CLEAN DEVELOPMENT MECHANISM
PROJECT DESIGN DOCUMENT FORM (CDM-SSC-PDD)
Version 03 - in effect as of: 22 December 2006

CONTENTS

Annexes

SECTION A. General description of small-scale project activity

A.1 Title of the small-scale project activity:

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Project title: CDM Project SHP Santa Carolina.

PDD Version number: 4.

Date: May 23th, 2011.

A.2. Description of the small-scale project activity:

The CDM Project SHP Santa Carolina (hereafter referred to as “Santa Carolina Project”) consists of the supply of clean hydropower electricity to the Brazilian National Interconnected System (SIN) through the implantation and operation of the Small Hydropower Plant (SHP) Santa Carolina, located in the state of Rio Grande Do Sul, Southern Region of Brazil. The SHP has total installed capacity of 10.50 MW and uses a small reservoir, with low environmental impact.

The Ministry of Mines and Energy[1], through the Decennial Plan for Electric Energy Expansion for the period of 2008-2017, projects for the next 10 years a growth of 427% and 124% in the total installed capacity of oil fuel and coal Thermoelectric Plants, respectively, taken from a 2008 baseline. With that, SHP Santa Carolina has the main objective of helping to fulfill the increasing demand for electricity in Brazil, due to economic and population growth, thus contributing, for the environmental, social and economical sustainability, through the increase of clean and renewable electricity participation in relation to the total country consumption.

The project activity reduces the emissions of greenhouse gases (GHGs) by preventing the electricity generation by fossil fuel sources with consequent CO_2 emissions that would be generated if the project did not exist. The supply of clean and renewable electricity will bring an important contribution to the sustainable development, reducing the emissions of carbon dioxide that would occur in the absence of the project.

SHP Santa Carolina contributes for sustainable development of country and of region once it provides economic development, without compromising the future generations, being aligned with the concept of Sustainable Development, established by the Brundtland Report, created by the World-wide Commission on Environment and Development, that defines the term as: “the development that satisfies the current needs, without compromising the capacity of the future generations of supplying its own necessities”[2]..

Santa Carolina Project contributes for sustainable development by the following actions:

(a) Through the operation of the SHP Carolina, clean and renewable electricity will be dispatched to the Brazilian National Interconnected System, displacing possible enterprises that generate energy through fossil fuel burning, preventing, thus, the emission of pollutant gases to the atmosphere.

(b) The construction of SHPs like SHP Santa Carolina causes positive impacts on the local economy, once it provides a growth of the average consumption in the region, developing social and economic

[1] Available at: http://www.mme.gov.br/mme/menu/todas_publicacoes.html .Acessed in 22th September 2009.

[2] WCED [CMMAD], 1987. Our Commom Future [Nosso Futuro Comum]. The World Commission on Environment and Development [Comissão Mundial sobre Meio Ambiente e Desenvolvimento]. Oxford University Press.

activities of the region where the Project is located. The operation and maintenance of the Project require the consulting of service providers of the region, from the most different areas. The Project fosters, mainly, the third sector economy, contributing once more for job generation, tax revenues increase and local economic development.

(c) The project implementation can attract investment to the region and foster an increase in industrial presence in the cities around the Project. Direct and indirect jobs will be created both in the construction phase and the operation phase of the enterprise. This economical dynamic causes an increase in the available wealth in the region, generating local development and subsistence.

(d) The electricity supply of Santa Carolina Project creates a great incentive to rise new ventures and businesses in the region, that will grant job and wealth generation to the cities involved, also increasing the generation reliability in the electrical system of the Rio Grande do Sul state and, consequently, a minor electricity dependence on other states.

(e) SHP Santa Carolina presents low environmental impact, with a small reservoir formation and high power density; in addition, project participants will realize considerable investments in environmental programs and actions. It will be developed a series of mitigation actions in the physical, biotic, anthropic environment in order to reduce and monitor the possible impacts of the project, according to the current environmental laws of the country. It is important to point that no family will be relocated with the enterprise construction, proving the sustainability of the Santa Carolina Project.

(f) The implementation of SHP Santa Carolina presupposes the acquisition of high-technology equipment, which will be acquired through the manufacturers settled in the national territory. The use of this equipment demands training and capacity for the local workers, coming from the manufacturers themselves. With this, the companies obtain more experience and the technology becomes more widely spread and consolidated in the region and in the country as a whole.

(g) The implementation of the enterprise will provide the increment of tax revenues of the cities, state and country where the project is located. This increase could be invested directly in social benefits to the local community.

A.3. Project participants:

Project Participants of Santa Carolina Project are: Carolina Geração de Energia Ltda; Enerbio Consultoria Ltda-ME and Multilagos Geração de Energia Elétrica Ltda.

The table below presents private and public parties and entities involved in the activity.

Table 1 – Private and public parties and 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 wishes to be considered as project participant (Yes/No)
Brazil (host)	Private Entity: Multilagos Geração de Energia Elétrica Ltda.	No
	Private Entity: Carolina Geração de Energia Ltda	
	Private Entity: Enerbio Consultoria Ltda-ME.	

Detailed information for contact with the party (ies) and with the public/private entities involved in the project activity are related in Annex 1.

A.4. Technical description of the small-scale project activity:

A.4.1. Location of the small-scale project activity:

A.4.1.1. Host Party (ies):

Brazil.

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

Region: South of Brazil.

State: Rio Grande do Sul.

A.4.1.3. City/Town/Community etc:

Cities of André da Rocha and Muitos Capões.

A.4.1.4. Details of physical location, including information allowing the unique identification of this small-scale project activity :

The implantation of SHP Santa Carolina is located in the state of Rio Grande do Sul, southern region of Brazil.

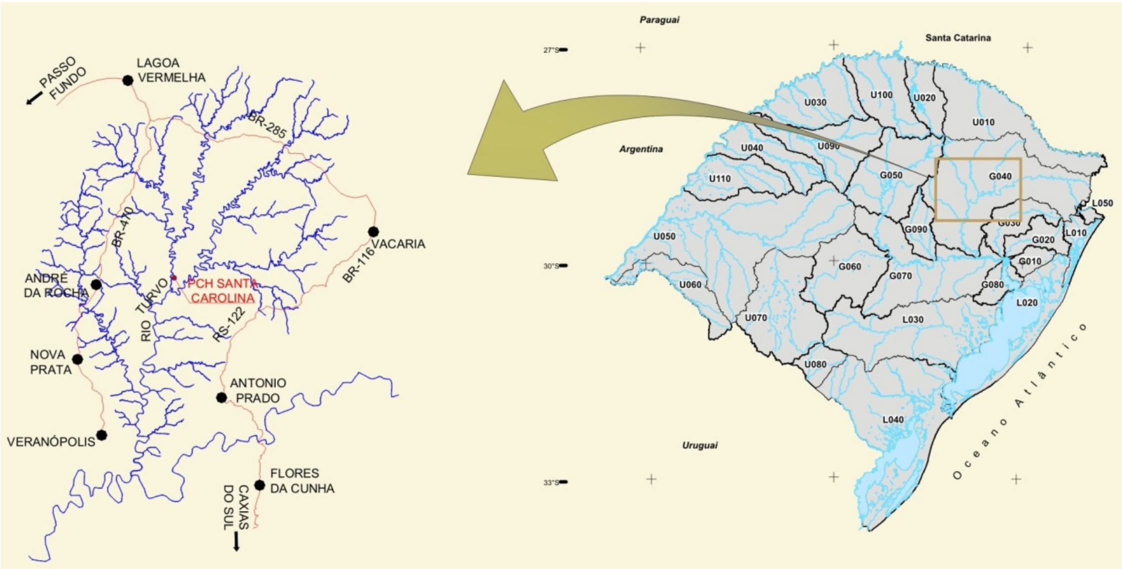
SHP Santa Carolina will be implanted in the city of André da Rocha and Muitos Capões, in Taquari-Antas, basin 8 e sub-basin 86, no Turvo River. The coordinates of the entrepreneurship's housepower are Latitude 28°37'8.11'' South and Longitude 51°24'3.52'' West[3].

The access to the power plants of these SHPs will be done according to the description below:

[3]: Source: Engineering Basic Consolidated Project..

The access to both margins of SHP Santa Carolina will be realized by private property lands. The right margin is accessed by road, distant by 6,5km from the district of Chimarrão, and the left margin is also accessed by road, located 7 km in the south of Ituim district.

Map 1 – Localization of Santa Carolina Project



A.4.2. Type and category(ies) and technology/measure of the small-scale project activity:

The Project SHP Santa Carolina fits the category I.D., used for projects which use renewable energy technologies to supply electricity to a grid.

SHP Santa Carolina will use the hydraulic potential of the river to generate electricity with an installed capacity of 10.50 MW. The SHP of the Santa Carolina Project is a run-of-river hydroelectric power plant with small reservoir formation. The SHP has a medium electricity generation potential of 5.46 MW. The engineering basic project elaborated by MEK Engenharia was approved by ANEEL (National Agency of Electricity in Brazil) in 18th February 2010 through the document "Nota Técnica 080/2010 – SGH/ANEEL". The medium energy and the plant load factor of the project (0.52) were calculated by ANEEL and this number is expressed in this document.

The energetic studies were developed considering the historic flow series in the period between January, 1939 and December, 2003.

The series of monthly average flow for SHP Santa Carolina was generated from two fluvial stations situated in Prata River and one fluvial station situated in Turvo River. The latest was used as the base for the study. Statistic methods were used to study the hydraulic potential of the river.

The motorization simulation was based in the classical methodology of incremental cost/benefit, with the investigation of the installation cost for each installed capacity. Furthermore, the following parameters were adopted by the engineering company that developed the engineering basic project:

- Hydraulic Losses – 3.76%
- Forced Outage – 1.74%
- Planned Outage – 1.75%
- Performance of the Group Turbine-Generator – 88.29%
- Installed Capacity – 10.5 MW.

The table below presents the main technical parameters of SHP Santa Carolina:

Table 2: Technical Characteristics of SHP Santa Carolina.

Technical Characteristics	SHP Santa Carolina
Installed Capacity (MW)	10.50
Reservoir Area (km^2)	0.0926
Power Density (W/m^2)	113.39
Medium Electricity (MW)	5. 46
Plant Load Factor	0.52
Turbines	
Quantity	2
Type	Francis
Number of Generators	2
Dam	
Type	Concrete
Maximum Height (meters)	9
Power House	
Type	Sheltered

The power density of the plant was calculated as follows:

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

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 of the project activity (W). For new hydro power plants, this value is zero;
A_{PJ} = Area of the reservoir measured in the surface of the water, after the implementation of the project activity, when the reservoir is full (m^2);
A_{BL} = Area of the reservoir measured in the surface of the water, before the implementation of the project activity, when the reservoir is full (m^2). For new reservoirs, this value is zero.

In this project, Cap_{PJ} = 10,500,000 W and the reservoir area is 92,600 m^2. Therefore, the power density is 113.39 W/m^2.

It is important to point that the Power Density of the Project (Installed Capacity/ Reservoir Area) is higher than 10 W/m^2, so, it is considered that the reservoir does not have significant emissions of CH_4 and the project does not present relevant emissions.

The equipments and technologies to be employed in the project will be developed in Brazil and have already been successfully applied to similar projects in the country and in the world. The enterprise implantation will also be responsibility of national companies, providing, therefore, development and employment of national workforce.

A.4.3 Estimated amount of emission reductions over the chosen crediting period:

Using the baseline emission factor calculated as presented on the item B.6 and Annex 3 of this PDD, the complete implementation of the Santa Carolina Project connected to the Brazilian Interconnected

System, will generate a total reduction of **53,080 tCO_2e** during the first 7-year-period, described in the table below:

Table 3: Estimation of emissions reduction of the Santa Carolina Project

Year	Estimation of Annual Emission Reduction in tonnes of CO_2e
2013	5,055
2014	7,583
2015	7,583
2016	7,583
2017	7,583
2018	7,583
2019	7,583
2020	2,527
Total estimated reduction (tonnes of CO_2e)	**53,080**
Total number of crediting years	**7**
Annual average of the estimated reductions over the crediting period (tCO2 e)	**7,582**

- Prevision for operation starting date of SHP Santa Carolina – May 01th 2013. The schedule of the company shows that the last turbine will get in operation on April 25th 2013. However, to simplify the projection it was adopted that project will get in operation on May 01th 2013;
- Numbers of Table 03 are rounded off. Spreadsheet with emission reductions calculations is provided to CDM entities with the exact numbers.
- The estimated project emission reduction is based on the Medium Electricity of SHP Santa Carolina, in accordance with table 2 of item A.4.2 minus 3% projected transmission losses and internal consumption, constituting a medium hour generation of 5,2962 MW.

A.4.4. Public funding of the small-scale project activity:

No public funding for the CDM project activity was solicited by parties involved in Annex I.

A.4.5. Confirmation that the small-scale project activity is not a debundled component of a large scale project activity:

According to Appendix C of the simplified modalities and procedures for small-scale CDM project activities, a small scale project is considered part of a large project if there is a registered small-scale CDM project activity or an application to register another small-scale CDM project activity:

- With the same project participants;
- In the same project category and technology/measure; and;
- Registered within the previous 2 years; and
- Whose project boundary is within 1 km of the project boundary of the proposed small-scale activity at the closest point.

In relation to the Santa Carolina Project, there is no other small scale project activity which fits the criteria mentioned above; therefore, the proposed project activity is not a debundled component of a large project activity.

For more information: http://cdm.unfccc.int/EB/036/eb36_repan27.pdf

SECTION B. Application of a baseline and monitoring methodology

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

- Version 16 of AMS I.D – "Grid connected renewable electricity generation".

For more information: http://cdm.unfccc.int/methodologies/SSCmethodologies/approved.html

B.2 Justification of the choice of the project category:

The methodology AMS I.D applies to the project activities of renewable energy generation connected to the grid. Therefore, Santa Carolina Project can be classified in the I.D. category, because it presents the following characteristics:

- The project activity consists on the supply of clean hydroelectric electricity to the Brazilian National Interconnected System through the implantation and operation of the Small Hydroelectric Power Plant (SHP) Santa Carolina, displacing, this way, electricity generated from fossil fuels that would occur in the absence of the project.

- The project activity has a total installed capacity of 10.50MW, not exceeding 15MW of maximum capacity, limit stipulated for the classification of a project as a small scale one

B.3. Description of the project boundary:

According to the methodology I.D, the boundary of a renewable energy generation connected to the grid project encompasses the physical and geographical site of the renewable generation source. Thus, the Santa Carolina Project boundary is restricted to the physical-geographical area of localization of the SHP.

Once the SHP will be connected to the National Interconnected System (SIN), a brief description of the SIN may be carried out for illustrative effects. The National Interconnected System (from the Portuguese: Sistema Interligado Nacional - SIN) is managed by ONS (Operator of the Electric National System), which is responsible for all activities related to the operation's planning. The ONS traditionally subdivides the National Interconnected System into four subsystems interconnected: the South Subsystem, the Southeast/Midwest Subsystem, the North Subsystem and the Northeast Subsystem. These Subsystems are related to the Brazilian geographic regions: South Region, the Southeast/Midwest Regions, the North Region and the Northeast Region.

Due to the offer's real availability and the consumption behavior in each region, ONS establishes inter-regional energy exchange politics, besides exceptional attitudes to thermal generation dispatch, in case the storage levels of water significantly reduce and tend to violate the security curves. These conditions are permanently monitored and available to the electric industry agents.

In May 2008, through the resolution nº 8, Brazilian DNA defined that the National Interconnected System should be considered a unique electricity system and that this configuration is valid for calculating the emission factors of CO_2 used to estimate the emissions reductions of greenhouse gases of energy generation connected to the national interconnected grid CDM projects. In this way, to the Project emission factor calculation procedure, the National Interconnected System was considered as one.

B.4. Description of baseline and its development:

Methodology AMS-I.D defines that if the project activity is the installation of a new grid-connected renewable power plant/unit, the baseline scenario is the electricity delivered to the grid by the project activity that otherwise would have been generated by the operation of grid-connected power plants and by the addition of new generation sources.

Baseline

According to the version 16 of methodology AMS I.D the baseline emissions of the Project are the product of electrical energy baseline $EG_{BL,\ y,}$ expressed in MWh of electricity produced by the renewable generating unit multiplied by the grid emission factor ($EF_{CO2,grid,y}$). This emission factor is calculated in a transparent and conservative way, according to a Combined Margin (CM), resulting from a combination between the operation margin (OM) and the construction margin (BM) emission factors. Those guidelines are described in the “Tool to calculate the emission factor for an electricity system”.

Both CO_2 emission factors – OM and BM - are calculated by the Brazilian DNA using the electricity generation verified in the National Interconnected System, and are published in tCO_2e/MWh. So, the units considered for the Electricity Supplied to the Grid by the Project Activity ($EG_{BL,y}$) and the CO_2 emission factor ($EF_{CO2,grid,y}$) were MWh and tCO_2e/MWh, respectively.

The baseline emission (BEy) resulted from the electricity supplied and/or not consumed by the grid is calculated, as follows:

$$\mathbf{BEy} = EG_{BL,y} * EF_{CO2,grid,y} \qquad \textbf{Equation 1}$$

Where:

BEy = Baseline Emission in year y (t CO_2e/year);
$EG_{BL,y}$ = Quantity of net electricity supplied to the grid as a result of the implementation of the CDM project activity to the grid (MWh)
$EF_{CO2,gri,y}$ = CO_2 emission factor of the grid in year y (tCO_2e/MWh)

The baseline emission factor ($EF_{CO2,grid,y}$) is calculated with a weighted average of operating margin emission factor and build margin emission factor, as described below:

$$EF_{CO2,grid,y} = EF_{grid,CM,y} = EF_{grid,\ OM,y}\ \times\ W_{OM} + EF_{grid,\ BM,y}\ \times\ W_{BM} \qquad \textbf{Equation 2}$$

Where:
$EF_{grid,\ BM,y}$ = Build margin CO_2 emission factor in year *y* (tCO_2e/ MWh);
$EF_{grid,\ OM,y}$ = Operating Margin CO_2 emission in year *y* (tCO_2e/ MWh);
W_{OM} = Weighting of operating margin emissions factor (%);
W_{BM} = Weighting of build margin emissions factor (%).

Calculation of EFgrid, OM,y and EFgrid, BM,y

According to the “Tool to calculate the emission factor for an electricity system”, in case the DNA (Designated National Authority) of the project’ host country has published a delineation about the project’s electricity systems and about the connected electricity system, these delineations must be used.

This way, the Brazilian DNA defined that the National Interconnected System must be considered as a Unique Electricity System and that this configuration will be valid for calculating the emission factors of CO_2 used to estimate the emission reductions of the greenhouse gases from CDM projects of electricity generation energy connected to the national interconnected grid.

The CO_2 emission factors from electricity generation verified in the Brazilian National Interconnected System (SIN) are calculated based on the generation record of plants centrally dispatched by ONS. The procedures for calculation were elaborated in cooperation between ONS, Ministry of Mines and Energy (MME) and the Ministry of Science and Technology (MCT).

As for the calculation of operating margin emission factor through the dispatch data analysis, the Brazilian Designated National Authority uses the generation dispatch data centrally dispatched by ONS, this data must be updated annually during the monitoring.

For the first crediting period, the build margin emission factor shall be updated annually, *ex-post*, including those units built up to the year of registration of the project activity or, if information up to the year of registration 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 emission factor shall be calculated *ex-ante*. For the third crediting period, the build margin emission factor calculated for the second crediting period should be used.

The build margin emission factor for the year 2009 was used for an ex-ante estimation of CERs generation, since they are the latest data available.

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 small-scale CDM project activity:

According to the Annex 46 of the Report of 41st meeting of the CDM Executive Board, Project activities with start date on 2nd August 2008 or after should inform to the Host Party DNA at the beginning of the Project activity about its start date and its intention to become a CDM project activity.

Multilagos Geração de Energia Elétrica Ltda. sent an official communication to the Brazilian DNA in 22nd May 2009, communicating its intention to turn SHP Santa Carolina into a CDM Project activity and informing about the previous consideration and the importance of revenues originated from CERs selling to the Project feasibility and existence. The reception was confirmed by the Brazilian DNA in 27th May 2009, through a letter sent to Enerbio Consultoria. In 1st July 2009, a similar document in English was sent to the CDM EB, which confirmed the reception in 2nd July 2009.

The Annex A of attachment B of Simplified modalities and procedures for small-scale CDM project activities establishes that the project participants shall provide an explanation to show that the Project activity would not have occurred anyway due to at least one of the following barriers:

(a) Investment barrier: a financially more viable alternative to the Project activity would have led to higher emissions;

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

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

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

Before analyzing the barriers faced by Santa Carolina Project, it is necessary to describe the alternative scenarios that would probably take place in the absence of the project activity.

The realistic alternatives to the project activity are:

- The continuity of the current situation, with electricity being generated by the current composition of generation of the National Interconnected System;
- The construction of new thermal power plant;
- The implementation of project without the CDM incentives.

In order to provide an ample view on the alternative scenarios, it is valid to sketch a panorama of the current Brazilian electrical sector and its projection for the future.

Based on the Aneel (National Energy Agency) Electricity Generation Database[4], the Brazilian installed capacity, at the moment of PDD development, was as described on table below:

Table 4: Generation Capacity in Brazil – Enterprises in Operation

Enterprises in Operation		
Type	Power (kW)	%
CGH	169,224	0.16
EOL	550,680	0.52
SHP	**2,923,739**	**2.72**
SOL	20	0
HPP	75,150,827	71.40
UTE	26,846,533	23.29
UTN	2,007,000	1.91
Total	**107,648,023**	**100**

Caption for table 4:
- *CHG: Hydro Power Plant Central Generation (Installed capacity minor than 1 MW)*
- *EOL: Wind Power Plant*
- *SHP: Small Hydro Power Plant (Installed capacity greater than 1 MW and less than 30 MW)*
- *HPP: Hydro Power Plant (Installed capacity greater than 30 MW)*
- *UTE: Thermal Power Plant*
- *UTN: Nuclear Thermal Plant*
- *SOL: Solar Power Plant*

Through the analysis of table 4, it can be noticed that only 2.72% of the country's installed capacity are generated through small hydroelectric power plants and that the main types of entrepreneurships responsible for the greatest parcel of contribution to the country's installed capacity are: large scale hydroelectric power plants (71.4%) and the thermoelectric power plants (23.29%).

Most of hydroelectric power plants (HPPs) were implemented through investments state-owned investments, when the electric sector was still centrally regulated. They present the characteristic of using great reservoir areas[5,] with high socio-environmental impacts, once the Brazilian legislation was still soft in the past concerning the implantation of entrepreneurships for energy generation. Big reservoirs usually provide more emission of greenhouse gases by the decomposition of biomass.

[4] Source: http://www.aneel.gov.br/aplicacoes/capacidadebrasil/capacidadebrasil.asp. Accessed in Septembery 22[h], 2009.

[5] Atlas of Electric Energy in Brazil / National Agency of Electric Energy, pages 45-46. (*Atlas de Energia Elétrica do Brasil / Agência Nacional de Energia Elétrica, Páginas 45-46. – Brasília: ANEEL, 2002.*)

In the case of thermoelectric energy generation, according to table 5[6], it can be noticed that 72.66% of the fuels used in Brazil are from fossil sources, which emit a higher quantity of Greenhouse gases.

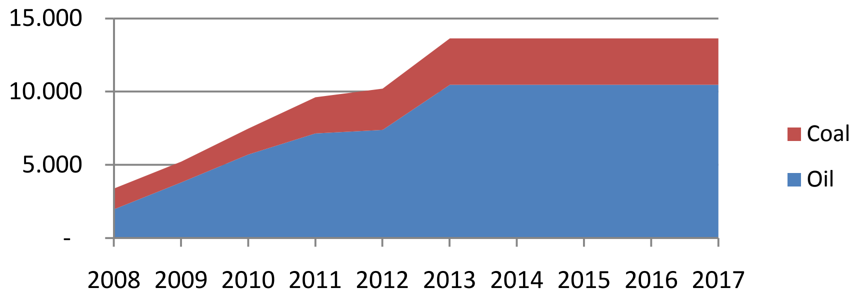
Table 5: Sources of Energy Explored in Brazil

Class of FuelsTypes Used in Brazil – Entrepreneurships in Operation			
Fuel	**Quantity**	**Power (kW)**	**%**
Biomass	334	5,737,443	23.41
Fossil Fuel	907	17,809,558	72.66
Others	23	962,483	3.93
TOTAL	**1,264**	**24,509,484**	**100**

Tables 4 e 5 present current data of national matrix. In 2008, the Ministry of Mines and Energy elaborated the Decennial Plan for Electric Energy Expansion to the period of 2008 a 2017[7], establishing an expansion scenario about energy generation in Brazil.

The MME projection estimates a growth in the electricity supply from fossil fueled plants in the next years. The projection points to a total growth of 8,479 MW in oil-fired Thermoelectric Plants and 1,760 Coal Fired between 2008 and 2017.[8] On the following graph, it is shown the expansion in the installed capacity of fossil fueled enterprises, according to the Decennial Plan for Electric Energy Expansion.

Graph 1: Evolution of Fossil Fueled Installed Capacity (MWh)
Decennial Plan for Electric Energy Expansion 2008-2017



Source: Ministry of Mines and Energy (Decennial Plan for Electric Energy Expansion), chapter 8. page 12

Observing the graph 1 above, it can be concluded that the supply of non-renewable electricity sources tends to a strong growth in the next years. The total oil-fire plants installed capacity should grow 427%, as well as the coal-fired plants should grow 124%, bearing in mind the baseline of 2008.

The projection forecasts also a growth of 39.27% of the installed capacity by Hydro Projects, including big hydropower plants and small hydropower plants. However, it is important to highlight that the hydro share in Brazilian Matrix is going to fall almost 8.70%, while the share of oil fired plants and coal plants will growth 4.77% and 0.63%, respectively. This relative growth of the fossil fuel sources of electricity in the Brazilian Energetic Matrix will contribute for more emission in the whole interconnected system.

[6] Source: http://www.aneel.gov.br/aplicacoes/capacidadebrasil/Combustivel.asp (22/09/2009)

[7] Available at: http://www.mme.gov.br/mme/menu/todas_publicacoes.html .Acessed in 22th September 2009.

[8] Page 45 of Decennial Plan for Electric Energy Expansion, elaborated by Ministry of Mines and Energy.

It is also important to highlight that there are currently 8 thermoelectric plants in Brazil, operating with mineral coal, totalizing an installed capacity of 1,455 MW, according to the table[9] below:

Table 6: Coal Thermoelectric Power Plants in Operation in Brazil

Power Plant	Capacity (MW)	State
Figueira	20	Paraná
Charqueadas	72	Rio Grande do Sul
Pres. Médici A e B	446	Rio Grande do Sul
São Jerônimo	20	Rio Grande do Sul
Jorge Lacerda I e II	232	Santa Catarina
Jorge Lacerda III	262	Santa Catarina
Jorge Lacerda IV	363	Santa Catarina
Alunorte	40	Pará
Total	**1,455**	

In Brazil, 7 of the 8 thermo electric entrepreneurships that generate electricity by coal are located at the south region, where Santa Carolina Project is located.

Traced a panorama of the current energetic matrix in Brazil and its perspective for the future, it can be established with more precision the barriers faced by the project.

Barriers

The first barrier faced by the project is the financial one. The implementation of the project activity without CDM is not financially feasible, since the cost of equity of SHP Santa Carolina is considerably above the Equity Internal Rate of Return (IRR).

The cash flow of the Project is based on the following premises:

- Total Gross Electricity Generated per Year – Result of the multiplication between 8760 annual hours and the Medium Electricity Generated per Hour of 5.46 MW;
- The Medium Electricity Generated of 5.46 MW was defined by ANEEL as described in item A.4.2;
- The Plant Load Factor of the Project was calculated by ANEEL as described in item A.4.2;
- 3% of Commercial Losses – It is considered that will occur 3% of transmission commercial losses and internal consumption. This is an assumption commonly used in the national electrical sector.
- Net Electricity Generated per Year = Total Gross Electricity Generated per Year – Commercial Losses;
- The energy tariff of R$ 140.00 / MWh is based on the results published by CCEE in the 1st Electricity Auction from Renewable Sources, realized in 2007[10];
- Total Investment = **R$ 51,931,989**, distributed as:
    - **R$ 46,861,693** related to the Consolidated Basic Project, developed by MEK Engenharia, a third part engineering company hired by Project Owners to develop the project. This budget is related to the Total Cost excluded the Interest incurred during the construction;
    - **R$ 3,802,685** related to the transmission line budget. This budget is estimated accordingly the budgets elaborated by the company "JAPCON", consulting company

[9] Source: Aneel - http://www.aneel.gov.br/aplicacoes/capacidadebrasil/GeracaoTipoFase.asp?tipo=2&fase=3

[10] The average price negotiated at the auction was R$134.99 /MWh, but Project Participants will conservatively use R$140.00 /MWh for this project.

hired to develop the budget of the transmission line. JAPCON provided to the Project Owners 8(eight) budgets for the transmission line considering different scenarios. It was used the less costly scenario. It is important to say that the real cost of this transmission line is at least R$ 23,286,500 as evidenced to the DOE through a budget supplied by JAPCON of the transmission line. Project Owners plans to share the costs of this transmission line budget with other 5 (five) entrepreneurs of other projects that are located near the place where the project will be constructed. The cost of the transmission line will probably be shared between these five entrepreneurs accordingly the installed capacity of each project. The contract between the Project Owner and JAPCON already considered these assumption and the costs were shared between these five entrepreneurs. SHP Santa Carolina has 17.5% of the installed capacity of these five projects. The process to start the investment in the transmission line is under negotiation. To be conservative, Project Owners considered the minimum budget presented by JAPCON multiplied by its participation of 17.5%.

  - **R$ 1,266,609** related to expenses with the financial arranger, the agent responsible for the funding intermediation. This cost can be evidenced by the Contract established between Project Owners and the company "Z&Zen Assessoria Empresarial Ltda". The second clause establishes the cost of 2.5% of Total Investment.

- **Cost of Debt:** Entrepreneurs of SHP Santa Carolina has not signed loan contract for this project yet. The cost of debt for Santa Carolina Project is based on the costs of funding, related to projects for small hydroelectric plants in Brazil, through funding from National Bank of Economic and Social Development, BNDES. The cost of loan financing from BNDES is usually indexed to the Interest Rate Term (6.00% per year.[11]), plus a basic remuneration of BNDES (0.9% a.a.) plus the Risk of Credit from BNDES (3.0% per year). The risk rate charged by the BNDES maximum credit for renewable energy projects is 3.57% per year as information available at the site of the Bank[12]. Conservatively, an estimated rate of 3.0% per year was considered. The estimated rate for financing is then 9.90% per year with an amortization period of 14 years as indicated by information in the website of the BNDES
- This method of calculating the cost of funding is indicated by the BNDES, as its website: http://www.bndes.gov.br/SiteBNDES/bndes/bndes_pt/Institucional/Apoio_Financeiro/Produtos/FINEM/energias_renovaveis.html. The company estimates that 70% of the amount needed for total investment will be financed by BNDES, the National Bank of Economic and Social Development;
- The taxes (PIS/COFINS/CSLL/IR) follow the Brazilian taxation of Presumed Profit;
- The ANEEL supervision tax was estimated according to Guidelines for SHP Projects, developed by Eletrobrás;
- The CCEE tax was estimated taking into account the ANEEL supervision tax;
- The RGR tax was based on Resolution nº 23 from 5th February 1999;
- The expenditures with insurance were estimated as being 0.5% of the total project investment. The projection was realized taking into account the previous experience of Multilagos' team;
- The cost of administration and O & M (Operation and Maintenance) was estimated as 2% of the Investment Amount as recommended by the Guidelines for Small Hydropower Plants[13], elaborated by Brazilian Ministry of Mines and Energy, ;
- The spending on TUSD (Tariff of Use of Distribution System) were estimated based on Resolution Nº 810 of 14th April 2009;

[11] http://www.bndes.gov.br/SiteBNDES/bndes/bndes_pt/Institucional/Apoio_Financeiro/Custos_Financeiros/Taxa_de_Juros_de_Longo_Prazo_TJLP/index.html. Accessed in 20/07/2010.

[12] The risk rate charged by the BNDES maximum credit for renewable energy projects is 3.57% a.a. as information in the Bank's website: http://www.bndes.gov.br/SiteBNDES/bndes/bndes_pt/Institucional/Apoio_Financeiro/Produtos/FINEM/energias_renovaveis.html

[13] Chapter 9, Page 07.

- The IRR calculation follows the Guidance on the Assessment of Investment Analysis, present in Tool for the demonstration and assessment of Additionality.;
- The period of the expected operation of the underlying project activity is concession period that ANEEL gives to the Project Owner of Small Hydropower Plants Projects in Brazil: 30 years.

The equity cash flow of the SHP Santa Carolina used in the financial projection, based on the assumptions described above, provides equity IRR of 6.39%.

Benchmarking - Cost of Equity

Benchmarking chosen for the project is the cost of equity. The cost of equity was calculated using the following equation.

$K_e = GB+PE_g$ **Equation 3**

Where:

- Ke = Cost of equity.
- GB = Risk Free Rate (Rf) + Country Risk Premium (ERP)
- PE_g = *Global Equity Risk Premium*

Adopted equation corresponds to equation 4B of the option 03 *"Draft tool to determine the weighted average cost of capital (WACC)"*. Although this tool is not approved at the time of PDD elaboration, it corresponds to a calculation method accepted by financial models and as it is suggested by the UNFCCC on a draft methodological, it is understood that it represents an appropriate way to calculate the cost of equity according to the Executive Board.

To calculate the cost of equity using equation 3, the parameters used were as follows:

- GB = 3.36% +7.50% = 10.86%.
  - R*f* = 3.36% => Average Rate of Return on U.S. Treasury bond (T-Bond) of 30 years[14] in the past 03 years (2007, 2008 and 2009) prior to preparation of the PDD;
  - ERP = 7.50% => Risk Premium in Brazil, based on data from Moody's, as calculated by Professor Aswath Damodaran[15].
- PE_g = 4.1% => Global Equity Risk Premium is provided by the article "The worldwide equity premium: A smaller puzzle Elroy Dimson, Paul Marsh and Mike Stautun of London Business School[16].

The nominal cost of equity of SHP Santa Carolina is 14.96%. Discounted rate of inflation of 2.70%[17], the cost of equity is 11.93%.

The following table shows a summary comparison between the project financial indicators and the benchmarking:

[14] Based on data from Standard & Poors. Available at http://pages.stern.nyu.edu/~adamodar/. To access it, you should enter the link Updated Date and thereafter on the link "Updtaed Data and the option "Historical Returns on Stocks, Bonds and Bills – United States" . Accessed in July, 19th 2010.

[15] Available at: http://www.stern.nyu.edu/~adamodar/pc/datasets/ctryprem.xls . Accessed in July, 19th 2010.

[16] This article is indicated in *Draft tool to determine the weighted average cost of capital (WACC).*

[17] Measured by Consumer Price Index (CPI). Available at: ftp://ftp.bls.gov/pub/special.requests/cpi/cpiai.txt . Accessed in July, 19th 2010.

Table 7: Financial Indicator Project x Benchmarking

Equity IRR	Cost of Equity
6.39%	11.93%

Thus, it is perceived that the Equity IRR of SHP Santa Carolina is lower than its cost of equity, indicating that the SHP Santa Carolina is not financially attractive without the incentives of the CDM. So the revenues from the sale of Certified Emission Reductions are essential to the financial attractiveness of the project and its development

Thus, the most financially viable alternative to the project activity would be to not develop the project activity. This decision would provide greater emissions through: (i) continuity of the current situation, with electricity being generated by the current generation composition of the National Interconnected System, or (ii) the construction of new thermoelectric power plants in the Southern Region.

To confirm how solid is the presented investment analysis, the participants of the project present below the sensitivity analysis for each scenario that collaborate to increase the financial and economic attractiveness of the project, varying the most important parameters of SHP Santa Carolina cash flow: (i) electricity price, (ii) the total amount of investment, (iii) the O&M and Administration cost of the plant , the (iv) Plant Load Factor and the (v) Loan Cost.
.
These parameters were used because:

- The electricity price and the assured energy (or the load factor) are the unique parameters that can influence the revenues of the project.;
- The total amount of investment represents the most important cash outflow of the project;
- It is projected that 70% of the investment is financed by BNDES. With that financial expenses are one of the most relevant expense during 14 years of the cash flow.
- The operational expenses of the project are, in general, taxes and spending defined by regulators. Regarding the O&M Cost, it is important to say that this item does not significantly affect the cash flow of the project, but as the variation of this item was required by CDM EB in other processes conducted by the Project Developer, therefore, its variation was also included in the sensitivity analysis. The O&M Cost (Operation and Maintenance Cost) can suffer changes, but its variance does not affect significantly the IRR;

The electricity price was based in the first auction of renewable energy where the highest price was R$ 135.00. Project Owners used an estimated price of R$ 140.00 per MW. The scenario where Project Owners sell this energy 10% above the price of R$ 140.00 is very unlikely to happen. The total amount of investment is estimated in the budgets that the company received. Regarding the O&M Cost, it can be seen that its variation does not affect significantly the project cash flow. This item can be very controlled and it does not suffer high changes during the project. The medium electricity (PLF Factor) variation was approved by ANEEL. Hardly, it will be changed. Loan Cost is based on BNDES indication. As it is going to be a long-term loan based on TJLP, the cost of debt will hardly fall 10%.

Therefore, it is unlikely that these items can suffer alteration that will contribute to a different increase in the project's financial and economic attractiveness that will not be covered in the range of variation between 0% and 10%. Therefore the range of variation between 0% and 10% covers more than the probable scenarios.

Table 8: Sensitivity Analysis of Santa Carolina Project

ELECTRICITY PRICE VARIATION		
Projected Situation	**MWh Price**	**Equity IRR**
0%	**R$ 140.00**	**6.39%**
5%	R$ 147.00	**7.42%**
10%	R$ 154.00	**8.47%**

TOTAL INVESTMENT AMOUNT VARIATION		
Projected Situation	**Investment (R$ thousand)**	**Equity IRR**
0%	**R$ 51,931**	**6.39%**
-5%	R$ 49,334	**7.47%**
-10%	R$ 46,738	**8.69%**

O&M AND ADMINISTRATIVE COST VARIATION		
Projected Situation	**Percentage of the Investment Amount**	**Equity IRR**
0%	**5%**	**6.39%**
-5%	4,75%	**6.57%**
-10%	4,50%	**6.75%**

PLANT LOAD FACTOR VARIATION (PLF)		
Projected Situation	**Medium Electricity (PLF)**	**Equity IRR**
0%	**5.46**	**6.39%**
+5%	5.73	**7.42%**
+10%	6.01	**8.47%**

LOAN COST VARIATION		
Projected Situation	**Loan Cost**	**Equity IRR**
0%	**9.90%**	**6.39%**
+5%	9.41%	**6.69%**
+10%	8.91%	**7.01%**

The sensitivity analysis confirms that the SHP Santa Carolina is not financially attractive, once its Internal Rate of Return is lower than its cost of equity, for all analyzed scenarios.

(C) Barriers due to prevailing practice

As seen in the description of the current Brazilian energy matrix projection of and the future scenario, established by the Brazilian Ministry of Mines and Energy, there is a clear predominance of large hydroelectric and thermoelectric power plants to fossil fuels in national energy matrix.

According to the Aneel[18] Electricity Generation Database, the generation of hydroelectric power in Brazil is composed mainly by large enterprises. According to this database, the country's 24 hydroelectric plants with capacity of 1000 MW or higher correspond to 65.18% of its installed capacity.

[18] Available at: http://www.aneel.gov.br/aplicacoes/capacidadebrasil/GeracaoTipoFase.asp?tipo=1&fase=3 Accessed in 26th May 2009

Enterprises of this size have, by their electricity generation capacity and consequent revenue generation, higher economic viability. Historically, this kind on enterprise was motivated by the government.

Also according to Aneel[19], historically the use of hydraulic potential in Brazil for electricity generation required the formation of large reservoirs and the flooding of large areas. These constructions had used, in most cases, the accumulation of water reservoirs and regularization of flows that cause changes in water regimes and the formation of microclimates, facilitating, impairing or even extinguishing species. These large reservoirs, in general, also provide more emission of CH_4 from the decomposition of the vegetation submerse.

It is also known that only one (1) of the total coal-fired plants it is located outside the southern region of the country. Furthermore, according to Brazilian Electric Energy Atlas[20], 89.25% of coal national of in the country are concentrated in Rio Grande do Sul state, where the state SHP Santa Carolina is located, providing, therefore, better conditions for the development of new UTEs by coal.

The projection for the period 2008-2017, elaborated by MME, described previously points to a growth of the thermal capacity and a fall in the hydro share in the energetic matrix of Brazil. This relative increase is already happening and it can be seen in the last results of the auctions organized by ANEEL ANEEL organizes auctions where the electricity distributing companies can buy the necessary electricity for its demand. The auction is driven by the minimum price. Prices of thermal electricity are, in general, less than prices of hydro electricity. Table below provides the results of the last 5 auctions of new electricity that happened in Brazil between 2007 and 2009 (Source: CCEE).

Table 09: Results of the Last Auctions of New Electricity in Brazil

%	4º Auction - 2007	5º Auction - 2008	6º Auction - 2008	7º Auction - 2008	8º Auction - 2009
Hydro	0%	30.93%	0%	3.87%	9.09%
Thermal	100%	69.07%	100%	96.13%	90.91%

The policy established for these auctions brings advantage for thermal plants that require less investment and therefore, can sell electricity with fewer prices. This kind of policy leads to the implementation of a technology with higher emissions.

SHP Santa Carolina is a small enterprise with small installed capacity and power generation, not similar, therefore, to the major national hydroelectric power and not having, therefore, the enormous revenue potential for this type of enterprise. Moreover, the SHP Santa Carolina is a run-of-river plant with low environmental impacts and considers in its planning a series of investments in environmental programs and actions that did not exist when the occurred the deployment of most of the hydroelectric plants of the South the country.

Thus, the implementation of this project does not have substantial income like the large Brazilian hydroelectric enterprises and has minimal environmental impacts that require investment, and having these characteristics, its cash flow presents rates of return below the market reference rates and the revenues from the sale of certified emission reductions (CERs) becomes important to make the project feasible. The configuration of enterprises like SHP Santa Carolina, with small reservoir, can avoid higher emission provided by the huge reservoirs of big hydropower plants.

[19] Atlas of Electric Energy in Brazil / National Agency of Electric Energy, page 32. (*Atlas de Energia Elétrica do Brasil / Agência Nacional de Energia Elétrica, Página 32. – Brasília: ANEEL, 2002.*)

[20] Atlas of Electric Energy in Brazil / National Agency of Electric Energy, pages 45-46. (*Atlas de Energia Elétrica do Brasil / Agência Nacional de Energia Elétrica, Páginas 45-46. – Brasília: ANEEL, 2002.*)

Besides that, the fact that projects in this configuration, without the additional revenue from selling the CERs are not attractive from a financial point of view and are not common in the country can be proved through the creation, by the Federal Government by Law No. 10.438, 26 April 2002, of the PROINFA Program.

PROINFA is a government program that seeks to motivate, in the financial point of view, the development of enterprises that use renewable technologies, due to difficulties in financing, the offer of guarantees to lenders and the need for high investments, considering small organizations.

Thus, the Federal Government tries to encourage project financing through different lines, and minimum revenue guarantees through the commitment of the from long-term contracts for the purchase of energy (PPAs) to be signed with a company of mixed economy, Eletrobras, which ensures a minimum return to the enterprise of 70% of the energy contracted during the period of the funding and full protection to the exposure risks of the market in the short term. The contracts have duration of 20 years and involve selected projects that should come into operation until December 2006. Projects from small hydroelectric plants are one of the types of projects eligible to participate in PROINFA.

SHP Santa Carolina does not participate in PROINFA and, this way, considers the revenue from the sale of CERs as an important factor to realize the investment. The existence of this kind of program proves that an economic incentive is important to motivate small hydro plants. Without this kind of program, thermal plants and big hydro plants tends to maintain its predominance, providing more emission of greenhouse gases. .

As a consequence of this fact, the organization has to deal with the difficulties inherent to the small agents of the Brazilian electrical sector as: (i) small power of attraction for potential buyers, before the small amount of electricity being produced and marketed, (ii) excess of collateral requirements by banks for financing to undertake the long-term financial liquidity of the company, (iii) the bureaucracy inherent in the process of building a small hydroelectric central, since its beginning until its effective entry into operation.

Moreover, the percentage related to the installed capacity of enterprises similar to Santa Carolina Project in the Rio Grande do Sul state’s energy matrix is very small, as table below:

Table 10: Generation Capacity of the Rio Grande do Sul state[21]

Enterprises into Operation		
Type	**Power (kW)**	**%**
CGH	20,317	0.29
EOL	150,000	2.11
SHP	287,551	4.04
HPP	4,977,270	69.88
UTE	1,687,839	23.70
TOTAL	**7,122,977**	**100**

In this way, through the data and information presented, it is perceived that the establishment of small hydroelectric plants is not a prevailing practice in the country and that this kind of enterprise faces barriers (as small power of attraction for potential buyers, thus to the small amount of electricity being produced and marketed, (ii) excess of collateral requirements by banks for financing, etc) commonly surpassed by Governmental Program and Projects.

The continuity of the current situation, with electricity being generated by the current composition of generation of the National Interconnected System is not affected by the prevailing practice due to fact that the thermal and hydro plants in operation counted on with the conditions described that does not exist anymore (PROINFA, Less Environmental demands, etc). It is important to highlight that the dispatch order for Brazilian Interconnected System is: hydroelectric power plants, wind, nuclear, imports from other systems in ascending order of cost, thermoelectric power plants in ascending order of generation cost. With the economic growth that requires more electricity, if new renewable plants are not constructed, generation will be supplied by thermal plants that are in operation or that will be constructed as described in the MME Projection presented before.

Furthermore, the fact that PROINFA does not exist anymore does not have any influence in the scenario of new thermal power plant once the Program was focused on renewable energy.

The non-implementation of SHP Santa Carolina would promote (i) the continuity of the current situation, with electricity being generated by the current generation of composition of National Interconnected System, specifically the South Subsystem (with great presence of coal-fired and oil-fired plants) or (ii) the construction of new thermoelectric power plants.

Thus, the implementation of the Santa Carolina Project provides emission reductions, which would not occur in the absence of the Project.

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

According to the methodology AMS I.D, version 16, if the energy generation equipment is transferred from another activity or if the equipment is transferred to another activity, leakage must be considered. In case of Santa Carolina Project, new equipments will be used, manufactured for the activity, so, there will be no leakage. The project does not provide emission because the power density is higher than 10 W/m^2.

Therefore, the emission reductions are calculated through the baseline emissions.

[21] Electricity Generation Database. Available at: http://www.aneel.gov.br/aplicacoes/ResumoEstadual/CapacidadeEstado.asp?cmbEstados=RS:RIO%20GRANDE%20DO%20SUL.. Accessed in 22th September 2009.

Baseline emissions

BEy = $EG_{BL,y}$ * $EF_{CO2,grid,y}$ **Equation 1**
Where:

BEy = Baseline Emission in year y (t CO_2e);
$EG_{BL,y}$ = Quantity of Net Electricity supplied by the project activity to the grid as a result of the implementation of the CDM Project Activity (MWh)
$EF_{CO2,grid,y}$ = CO_2 emission factor of the grid (tCO_2/MWh) .

As mentioned previously, SHP Santa Carolina is a new energy plant to be connected to the grid, therefore no modification or retrofit of generators through the project activity will happen.

The $EG_{BL,y}$ variable will be continuously monitored by the project participants and corresponds to its main product: the electricity generation. The medium energy of SHP Santa Carolina minimum 3% projected for transmission losses and internal consumption was considered for the *ex-ante* estimation of the project baseline emissions.

To calculate $EF_{CO2,grid,y}$, it will be used data supplied by the Brazilian DNA which makes available the data of Dispatch data analysis operating margin emission factor and the build margin emission factor through using the tool to calculate the emission factor for an electricity system (version 02.1.0) which suggests the following steps:

Step 1*. Identify the relevant electric power system*

According to the "Tool to calculate the emission factor for an electricity system", if the DNA of the Host Country has published a delineation of the project electricity system and connected electricity system, these delineations should be used.

This way, the Brazilian DNA defined through the Resolution 8 of 26^{th} May 2008 that the National Interconnected System must be considered as a unique System and that this configuration will be valid for calculating the emission factor of CO_2 used to calculate the emission reduction of greenhouse gases in CDM Projects of electricity generation connected to the grid. This definition will be applied to the Santa Carolina Project.

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

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

Option 1: Only grid power plants are included in the calculation.
Option 2: Both grid power plants and off-grid power plants are included in the calculation.

The option that was chosen by project participants was Option 1

Step 3*. Select an operating margin (OM) method*

The operating margin aims to assess the contribution of the power plants that would be dispatched in the absence of the project activity's generation. 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 method chosen to calculate the emission factor of Santa Carolina Project was the operation margin by dispatch data analysis. This method was chosen following the recommendation of the resolution number 8[22] of the Brazilian DNA (Designated National Authority).Thus, the data vintage that was chosen to calculate operating margin (OM) to Santa Carolina Project is ex-post (mandatory for Dispatch data Analysis).

***Step 4**. Calculate the operating margin emission factor according to the selected method*

The calculation of the operation margin emission factor follows the dispatch data analysis OM emission factor ($EF_{grid,OM\text{-}DD,y}$) and it is calculated and defined by the Brazilian Designated National Authority in accordance with the dispatch data of the ONS - National System Operator.

The CO_2 emission factors resulting from the power generation in the Brazilian National Interconnected System (SIN) are calculated based on the generation record of plants centrally dispatched by ONS. The procedures for calculation were elaborated in cooperation between ONS, Ministry of Mines and Energy (MME) and the Ministry of Science and Technology (MCT).

Following that procedures, from July of 2008, the operating margin emission factor started to be calculated for the National Interconnected System, considering the System as unique, and it became available to be consulted by the interested public and investors.

The dispatch data OM emission factor is defined as the weighted average of the emission factors of the set of power plants in the top 10% of the priority curve of the grid system dispatch order and is calculated for each hour.

The emission factor for each plant in the system is calculated annually based on values for generation and fuel consumption of the plant in the previous year. For the new thermal plants that come into operation each year, the value for a similar plant in the previous year must be adopted.

At the moment of the PDD development, the most recent data published by the Designated National Authority was the operating margin emission factor for the year 2009 dispatch and it will be used to the *ex-ante* estimation of CER generation. All data used to calculate the *ex-ante* operating margin emission factor are available in the Annex 3 of this PDD.

***Step 5**. Identify the cohort of power units to be included in the building margin*

The sample group of power units *m* used to calculate the build margin consists of either:

(a) The set of five power units that have been built most recently, or
(b) The set of power capacity additions in the electricity system that comprise 20% of the system generation (in MWh) and that have been built most recently.

As a general guidance, a power unit is considered to have been built at the date when it started to supply electricity to the grid.

[22] Source: Designated National Authority. http://www.mct.gov.br/upd_blob/0024/24719.pdf. Accessed on January 2011

Power plants registered as CDM project activities should be excluded from the sample group *m*. However, if group of power units, not registered as CDM project activities, identified for estimating the build margin emission factor includes power unit(s) that is(are) built more than 10 years ago then:

(i) Exclude power unit(s) that is(are) built more than 10 years ago from the group;
(ii) To include grid connected power projects registered as CDM project activities, which are dispatched by dispatching authority to the electricity system.

Capacity additions from retrofits of power plants should not be included on the calculation of the build margin emission factor.

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, if information up to the 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 emission factor shall be calculated *ex-ante*, as described in option 1 above. For the third crediting period, the built margin emission factor calculated for the second crediting period should be used.

The option that was chosen by project participants was Option 2.

Step 6. *Calculate the build margin emission factor*

The build margin emission 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.

The CO_2 emission factors resulted from the electricity generation in the National Interconnected System (SIN) are calculated based on the generation record of plants centrally dispatched by ONS. The procedure for calculation was elaborated in cooperation between ONS, MME and MCT and follows "Tool to calculate the emission factor for an electricity system"

Following that procedures, from July of 2008, the build margin emission factor started to be calculated for the National Interconnected System, considering the System as unique, and it became available to be consulted by the interested public and investors.

At the moment of PDD development, the most recent data published by the DNA the build margin emission factors for 2009 dispatch and will be used to the *ex-ante* estimation of CER generation. All data used to calculate the *ex-ante* build margin emission factor are available in the Annex 3 of this PDD.

Step 7. *Calculate the combined margin emission factor*

The combined margin emission factor is calculated as the equation 2 presented in item B.4:

$$EF_{CO2,grid,y} = EF_{grid,OM,y} \times W_{OM} + EF_{grid,BM,y} \times W_{BM} \quad \textbf{Equation 2}$$

Where:
$EF_{grid, BM,y}$ = Build margin CO_2 emission factor in year *y* (tCO_2e/ MWh);
$EF_{grid, OM,y}$ = Operating Margin CO_2 emission in year *y* (tCO_2e/ MWh);
W_{OM} = Weighting of operating margin emissions factor (%);
W_{BM} = Weighting of build margin emissions factor (%).

As previously mentioned, the following weighting were adopted to the Santa Carolina Project: W_{OM} = 0.50 and W_{BM} = 0.50.

Project Emissions Reductions

Accordingly AMS I.D, project emissions reduction are calculated in accordance with the following equation:

$ER_y = BEy\text{-}PEy\text{-}LEy$ **Equation 4**

Where,

ER_y = Emission reductions in year y (t CO_2/y)
BE_y = Baseline Emissions in year y (t CO_2/y)
PE_y = Project emissions in year y (t CO_2/y)
LE_y = Leakage emissions in year y (t CO_2/y)

Accordingly the methodology, this project will not provide any emissions neither leakage, therefore PE_y and LE_y are zero. With that, ER_y=$BE_{y.,}$ In summary, the emission reduction of the project will be calculated based on the equation 1 of this PDD, where the quantity of electricity supplied to the grid by the project will be multiplied by the combined margin emission factor, being the operating margin emission factor being calculated according to dispatch data analysis OM and the build margin emission factor will be calculated through the option 2 which considers that this emission factor must be updated *ex-post*. Besides it will be considered 50% for the weights that forms the Combined Margin Emission Factor.

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

Data / Parameter:	**Installed Capacity before the implementation** (Cap_{BL})
Data Unit:	MW
Description:	Installed Capacity of the hydro power plant before the implementation of the project activity. For new hydro power plants, this value is zero.
Source of data used:	The Previous License of the enterprise shows that SHP Santa Carolina is a new plant, which means that it has no capacity installed before implementation.
Value applied:	As SHP Santa Carolina is a new plant, the value is zero.
Justification of the choice of data or description of measurement methods and procedures actually applied :	For new reservoirs, this value is zero.
Any comment:	

Data / Parameter:	**Reservoir area before the implementation (A_{BL})**
Data Unit:	m²
Description:	Area of the reservoir measured in the surface of the water, before the implementation of the project activity, when the reservoir is full (m²). For new

	reservoirs, this value is zero.
Source of data used:	The previous license, because the SHP Santa Carolina is a new plant and it does not have a reservoir before implementation.
Value Applied	As SHP Santa Carolina will create a new reservoir, the value is zero.
Justification of the choice of data or description of measurement methods and procedures actually applied :	For new reservoirs, this value is zero.
Any comment:	

B.6.3 *Ex-ante* calculation of emission reductions:

It follows below the description about emissions reduction provided by Santa Carolina Project.

Accordingly AMS I.D, project emissions reduction are calculated in accordance with the following equation:

$ER_y = BE_y - PE_y - LE_y$ **Equation 4**

Where,

ER_y = Emission reductions in year y (t CO_2/y)
BE_y = Baseline Emissions in year y (t CO_2/y)
PE_y = Project emissions in year y (t CO_2/y)
LE_y = Leakage emissions in year y (t CO_2/y)

As this project does not provide emissions neither leakage, PE_y and LE_y are zero. Therefore, ER_y=$BE_{y.,}$

BEy Calculation

For BEy Calculation it was applied the equation as follows:

BEy = $EG_{BL,y} * EF_{CO2,grid,y}$ **Equation 1**

Tables below shows step by step the components of equation applied for BEy Calculation.

$EG_{BL,y}$ Calculation

Table 11: $EG_{BL,y}$ Calculation

Period	SHP Santa Carolina
	$EG_{BL,y}$
2013	30,929
2014	46,394
2015	46,394
2016	46,394
2017	46,394
2018	46,394
2019	46,394
2020	15,464

Total	324,757

Assumptions:

- $EG_{BL,y}$ projection was assuming power plant operation during 8,760 hours per year;
- Prevision of SHP Santa Carolina Operation Beginning –May 01th 2013.
- The electricity generation of Santa Carolina Project is projected according to its medium electricity , as described in table 2 of this PDD minus the estimated percentage with transmission losses and internal consumption (3%), resulting 5.2962 MW.

As presented in the item B.6.1, the $EF_{CO2,grid,y}$ is calculated as equation 02 below.

$$EF_{CO2,grid,y} = EF_{grid,CM,y} = EF_{grid,OM,y} \times W_{OM} + EF_{grid,BM,y} \times W_{BM}$$ **Equation 2**

The values used for ex-ante estimation are presented in the following table:

Table 12: $EF_{CO2,\ 2009}$ Calculation

Emission Factors	jan-2009	feb-2009	mar-2009	april-2009	may-2009	jun-2009	jul-2009	aug-2009	sep-2009	oct-2009	nov-2009	dec-2009
$EF_{grid,OM}$*	0.2813	0.2531	0.2639	0.2451	0.4051	0.3664	0.2407	0.1988	0.1622	0.1792	0.1810	0.1940
$EF_{grid,BM}$*	0.0794											
W_{OM}	0.50											
W_{BM}	0.50											
$EF_{CO2,2009}$	**0.1635**											

The emission factor which will be used for *ex-ante* estimation of emission reduction of Santa Carolina Project is 0.1635, which was obtained from data of the National Interconnected System with data supplied by Brazilian DNA.

Observations:

- The most recent information available by Brazilian Designated National Authority for complete years refers to the year 2009;
- The daily data for Operating Margin Emission Factor is available on Annex 3;

As described on item B.6.1, there is no leakage for Santa Carolina Project and, therefore, LEy is 0 (zero).

The *ex-ante* estimation of certified emission reduction can be view through the table below:

Table 13: E*x-ante* estimation of Santa Carolina Project Emission Reductions (tCO_2 e)

Year	SHP Santa Carolina (t CO2 e)
2013	5,055
2014	7,583
2015	7,583
2016	7,583
2017	7,583
2018	7,583
2019	7,583
2020	2,527
Total	**53,080**

- Numbers of Table 13 are rounded off.

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

Table 14: Summary of the *ex-ante* estimation of emission reductions

Year	Estimation of project activity emissions (tCO_2 e)	Estimate of baseline emissions (tCO_2 e)	Estimation of leakage (tCO_2 e)	Estimate of overall emission reductions (tCO_2e)
2013	-	5,055	0	5,055
2014	-	7,583	0	7,583
2015	-	7,583	0	7,583
2016	-	7,583	0	7,583
2017	-	7,583	0	7,583
2018	-	7,583	0	7,583
2019	-	7,583	0	7,583
2020	-	2,527	0	2,527
Total (tonnes of CO2 e)	**-**	**53,080**	**0**	**53,080**

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

B.7.1 Data and parameters monitored:

Based on the methodology AMS - ID, this section presents parameters to be monitored by project participants.

Electricity measurement is essential to monitor and verify the GHGs emission reduction. It is necessary, then, the use of measurement equipment to record and verify the energy generated by the unit.

All data collected as part of the monitoring will be archived electronically and kept for at least two (2) years after the last crediting period. All measurements are conducted with calibrated measurement equipment according to Brazilian industry standards.

The following data and parameters will be monitored:

Parameter:	**$EG_{facility, y}$**
Unit:	MWh/y
Description:	Quantity of net electricity supplied to the grid in year y
Source of Data:	Location of the project activity (internal spreadsheets).
Value of data:	The value of data will be monitored monthly. For *ex-ante* estimation of emission reductions the **medium electricity** of SHP Santa Carolina was used, which is equal to **5.46 MW** less than 3% of losses (with transmission and consumption) with a value of **5.2962 MW**.
Brief description of measurement methods and procedures to be	It will be used spreadsheets obtained monthly directly from the meter with hourly information. If necessary, the information can be confronted with reports provided by CCEE.

applied:	
QA / QC procedures to be applied (if any):	The level of uncertainty of these data is low. They will be used to calculate emission reductions. The generated electricity will be monitored continuously by the project participants.
Any comment:	

Parameter:	$\mathbf{A_{PJ}}$
Unit:	m²
Description:	Area of the reservoir measured in the surface of the water, after the implementation of the project activity, when the reservoir is full.
Source of Data:	Enterprise Previous License. The following licenses could be used to prove the value adopted by the Project.
Value of data:	92.600
Brief description of measurement methods and procedures to be applied:	The flooded area of the reservoir is monitored by the local environmental agency in the licensing process. Monitoring frequency is yearly accordingly the methodology. The area of the reservoir is monitored during the licensing process by regulators and it can be prove by licenses of the project.
QA / QC procedures to be applied (if any):	The level of uncertainty of these data is low. The reservoir area is monitored by environmental regulator entity.
Any comment:	

Parameter:	$EF_{CO2,y}$
Unit:	tCO_2e/kWh
Description:	CO_2 emission factor of the grid electricity in year y
Source of Data:	*Ex-post* emission factor will be calculated by Enerbio Consultoria through ONS data supplied by Brazilian DNA. The variables $EF_{grid,OM,y}$ and $EF_{grid,BM,y}$, necessary for EF_{CO2} calculation, will also be monitored and calculated through the Dispatch Data of the National Interconnected System.
Value of data:	The values of ($EF_{grid,CM,y}$) Combined Margin CO_2 Emission Factor which were used for *ex-ante* estimation of emission reduction of Santa Carolina Project is 0.1635 which was obtained from data of the National Interconnected System supplied by Brazilian DNA as described on table 14 on the item B.6.3 and as described on the Annex 3.
Brief description of measurement methods and procedures to be applied:	As described in the most recent version of the “Tool to calculate the emission factor for an electricity system”.
QA / QC procedures to be applied (if any):	As described in the most recent version of the “Tool to calculate the emission factor for an electricity system”. The uncertainty level for these data is low.
Any comment:	

B.7.2 Description of the monitoring plan:

Carolina Geração de Energia Ltda team will be responsible for the operation and maintenance of SHP Santa Carolina, also taking care of the consolidation and analysis of electricity generation data. The generation units will be measured by two meters, one principal and one rear, located in the plant substation as described in the basic diagram of the project.

The activities are carried out to remotely measure, via meters’ reading software. The procedures of the grid will be established in accordance with the rules of the National System Operator (ONS) and the company Rio Grande Energia (RGE), the distributor company in which plant will be connected.

The calibration of the energy meters also follow the rules established by the National System Operator (ONS) and Rio Grande Energia (RGE).

Below, follows the description of how it the Measurement System is structured and the responsibilities of those agents involved in the process.

- **Measurement System**

As the Commercialization Convention approved by ANEEL Resolution No 109 of 26 October 2004 determines CCEE is responsible for the specification, guidance and determination of the issues concerning the adequacy of measurement systems billing (SMF), and the deployment, operation and maintenance of SCDE - Data Collection System for Energy, in order to facilitate electricity data collection for use in the Accounting and Settlement System - SCL, to ensure the accuracy of the quantities found, and meet the required deadlines. (Source: www.ccee.org.br).

- **System of Measurement Billing - SMF**

As Module 12 of the Grid procedure of the ONS, the Billing System of Measurement (SMF) is a system composed of the principal meter and rear, the instruments power transformers (TI) - a potency transformer and current transformer, the channels of communication between CCEE and agents, and the systems of data collection for measuring billing.

The Measurement System Billing - SMF provides:

a) data about demand for verification of Charges for Use of Transmission System – EUST, within the ONS, and Charges for Use of other Transmission Facilities - DIT, where the case apply;

b) data about the accounting and settlement of electricity within the CCEE;

c) data generation for the determination of charges for ancillary services under the CCEE;

d) data about the installed measurements in the generating units, used for verification of compliance with the instructions of an order, the determination of ancillary services and declared capacity of these units;

e) data for power factor calculation, in the point of connection to the basic grid;

f) data for calculation of losses factors on transformation and processing and;

g) data about electricity (QEE) quality at the connection points to the core network. (Source: www.ons.org.br)

- **Data Collection System for Energy - SCDE**

The SCDE is the system responsible for daily collection and processing of measurement data, bering in mind that the acquisition of these data is carried out automatically directly to the meter or through the database of the agent (UCM). This system allows the execution of logical checks with direct access to the meters and providing greater reliability and accuracy of data obtained.

With SCDE the agent has more practicality of sending the measurement data to CCEE and allows the daily monitoring of the information sent. The meters readings are directed to the Data Collection System for Energy - SCDE the CCEE and are conducted through direct access to the meters of the agent, either by normal collection, either by logical inspection of the Collection Service Unit - UCM.

The collected data are processed in SCDE for electricity accounting by CCEE, sent to the ONS for the calculation of EUST and also turned available for all players participating in the market for control of their own billings.

- **Responsibility of the SHP Santa Carolina Team**

Maintaining the Billing System of Measurement in operation and available for daily collection and logic inspection collection of CCEE.

- **Data Consolidation in the CCEE:**

In the first week of each month, the CCEE consolidates data from previous generation of the month, and if there is any inconsistency or error in the collected data, it generates an e-mail, informing the agent about the missing or inconsistent data and asks the team adjustment of these data in SCL - Accounting and Settlement System and the justifying the need for this adjustment.

In case of unavailability of reading from any point of measurement, due to maintenance, commissioning or any other reason, the methodology will be used for data estimation according to item 14.3 as the Commercialization Procedure PDC ME.01. (Source: www.ccee.org.br).

- **Data Consolidation of SHP Santa Carolina:**

In the first week of each month, the operators of SHP Santa Carolina collect, in the mass memory of the energy meters, the data of hourly gross and net generation of each generating unit for the previous month.. These data are combined into a single spreadsheet that is the internal spreadsheet for control of electricity generation of the SHP for the month under review.

- **Comparison of information from internal generation reports with a third party:**

The information contained in the internal spreadsheet for control of electricity generation will be confronted with a spreadsheet of SCDE. The SCDE spreadsheets provide values of power generation similar to the values of the internal spreadsheet for control of electricity generation of the SHP. For calculation purposes of emission reductions, the electricity generation data used will be those of the General Service Report of CCEE, present in the CCEE website for agents accredited by CCEE.

- **Information Storage:**

The generation of information, both internal and the CCEE's are stored by Multilagos. Periodically, backup will be made to ensure the security of all data from the generation plant. All data collected as part of the monitoring will be archived and maintained for at least two years after the last period of accreditation.

- **Training of the Operation and Maintenance Team:**

All operators of the SHP will be trained to ensure the quality, safety and reliability in the operation of the plant.

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

The baseline study and monitoring methodology for the project activity were elaborated by Enerbio Consultoria and they were completed on 10/06/2009. Enerbio Consultoria is also a project participant.

Responsible for the project and participant listed on Annex I with the contact information

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SECTION C. Duration of the project activity / crediting period

C.1 Duration of the project activity:

C.1.1. Starting date of the project activity:

01/02/2012

The starting date has not happened yet, because Project Owners had not hired any company to construct the plant. Also, Project Owners had not signed any contract to buy equipment to the plant. Therefore, a future date was considered. 01/02/2012 is an expected date for construction contract assignment.

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

30 years.

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

The project activity uses renewable crediting periods.

C.2.1. Renewable crediting period

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

01/05/2013.

C.2.1.2. Length of the first crediting period:

7 years.

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. If required by the host Party, documentation on the analysis of the environmental impacts of the project activity:

The Brazilian legislation requires the development of a environmental licensing process for enterprises that involve polluting or potentially polluting activities. In the State of Rio Grande do Sul, the State Environmental Protection Foundation Henrique Luiz Roessler (FEPAM) is legally responsible for the licensing process, which begins with the environmental impact assessment conducted by the entrepreneur and follows with the prior analysis (preliminary studies) undertaken by the local environmental agency.

In the state of Rio Grande do Sul, the electricity sector entrepreneurs are required to develop an Environmental Impact Assessment (EIA) for enterprises that have installed capacity greater than 10 MW. If the enterprise has installed capacity below 10 MW, the environmental impact assessment could be simplified, and called Simplified Analysis Report (RAS). After the enterprise feasibility is validated, the process must go through three stages before obtaining all permits necessary for its operation.

In the first phase, consultation to federal and state environmental legislation is required to verify the environmental viability of the enterprise and to impose the legal conditions. If the FEPAM have a good understanding of the concepts of environmental concepts, the Previous License (LP) is issued.

After the LP is obtained, it shall be submitted the physical and operational project of the enterprise, if necessary, demonstrating how will be attended the restrictions imposed by the LP. In order to obtain the environmental Installation Permit (LI) is necessary to present: (a) information about the previous environmental assessment (b) a new simplified evaluation (RDPA – Detailed Report of the Environmental Programs), or (c) the Basic Environmental Project (PBA), as resolution of the environmental agency's decisions, reported on LP.

If all Project requirements expressed in the LP were satisfied, the enterprise obtains the approval to start the project development through the Environmental Installation License (LI) issue.

The third and last stage of creditation provides the authorization for the operational start of the enterprise with the dispatch of Environmental Operating License (LO). The LO issue is the confirmation that the enterprise construction was run according to the submitted project and is licensed, with the service conditions and environmental restrictions.

By the time of the PDD development, the SHP's Santa Carolina Previous License was issued, according to data below. Licenses and environmental studies will be delivered to the DOE that perform the project validation.

SHP Santa Carolina

LP nº 458/2009-DL. Issued on April 27th, 2009.

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 SHP Santa Carolina has a restricted flooded area and it will not significantly alter the environment. Thus, according to the EIA, the enterprise presents a low environmental impact. As confirmation of this assumption, the project has quite high indicators of efficiency, related to the environmental perspective of enterprise. The power density, which measure the ratio between the amount of generated electricity and flooded area of the project, is equal to 113.39 MW / km², attesting to the high environmental efficiency of the project. Other evidence about the low impacts caused by the enterprise is that no family will be relocated for the construction of SHP Santa Carolina, producing low social impacts and facilitating the process of land acquisition.

Notwithstanding, there are initially planned activities and programs for monitoring, control and repair of possible negative and positive impacts.

Aiming to identify the possible environmental impacts caused by the SHP the study called Environmental Impact Assessment was realized. In this paper, all environmental impacts produced, in the physic, biotic and anthropic perspectives are described and explained. There are also some social and environmental projects to be developed with the objective of mitigating the impact generated by the enterprise, though small.

Below there is a description of some programs to be developed in the Santa Carolina Project implementation:

The **Program for Limnologic Monitoring and Water Quality** has its action focus in maintaining the biological integrity of aquatic communities and ensuring the multiple uses of the river Turvo water, during and after the implementation of SHP Santa Carolina. The water quality monitoring begins in the pre-filling of the reservoir assessing all phases of the construction works and continues in the post-filling. After each step, there will be an analysis of results for a program adaptation.

The **Implementation Program of the Conservation Plan and Use of the Reservoir Surroundings** means to reconcile the use reservoir and the surrounding areas with environmental and heritage preservation of them, seeking the ideal conditions for generation, conservation and security of local people. It should be operationalized between the Previous License and prior to the reservoir filling.

The **Recovery Program of Degraded Areas** provides restoration of all areas affected by the works of SHP's Santa Carolina implementation: site of work, accommodation, road services, quarries, lending areas, sand, and other going-outside, seeking conservation of soil and water sources, avoiding the occurrence of erosion processes and siltation. This program also will promote the reintegration of these landscape areas (natural revegetation or return to the production process) and the creation of new habitats for wildlife.

The **Social Communication Program** seeks to inform all those involved, directly and indirectly, by the enterprises on the work development and its compensative programs, prioritizing to disseminate the proceedings caused by their implementation and operation, contributing to the adaptation of the affected areas' population. Together with the Social Communication Program **Environmental Education Program** aims to give knowledge to communities, in an integrated manner, about the concepts related to the environment and assist in the attitudes development that trigger improvements to the environment and life quality. Other issues to be addressed, relating to environmental education, are related to the exploitation of natural resources that surround the local communities, bearing in mind the understanding to adopt procedures regarding the preservation of the environment in which they live.

The **Program of Environmental Action Management** aims to organize, systematize, integrate, synchronize and manage all activities related to the environment, throughout the implementation and operation of the SHP Santa Carolina.

In the social scope, positive impacts can be noted, as the increase in job demand, especially for low-qualified labour, present in the region, resulting in a boosting to local growth due to a scenario of lack investment choices. Changes will also occur in the local goods and public services market and in the regional income and municipal tax revenues, since the new workers will represent an increase in the regional wages, to be spent on consumption. There will be modifications in the local community too, once the reservoirs will provide new recreational opportunities like fishing, camping and the use of space as a balneary site, which could lead to a tourism exploration of the region.

SECTION E. Stakeholders' comments

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

Referring to resolutions published by the Brazilian Designated National Authority and consolidated in the Manual for Submission of Project Activities under the CDM, developed by the Brazilian Designated National Authority, local actors should be invited to perform comments on CDM project activities.

Thus, the following local stakeholders were invited, through letters:

City of André da Rocha:

- André da Rocha City Hall
- Municipal Assembly of André da Rocha
- Municipal Secretariat of Agriculture and Environment
- Rural Workers' Union of André da Rocha
- Rural Union of André da Rocha

City of Muitos Capões:

- Muitos Capões City Hall
- Municipal Assembly of Muitos Capões
- Municipal Secretariat of Industry, Commerce, Tourism and Environment
- Rural Workers' Union of Muitos Capões

Other Stakeholders:

- State Environmental Agency (FEPAM)
- Brazilian NGO Forum (FBOMS)
- State Federal Attorney of Public Interest
- Federal Attorney of Public Interest

E.2. Summary of the comments received:

No comments have been received to date.

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

No comments have been received to date.

Annex 1

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Annex 2

INFORMATION REGARDING PUBLIC FUNDING

No public funding coming from Annex I countries was used in this project.

Annex 3

BASELINE INFORMATION

Since 2006, the MCT in cooperation with the MME and ONS, started to make available the calculation methodology for CO_2 emission factor for grid-connected electricity generation in the Brazilian National Interconnected System using dispatch data analysis. The emission factor started to be widespread for each Subsystem of Brazilian Interconnected System.

In May 2008, the Designated National Authority of CDM in Brazil defined that the National Interconnected System must be considered as a unique System and, this way, this configuration started to be valid for calculating the emission factor of CO_2 used to calculate the emission reduction of greenhouse gases for CDM Projects of electricity generation connected to the grid.

The calculation of emission factor of CO_2, published by CIMGC, follows the methodological tool "Tool to calculate the emission factor for an electricity system" approved by the CDM Executive Board.

The tables below present the values considered to calculate the operating margin emission factor ($EF_{grid,OM,y}$) and the build margin emission factor ($EF_{grid,BM,y}$) which were used for Santa Carolina Project *ex-ante* estimation of emission reductions. All of these data were provided by the Brazilian DNA.

Table 15 – Monthly Medium Operating Margin Emission Factor of the year of 2009 Brazilian Interconnected System

Medium Emission Factor (tCO_2/MWh) - Monthly												
2009	Month											
	Jan.	Feb.	March	April	May	June	July	Aug	Sep.	Oct.	Nov.	Dec.
	0,2813	0,2531	0,2639	0,2451	0,4051	0,3664	0,2407	0,1988	0,1622	0,1792	0,1810	0,1940

Table 16 – Daily Medium Operating Margin Emission Factor of the year of 2009 Brazilian Interconnected System

Average Emission Factor (tCO_2/MWh) – Daily												
2009	Month											
Day	Jan	Feb	March	April	May	June	July	August	Sep	Oct	Nov	Dec
1		0,3036	0,2409	0,2665	0,2744	0,3277	0,3077	0,2361	0,1627	0,2058	0,2333	0,1720
2	0,2262	0,2531	0,1960	0,2705	0,4220	0,3511	0,2790	0,2619	0,1612	0,2137	0,2118	0,1784
3	0,1969	0,2507	0,1868	0,2726	0,4894	0,3029	0,2729	0,2563	0,1580	0,2157	0,1821	0,1843
4	0,2367	0,2346	0,2073	0,2003	0,4338	0,2941	0,2915	0,2373	0,1549	0,2484	0,1800	0,1815
5	0,2669	0,2401	0,2237	0,2272	0,4887	0,2856	0,3846	0,2042	0,1306	0,2017	0,1856	0,1955
6	0,2006	0,2511	0,2222	0,2023	0,4813	0,2401	0,3354	0,1960	0,1527	0,1728	0,1832	0,2208
7	0,1749	0,2596	0,2348	0,1846	0,4570	0,3098	0,3460	0,1875	0,1540	0,1240	0,2069	0,1924
8	0,1549	0,2158	0,3071	0,1639	0,4898	0,2960	0,3155	0,2124	0,1220	0,0970	0,2370	0,2014
9	0,1606	0,1996	0,2627	0,1548	0,4128	0,2975	0,3087	0,2418	0,1660	0,1123	0,1604	0,2054
10	0,1672	0,2033	0,2584	0,1586	0,4305	0,2562	0,2837	0,1859	0,1727	0,2240	0,1602	0,2023
11	0,2368	0,1980	0,2523	0,1581	0,4487	0,2466	0,2780	0,1958	0,1477	0,2503	0,1896	0,1923
12	0,2476	0,1953	0,2621	0,2023	0,4252	0,2330	0,3245	0,1498	0,1473	0,2410	0,1686	0,1844
13	0,2513	0,2106	0,2772	0,2005	0,4280	0,3392	0,2858	0,1970	0,1424	0,1735	0,1658	0,2219
14	0,2503	0,2102	0,2913	0,2015	0,4306	0,3783	0,2736	0,2195	0,1287	0,1574	0,1668	0,1875
15	0,2656	0,2072	0,3130	0,1696	0,4332	0,3602	0,2858	0,1728	0,1235	0,1673	0,1883	0,1763
16	0,2223	0,1787	0,2952	0,2275	0,3552	0,3851	0,2545	0,2075	0,1334	0,1534	0,1705	0,1760
17	0,3490	0,2139	0,3247	0,2888	0,3945	0,4041	0,2124	0,1885	0,1444	0,1821	0,2010	0,1723
18	0,4460	0,2027	0,2945	0,2905	0,4455	0,4334	0,1672	0,1743	0,1661	0,2021	0,1536	0,2045
19	0,4214	0,2093	0,2823	0,3188	0,4198	0,4287	0,1596	0,1803	0,1949	0,1700	0,1668	0,2061
20	0,4369	0,2509	0,2761	0,2648	0,4093	0,5456	0,1063	0,1631	0,2236	0,1291	0,1676	0,2289
21	0,4243	0,3033	0,3020	0,2823	0,3492	0,5636	0,1264	0,1605	0,1590	0,1796	0,1859	0,1708
22	0,4353	0,4380	0,3371	0,3089	0,3650	0,5236	0,1494	0,1708	0,1607	0,1504	0,1989	0,1644
23	0,3837	0,4572	0,2944	0,2978	0,3284	0,5156	0,1474	0,2085	0,1454	0,1545	0,1709	0,1687
24	0,3246	0,4502	0,2592	0,2873	0,3320	0,4446	0,1645	0,1775	0,1609	0,1812	0,1795	0,2097
25	0,3960	0,3402	0,2467	0,2848	0,3577	0,4312	0,2018	0,1839	0,1602	0,2004	0,1642	0,2536
26	0,3145	0,2683	0,2478	0,3208	0,3576	0,4155	0,1933	0,2100	0,1897	0,1923	0,1612	0,2324
27	0,2582	0,2149	0,2405	0,2846	0,3934	0,3240	0,1581	0,2105	0,2546	0,1975	0,1709	0,2281
28	0,2380	0,2288	0,2644	0,2944	0,3722	0,3945	0,1672	0,2083	0,2003	0,1913	0,1862	0,1847
29	0,2367		0,3023	0,2845	0,3951	0,3469	0,2174	0,1928	0,1896	0,1752	0,2056	0,1699
30	0,2622		0,2453	0,2904	0,3431	0,3294	0,2462	0,2239	0,1776	0,1671	0,1675	0,1928
31	0,2588		0,2820		0,3566		0,2463	0,1771		0,1795		0,2004

The hourly average emission factors are also available at the following link: http://www.mct.gov.br/index.php/content/view/303076.html#ancora (accessed on July 2010). The operating margin emission factor is calculated for Brazilian National Interconnected System for each hour based on the value of energy dispatched by each plant, generation cost of each plant (dispatch priority), hourly exchange with neighboring subsystem and emission factors for thermoelectric plants.

The dispatch order for Brazilian Interconnected System is: hydroelectric power plants, wind, nuclear, imports from other systems in ascending order of cost, thermoelectric power plants in ascending order of generation cost.

The tables below present the data concerned to the build margin emission factor ($EF_{grid,BM,y}$) used for project ex-ante emission reduction estimation.

Table 17 – Build Margin Emission Factor of the year 2009 – National Interconnected System

	Average Emission Factor (tCO_2/MWh) - Year
2009	
	0.0794

Source: Brazilian Designated National Authority
*(*http://www.mct.gov.br/index.php/content/view/303076.html#ancora) (accessed on July 2010).

The build emission factor is the average emission factor of the most recent plants of the subsystem. This set should comprise at least 5 plants and its installed capacity should be greater than 20% of installed capacity of the subsystem.

Others information about the baseline scenario and baseline emissions is presented on item B of the PDD.

Annex 4

MONITORING INFORMATION

All monitoring information is provided on item B.7 of the PDD.