE_y$$ **Equation 9**

Where:

ER_y = Emission reductions in year y (tCO_2e/yr);

BE_y = Baseline emissions in year y (tCO_2/yr);

PE_y = Project emissions in year y (tCO_2e/yr).

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

Data / Parameter:	Cap_{BL}
Data unit:	W
Description:	Installed capacity of the hydro power plant before the implementation of the project activity.
Source of data used:	Serra dos Cavalinhos I SHPP site
Value applied:	0
Justification of the choice of data or description of measurement methods and procedures actually applied :	The methodology states that this value shall be applied for new hydro power plants.
Any comment:	

Data / Parameter:	EF_{Res}
Data unit:	$kgCO_2e/MWh$
Description:	Default emission factor for emissions from reservoirs
Source of data:	Decision by EB23
Value to be applied:	90 $kgCO_2e/MWh$
Justification of the choice of data or description of measurement methods and procedures actually applied:	The methodology states that this value shall be applied for hydro power plants that the power density of the project activity (*PD*) is greater than 4 W/m^2 and less than or equal to 10 W/m^2:
Any comment:	-

Data / Parameter:	A_{BL}
Data unit:	m^2
Description:	Area of the single or multiple reservoirs measured in the surface of the water when the reservoir is full (m^2), before the implementation of the project activity.
Source of data used:	Serra dos Cavalinhos I SHPP site
Value applied:	0

Justification of the choice of data or description of measurement methods and procedures actually applied :	The methodology states that this value shall be applied for new hydro power plants.
Any comment:	

B.6.3 Ex-ante calculation of emission reductions:

Baseline emissions

As described in section B.6.1, baseline calculation (BE_y) are calculated directly from electricity supplied by the project to the grid ($\mathbf{EG_{PJ,y}}$) multiplied by the emission factor of the grid ($EF_{grid,CM,y}$).

Future electricity supplied by the project to the grid is estimated based on the assumptions made the Project Participants considering the technical configuration of SCVI.

The estimative of the net electricity generated by the plant, equivalent to the total amount of energy effectively dispatched to the national grid, is based on the assured energy determined for the plant. The assured energy already considers the discount of the electricity consumption by the auxiliary systems of the plant as well as the transmission losses and was established been equal to 15.20 $MW_{average}$.

Considering the plant is expected to be operational 8760 hours/year the net energy generated ($EG_{facility,y}$) by the plant is 133,152 MWh/year.

For estimation purposes, the latest available value from the hourly emission factor data provided by the Brazilian DNA for the 2010 was applied. When applying the estimate figures in the formula presented in step 3 of Annex 3 the $EF_{grid,OM,y}$ obtained was:

$$EF_{grid,OM\text{-}DD,\ 2010} = 0.4787\ tCO_2/MWh.$$

The average building margin for the considered years is:

$$EF_{BM,2010} = 0.1404\ tCO_2/MWh.$$

With these numbers, applying in the formula presented in step 6 of B.6.1, we have:

$$EF_y = 0.5 \times 0.4787 + 0.5 \times 0.1404$$

$$EF_y = 0.3095\ tCO_2/MWh.$$

Considering Equation 5 and the expected annual electricity delivery to the grid by the project, the baseline emissions are as follows:

Emission factor 2010 (tCO_2/MWh):	0.3095

Table 12 – Estimated energy generated, exported to the grid and baseline

Year	Net Energy Generated ($EG_{facility,y}$) in MWh	BE (tCO_2e)
2014*	100,320	31,049
2015	133,152	41,210
2016	133,152	41,210
2017	133,152	41,210
2018	133,152	41,210
2019	133,152	41,210
2020	133,152	41,210
2021**	32,832	10,161
TOTAL	**932,064**	**288,470**

**Starting on April1st*

***Until March 31th*

Project emissions calculation

Emissions from fossil fuel combustion ($PE_{FF,y}$)

As mentioned in section B.6.1, there is no fossil fuel combustion in the proposed project activity. Therefore, $PE_{FF,y}$ = 0 tCO_2/year.

Emissions from the operation of geothermal power plants due to the release of non-condensable gases ($PE_{GP,y}$)

As mentioned in section B.6.1, there are no emissions of non-condensable gases from the operation of geothermal power plants. Therefore, $PE_{GP,y}$ = 0 tCO_2/year.

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

According to ACM0002, new hydropower projects that result in new single or multiple reservoirs, shall account for related project emissions based on the calculation of their power density.

The installed capacity of SCVI is 25 MW and its reservoir area is equal to 1.50 km^2. In the baseline no electricity was generated at the project site, consequently there wasn't reservoir. Applying these numbers on Equation 8, the result is:

$$PD = \frac{25 \cdot 10^6 W - 0}{1.5 \cdot 10^6 m^2 - 0} = 16.67\ W / m^2$$

As a result of PD value, $PE_{HP,y} = 0$.

Then, $\mathbf{PE_y = 0}$.

Leakage emissions

As explained above in section B.6.1. no leakage is to be considered. Hence, ***LE* = 0** tCO_2/year.

Emission reductions calculation

According to the selected approved methodology ACM0002, emission reductions are calculated as follows:

$$ER_y = BE_y - PE_y$$

ER_y = 41,210 tCO_2/year – 0 = 41,210 tCO_2e/year

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

Table 13 – Summary of the ex-ante estimation of emission reductions of Serra dos Cavalinhos I SHPP

Years	**Estimation of project activity emissions** (tonnes of CO_2e)	**Estimation of baseline emissions** (tonnes of CO_2e)	**Estimation of leakage** (tonnes of CO_2e)	**Estimation of overall emission reductions** (tonnes of CO_2e)
Year 1 - (2014)*	0.0	31,049	0.0	31,049
Year 2 - (2015)	0.0	41,210	0.0	41,210
Year 3 - (2016)	0.0	41,210	0.0	41,210
Year 4 - (2017)	0.0	41,210	0.0	41,210
Year 5 - (2018)	0.0	41,210	0.0	41,210
Year 6 - (2019)	0.0	41,210	0.0	41,210
Year 7 - (2020)	0.0	41,210	0.0	41,210
Year 8 - (2021)**	0.0	10,161	0.0	10,161
Total (tonnes of CO_2e)	**0.0**	**288,470**	**0.0**	**288,470**

*starting on 01st April

**until 31^{t} March

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

B.7.1 Data and parameters monitored:

Data monitored and required for verification and issuance will be kept for two years after the end of the crediting period or the last issuance of CERs for this project activity, whichever occurs later. 100% of the data will be monitored.

Data / Parameter:	$EG_{facility,y}$
Data unit:	MWh/year
Description:	Quantity of net electricity generation supplied by the project plant/unit to the grid in year *y*.
Source of data:	Project site.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	133,152
Description of measurement methods and procedures to be applied:	There are two electricity meters (principal and back-up) which continuously monitor the electricity generated by the plant and delivered to the grid. As per the information presented above, they are calibrated every two years following the recommendations of the System National Operator. To additional information, please refer to section B.7.2.
QA/QC procedures to be applied:	The company´s internal generation reports can be crosschecked with official reports issued by CCEE. The equipments used have by legal requirements extremely low level of uncertainty, precision class of 0.2%.
Any comment:	-

Data / Parameter:	Cap_{PJ}
Data unit:	W
Description:	Installed capacity of the hydro power plant after the implementation of the project activity.
Source of data:	Project site.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	$25*10^6$
Description of measurement methods and procedures to be applied:	Determine the installed capacity based on recognized standards. Verified at the project´s site. Monitoring frequency: yearly.
QA/QC procedures:	-

Any comment:	-

Data / Parameter:	A_{PJ}
Data unit:	m^2
Description:	Area of the single or multiple reservoirs measured in the surface of the water, after the implementation of the project activity, when the reservoir is full.
Source of data to be used:	Project site.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	$1.50 * 10^6$
Description of measurement methods and procedures to be applied:	The reservoir area will be monitored through topographical data in the location of the project activity (made once at the time of the project design) and the reservoir level monitored yearly by the project sponsor. The water level to be compared with the topographical study will be based on the average water level that will be verified annually. A_{PJ} parameter can be cross-checked with ANEEL's Geo-referenced Information Systems of the Electric Sector. Electronically archived.
QA/QC procedures:	Engineering/Environmental studies and/or licenses issued by the Environmental Agency of the State will be available at that time of the verification for cross-checking purposes. Electronically archived.
Any comment:	-

Data / Parameter:	$EF_{grid.CM.y}$
Data 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 to be used:	Calculated following the steps provided by the "*Tool to calculate the emission factor for an electricity system*" applying the numbers published by the Brazilian DNA website: (http://www.mct.gov.br/index.php/content/view/4016.html)
Value of data applied for the purpose of calculating expected emission reductions in section B.5	0.3095
Description of measurement methods and procedures to be applied:	The emission factor is calculated based on an average of Operating and Build margin emission factors for the year 2010 according to procedures prescribed in the "*Tool to calculate the emission factor for an electricity system*". Once option C) for the calculation of the operating margin was chosen by the DNA, this value

	will be up-dated annually following the prescription of the tool.
QA/QC procedures to be applied:	As per the 'Tool to calculate the emission factor for an electricity system'.
Any comment:	

B.7.2 Description of the monitoring plan:

The Monitoring Plan will be based on amount of electricity delivered to the grid ($EG_{facility,y}$) by the project activity, measured by electricity meters calibrated every two years in compliance with local energy standards. This amount of energy is monitored by the project owner, as well as by the Chamber of Electrical Energy Commercialization (from the Portuguese *Câmara de Comercialização de Energia Elétrica* - CCEE) that controls all electricity dispatched to the grid and contractually assures, for the buyer, that the electricity sold will be appropriately delivered. Once energy losses are accounted and the data consistency is verified, CCEE issues an official report that indicate, per week, the amount of electricity dispatched during a certain month, in which is based the GHG emission reductions calculation.

From what is established in the relevant regulation of the energy sector in Brazil, all the plants delivering electricity to the grid have to implement a *Measurement System for Invoicing (from the Portuguese, Sistema de Medição e Faturamento - SMF)* in accordance with the specifications set by CCEE. Model and type of energy meters installed are in accordance with CCEE´s standards. Such configuration is in accordance with ONS´s grid procedures, "Module 12: Measurement for Invoicing". The measurements related to the project activity will be controlled in real time by the Operation and Management System Center (COGS) in Curitiba.

There will be two energy meters (principal and back up) specified by CCEE, these meters are calibrated by an entity with credential from the Brazilian Calibration Network (in a free translation from the Portuguese *Rede Brasileira de Calibração*). The installed capacity of the power plant will be checked by DOE during on-site visit every verification and cross-checked with official documents, *e.g.* ANEEL resolution or licenses issued by the environmental agency of Rio Grande do Sul State.

The reservoir area will be monitored through topographical studies (made at the time of the project design) and water reservoir levels, which will be yearly monitored by the project sponsors. The water level to be compared with the topographical study will be based on the average water level that will be verified annually. Data can be cross-checked with official documents, *e.g.* engineering/environmental studies and/or licenses issued by the Environmental Agency of the State and can be cross-checked with ANEEL's Geo-referenced Information Systems of the Electric Sector. This information will be available at the time of the project verification.

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Brookfield Energia Renovável (BER) is responsible for the calibration (each two years), according to the procedures established by the ONS[33], and maintenance of the monitoring equipments of Serra dos

[33] Please refer to the document "*Módulo 12 do ONS, Submódulo 12.3 – Manutenção do sistema de medição para faturamento".* Available at: http://www.ons.org.br/download/procedimentos/Submodulo%2012.3_v10.0.pdf.

Cavalinhos I. BER is also responsible for the project management, as well as for organising and training the staff in the appropriate monitoring procedures. The plant is subject to ANEEL inspection in which the agency assesses the compliance with legal requirements as per official procedures and standards.

All monitored data required for verification and issuance will be archived electronically and will be kept for two years after the end of the crediting period or the last issuance of CERs for this project activity, whichever occurs later.

B.8 Date of completion of the application of the baseline study and monitoring methodology and the name of the responsible person(s)/entity(ies)

Date of completing the final draft of this baseline section *(DD/MM/YYYY):21/06/2011*.

Name of person/entity determining the baseline:

Company:	Ecopart Assessoria em Negócios Empresariais Ltda.
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Ecopart Assessoria em Negócios Empresariais Ltda. is Project Advisor and Project Participant.

SECTION C. Duration of the project activity / crediting period

C.1 Duration of the project activity:

C.1.1. Starting date of the project activity:

Considering that the EPC contract will is expected to be signed after the project´s registration, the starting date of the project activity is foreseen to occur on 01/04/2012.

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

30y-0m

C.2 Choice of the crediting period and related information:

C.2.1. Renewable crediting period

Each crediting period shall be at most 7 years and may be renewed at most two times, provided that, for each renewal, a designated operational entity determines and informs the Executive Board that the original project baseline is still valid or has been updated taking account of new data where applicable.

C.2.1.1. Starting date of the first crediting period:

Date of registration of the CDM project activity, or the date of the plant´s operational beginning (expected to occur two years after the project´s starting date, 01/04/2014), whichever is later.

C.2.1.2. Length of the first crediting period:

7y-0m

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

Not applicable.

C.2.2.2. Length:

Not applicable.

SECTION D. Environmental impacts

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

In Brazil, the sponsor of any project that involves construction, installation, expansion or operation of any polluting or potentially polluting activity or any other capable to cause environmental degradation is obliged to secure a series of permits from the relevant environmental agency (federal and/or local, depending on the project).

Although small hydro projects have reduced environmental impacts given the smaller dam and reservoir size, project sponsors have to obtain all licenses required by the Brazilian environmental regulation (Resolution CONAMA - *Conselho Nacional do Meio Ambiente* (National Environmental Council) nr. 237/97):

- The preliminary license (*Licença Prévia* or LP),
- The construction license (*Licença de Instalação* or LI); and
- The operating license (*Licença de Operação* or LO).

Accordingly to article 3 of this Resolution, the issuance of environmental license for a Project with significant environmental impacts only occurs after the development of an Environmental Impact Assessment and a Public Hearing is held. For projects that do not incur in significant impacts the environmental agency establishes the scope of the assessment to be made in order to evaluate the project. This was the case of SCVI

The environmental permit process has an administrative nature and was implemented by the National Environmental Policy, established by the Law n. 6938 dated on October 31st, 1981. Additionally, other norms and laws were issued by CONAMA and local state agencies.

In order to obtain all environmental licenses every small hydro projects shall mitigate the following impacts, (if applicable):

- Inundation of indigenous people's lands and slaves historical areas – the authorization for that depends on National Congress decision;
- Inundation of environmental preservation areas, legally formed as National Parks and Conservation Units;
- Inundation of urban areas or country communities;
- Reservoirs where there will be urban expansion in the future;
- Elimination of natural patrimony;
- Expressive losses for other water uses;
- Inundation of protected historic areas; and
- Inundation of cemeteries and other sacred places.

The process starts with a previous analysis (preliminary studies) by the local environmental department. After that, if the project is considered environmentally feasible, the sponsors have to prepare the Environmental Assessment, which is basically composed by the following information:

- Reasons for project implementation;
- Project description, including information regarding the reservoir;
- Preliminary Environmental Diagnosis, mentioning main biotic, and anthropic aspects;
- Preliminary estimation of project impacts; and
- Possible mitigating measures and environmental programs.

The result of those assessments is the Preliminary License (LP), which reflects the environmental local agency positive understanding about the environmental project concepts.

In order to obtain the Construction License (LI) it is necessary to present (a) additional information about previous assessment; (b) a new simplified assessment; or (c) the Environmental Basic Project, according to the environmental agency decision informed at the LP.

The Operation License (LO) is issued after the environmental agency verifies if all environmental requirements of construction phase were fulfilled and where operational conditions are established.

The plant possesses Preliminary License nr. 701/2008-DL, issued by the Rio Grande do Sul Environmental Agency (*FEPAM - Fundação Estadual de Proteção Ambiental Henrique Luiz Roessler*) on 10th June, 2008. The preliminary license is valid until 23rd November, 2008. Given this, the project does not imply in any negative transboundary environmental impacts; the license would not have been issued if the project had negative transboundary environmental impacts existed.

A request for Construction License obtaining was made on August 12th, 2008 to FEPAM. Project sponsors are still waiting FEPAM's authorization.

Other guideline was used in order to evaluate the project contribution in achieve the host country's environmental sustainability called *Anexo III*, required by the Brazilian DNA in order to obtain the Letter of Approval. Anexo III includes an analysis of the project contribution related to: local environmental sustainability, quantity and quality development of jobs, fair income distribution, technological development and capacity building, regional integration and relationships among other sectors.

D.2. If environmental impacts are considered significant by the project participants or the host Party, please provide conclusions and all references to support documentation of an environmental impact assessment undertaken in accordance with the procedures as required by the host Party:

The growing global concern on sustainable use of resources is driving the requirement for more sensitive environmental management practices. Increasingly, this is being reflected in countries' policies and legislation. In Brazil the situation is no different; environmental rules and licensing process policy are very demanding in line with the best international practices.

SECTION E. Stakeholders' comments

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

Brazilian Designated National Authority, "*Comissão Interministerial de Mudanças Globais do Clima*", requests comments from local stakeholders, and the validation report issued by an authorized DOE according to the Resolution nr. 7, issued on March 5th, 2008, in order to provide the letter of approval.

The Resolution determines that copies of the invitations for comments sent by the project proponents at least to the following agents involved in and affected by project activities:

- Government and state assembly of the project;
- State and federal governments;
- Brazilian Forum of NGOs and Social Movements for Environment and Development;
- National entities with objectives related to the project activity;
- Community associations;
- Federal and State Attorney for the Public Interest.

Invitation letters were sent to the following agents (copies of the letters and post office confirmation of receipt communication are available upon request):

- City Hall of Bom Jesus, Monte Alegre dos Campos and São Francisco de Paula;
- Municipal Assembly of Bom Jesus, Monte Alegre dos Campos and São Francisco de Paula;

- Environmental Agency of Bom Jesus, Monte Alegre dos Campos e São Francisco de Paula;
- Environmental Agency of Rio Grande do Sul (*Fundação Estadual de Proteção Ambiental Henrique Luiz Roessler – RS – FEPAM/RS*);
- Comunitarian Association of Bom Jesus, Monte Alegre dos Campos and São Francisco de Paula;
- Federal and State Attorney for the Public Interest of Rio Grande do Sul State;
- Brazilian Forum of NGOs and Social Movements for the Development and Environment (*Fórum Brasileiro de ONGs e Movimentos Sociais para o Desenvolvimento e Meio Ambiente*).

E.2. Summary of the comments received:

Attending Brazilian DNA Resolution, four comments were received:

Comment 1: City Hall of Bom Jesus;

The local authorities congratulates the initiative, and stressing the importance of the project for the local development without causing relevant environmental impacts, it also states that the project´s site is not covered by forest neither residents.

Comment 2: Municipal Assembly of São Francisco de Paula;

The representatives states that the Assembly assessed the project, and found it in accordance with all legal and social-environmental requirements. It also notes the importance of the project for the local development without causing relevant environmental impacts.

Comment 3: Municipal Assembly of São Francisco de Paula;

The representative requests a study contemplating the possibility of building infrastructure improvements to project developers. The request was forwarded to Brookfield Energia Renovável.

Comment 4: Rio Grande do Sul Prosecutor

Requesting clarification regarding the differences found on the total installed capacity and location of the project activity at the PDD and the Environmental Licenses issued on 2006 and 2008. PP explained that the SHPP basic design was revised, and that those modifications were properly presented to ANEEL assessment.

All comments were answered and clarified. Copies of the letters received from the local stakeholders mentioned above were supplied to the DOE validating the project and are available upon request.

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

Considering the comments received, Project Participants responded the correspondence letter on April 20th, 2011 explaining the project´s revision and that all related state agencies were properly addressed, also PP forwarded the most recent, and related documents licenses to Rio Grande do Sul Prosecutor that demonstrates the PDD´s full accordance with the environmental licenses.

Annex 1

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Annex 2

INFORMATION REGARDING PUBLIC FUNDING

No public funding is involved in the present project.

This project is not a diverted ODA from an Annex 1 country.

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Annex 3

BASELINE INFORMATION

The Brazilian electricity system, for the purpose of CDM activities, was delineated as a single interconnected system comprehending the five geographical regions of the country (North, Northeast, South, Southeast and Midwest). This was determined by the Brazilian DNA through its Resolution nr. 8 dated 26th May, 2008.

More information on how the Interconnected System is delineated and the emission factor values is available at the Brazilian DNA's website <http://www.mct.gov.br/index.php/content/view/72764.html>.

BUILD MARGIN

	Average Emission Factor (tCO_2/MWh) - **ANNUAL**
2010	0.1404

OPERATING MARGIN

	Average Emission Factor (tCO_2/MWh) - **MONTHLY**											
2010	MONTH											
	January	February	March	April	May	June	July	August	September	October	November	December
	0.2111	0.2798	0.2428	0.2379	0.3405	0.4809	0.4347	0.6848	0.7306	0.732	0.7341	0.6348

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Annex 4

MONITORING INFORMATION

Serra dos Cavalinhos I Small Hydropower Plant Project Activity monitoring plan will proceed according to the “Approved consolidated baseline and monitoring methodology ACM0002” – “*Consolidated baseline methodology for grid-connected electricity generation from renewable sources*”.

Information details are described in Section B.7.2.

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Annex 5

REFERENCES

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