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

CONTENTS

Annexes

Revision history of this document

Version Number	Date	Description and reason of revision
01	21 January 2003	Initial adoption
02	8 July 2005	• The Board agreed to revise the CDM SSC PDD to reflect guidance and clarifications provided by the Board since version 01 of this document. • As a consequence, the guidelines for completing CDM SSC PDD have been revised accordingly to version 2. The latest version can be found at <http://cdm.unfccc.int/Reference/Documents>.
03	22 December 2006	• The Board agreed to revise the CDM project design document for small-scale activities (CDM-SSC-PDD), taking into account CDM-PDD and CDM-NM.

SECTION A. General description of small-scale project activity

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

Project title: BT Geradora de Energia Elétrica S.A. – Ferradura Small Hydro Power Plant – Small Scale CDM Project (hereafter referred to simply as "BT SSC-CDM Project" or "BGEE")[1].

PDD version number: 04.1

Date (DD/MM/YYYY): 10/08/2012.

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

The primary objective of the BT Project is to help meet Brazil's rising demand for energy due to economic growth and to improve the supply of electricity, while contributing to the environmental, social and economic sustainability by increasing renewable energy's share of the total Brazilian (and the Latin America and the Caribbean region's) electricity consumption.

This indigenous and cleaner source of electricity also provides an important contribution to environmental sustainability by reducing carbon dioxide emissions that otherwise would have occurred in the absence of the project. The project activity reduces emissions of greenhouse gas (GHG) by avoiding electricity generation from fossil fuel sources (and CO_2 emissions), which would be generated (and emitted) in the absence of the project.

The project activity consist of a SHPP located in the Guarita River, in the city of Erval Seco, State of Rio Grande do Sul (South of Brazil) with 10.1 MW[2] of total installed capacity and reservoir of 0.5335 km². Detailed description related to the technology of the project activity is presented in the Section A.4.2. It improves the supply of electricity with clean, renewable hydroelectric power while contributing to the regional/local economic development. These small scale projects provide site-specific reliability and transmission and distribution benefits including:

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

[1] This Project Design Document corresponds to the *second* crediting period of the proposed CDM project activity. The *first* crediting period is from 01/01/2004 to 31/12/2010.

[2] As per paragraph 4a of EB59, Annex 9, the determination of the rated/installed capacity was based on the installed/rated capacity of generator.

It can be said that fair income distribution is achieved from job creation and an increase in people's wages, however better income distribution in the region where the project is located is obtained from less expenditures and more income in the local municipalities. The surplus of capital that these municipalities will have could be translated into investments in education and health which will directly benefit the local population and indirectly impact a more equitable income distribution. This money would stay in the region and be used for providing the population better services which would improve the availability of basic needs. A greater income comes from the local investment on the local economy, and a greater tax payment, which will benefit the local population.

BT Geradora de Energia Elétrica S.A., owner of the project, is a special purpose company (SPC) formed by the shareholders presented below:

- TMKN – Administração de Bens e Participações Societárias Ltda, located in the town of Pomerode, state of Santa Catarina. Owns 20.8% of the company, and manages holding participation.
- Master S/A, located in the town of Brusque, state of Santa Catarina. Owns 20.0%, and works in the real state business.
- Dimas Luiz Tagliari, living in Frederico Westphalen, state of Rio Grande do Sul. Owns 12.5%.
- Rio Novo Participações Ltda., located in the town of Braço do Norte, state of Santa Catarina. Owns 12.0%, and works with consulting to other companies.
- Rischbieter Engenharia Indústria e Comércio Ltda., located in the town of Vista em Gaspar, state of Santa Catarina. Owns 9.0%, and works with the manufacturing of cement and gypsum products.
- Others: 24.7% joint participation.

Therefore, indisputably the project has reduced negative environmental impacts and has developed the regional economy, resulting, consequently, in better quality of life. In other words, environmental sustainability combined with social and economic justice, definitely, contributes to the host country's sustainable development.

A.3. Project participants:

Table 1 – Parties and private/public entities involved in the project activity

Name of Party involved (*) ((host) indicates a host Party)	Private and/or public entity(ies) Project participants (*) (as applicable)	Kindly indicate if the Party involved whishs to be considered as project participant (Yes/No)
Brazil (host)	BT Geradora de Energia Elétrica S.A.	No
United Kingdom of Great Britain and Northern Ireland	Ecopart Assessoria em Negócios Empresariais Ltda.	No

Japan	The Chugoku Electric Power Co., Inc.	No
United Kingdom of Great Britain and Northern Ireland	Constellation Energy Commodities Group Inc.	No
(*) In accordance with the CDM modalities and procedures, at the time of making the CDM-PDD public at the stage of validation, a Party involved may or may not have provided its approval. At the time of requesting registration, the approval by the Party(ies) involved is required.		

Please refer to Annex 1 for detailed contact information.

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.:

State of Rio Grande do Sul (South of Brazil).

A.4.1.3. City/Town/Community etc:

Erval Seco.

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

The project is located in the South region of Brazil, Rio Grande do Sul State, in the municipality of Erval Seco (Figure 1), and uses the hydro potential of the Guarita's River. PCH Ferradura' geographic coordinates are as follows according to the Brazilian Power Regulatory Agency (from the Portuguese *Agência Nacional de Energia Elétrica – ANEEL*) Resolution # 180 dated June 1st, 2000[3]: 27°33'35'' South Latitude and 53°34'36'' West Longitude.

[3] Available at ANEEL's website: <http://www.aneel.gov.br/cedoc/res2000180.pdf>.

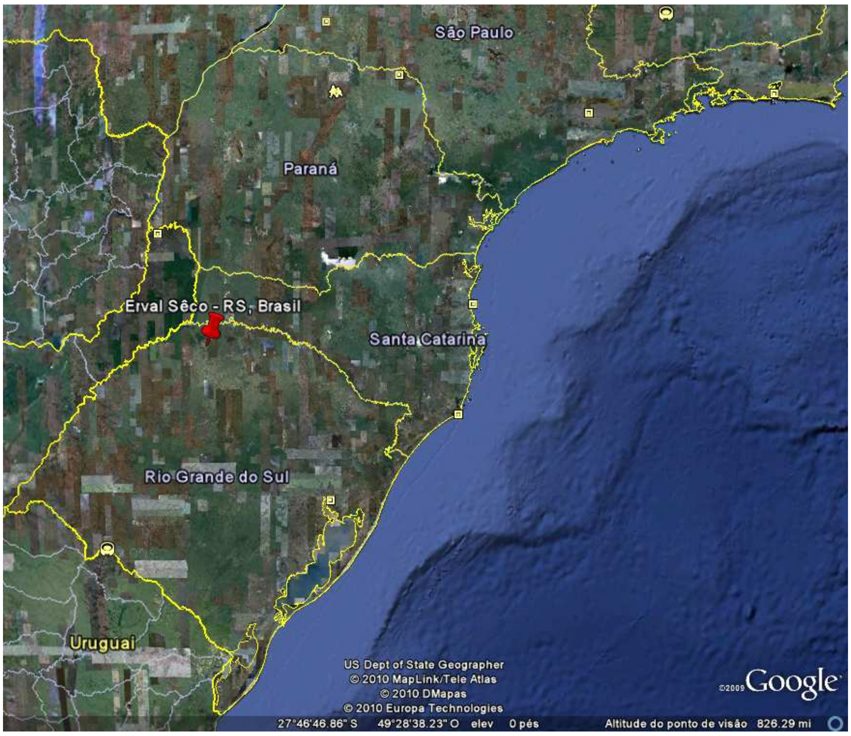

Figure 1 - Political division of Brazil showing the municipality of Erval Seco in the state of Rio Grande do Sul

(Source: Google Earth)

The city of Erval Seco has 8,196 inhabitants, 364 km[2][4] and is 353.85 km from Porto Alegre[5], the capital of the State of Rio Grande do Sul.

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

Type I: Renewable energy projects.

Category I.D.: Grid connected renewable electricity generation.

The project uses the renewable hydro potential of the Guarita River to supply electricity to a distribution system (Brazilian interconnected grid) that is supplied by at least one fossil fuel fired generating unit and has an installed capacity of 10.1 MW[2] (below the eligibility limit of 15 MW for small scale projects). The technology and equipment used in the project was developed and manufactured locally.

[4] IBGE (2010). Banco de dados Cidades@. Instituto Brasileiro de Geografia e Estatística. Available at: <http://www.ibge.gov.br/>.

[5] Available at: <http://www.portalmunicipal.org.br/entidades/famurs/dado_geral/mumain.asp?iIdEnt=5523&iIdMun=100143139>. Accessed on May 25th, 2010.

The project consists of a small-hydro power plant, in operation since December 2003[6], the yearly guaranteed energy output provided by the SHPP is 46,954 MWh[7] and it has a small reservoir with 0.5335 km² of area.

The project facility contains a small reservoir, which stores water in order to generate electricity for short periods of time. Run-of-river projects do not include significant water storage, and must therefore make complete use of the water flow. A typical run-of-river scheme involves a low-level diversion dam and is usually located on swift flowing streams (Figure 2).

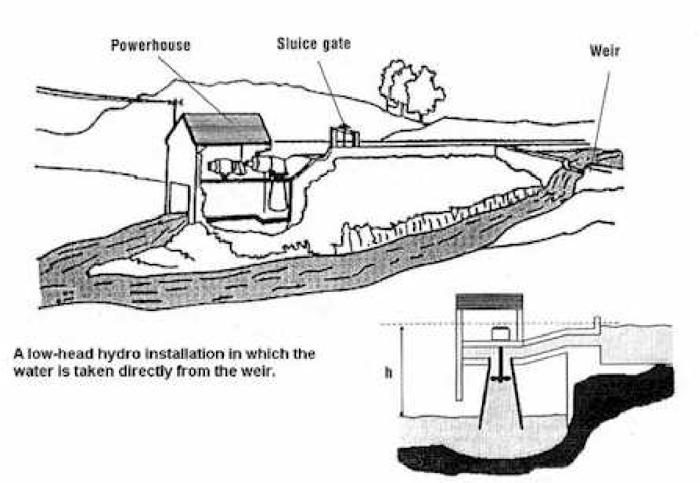

Figure 2 – Schematic view of a run-of-river power plan

According to Eletrobrás (1999), run-of-river projects are defined as "the projects where the river's dry season flow rate is the same or higher than the minimum required for the turbines".

A low-level diversion dam raises the water level in the river sufficiently to enable an intake structure to be located on the side of the river. The intake consists of a trash screen and a submerged opening with an intake gate. Water from the intake is normally taken through a pipe (called a penstock) downhill to a power station constructed downstream of the intake and at as low a level as possible to gain the maximum head on the turbine.

The Francis turbines, used in BGEE Project, are the most widely used among water turbines (Figure 3).

The Francis turbine is a type of hydraulic reaction turbine in which the flow exits the turbine blades in the radial direction. They are common in power generation and are used in applications where high flow rates are available at medium hydraulic head. Water enters the turbine through a spiral tank and is directed onto the blades. The low momentum water then exits the turbine through a ducting known

[6] The ANEEL approval establishes the beginning of the commercial plant operation, see resolution nr. 1032 dated 30/12/2003, available at: <http://www.aneel.gov.br/cedoc/dsp20031032.pdf>.

[7] Total energy generation per year was estimated based in the assured energy of the plant as established by the Brazilian Ministry of Mines and Energy as per ANEEL resolution nr. 446, dated 01/09/2003, available at: <http://www.aneel.gov.br/cedoc/res2003446.pdf>.

as suction tube. In the model, water flow is supplied by a variable speed centrifugal pump. A load is applied to the turbine by means of a magnetic brake, and torque is measured by observing the deflection of calibrated springs. The performance is calculated by comparing the output energy to the energy supplied.

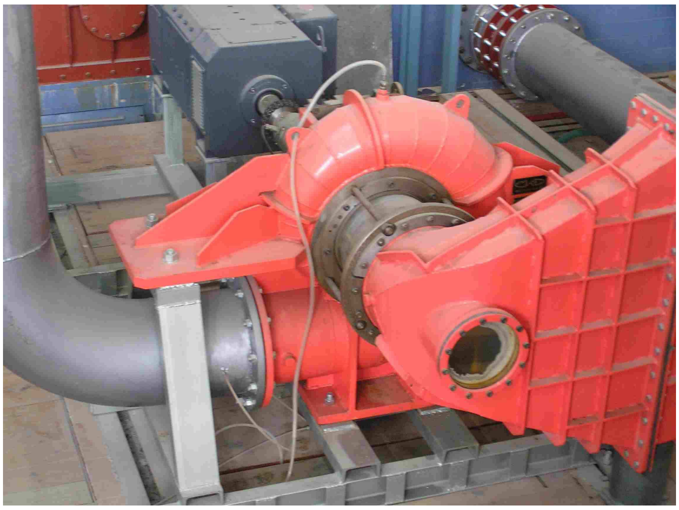

Figure 3 - Example of a Francis Turbine

Source: NTUA, 2009[8]

The equipment and technology used in the project has been successfully applied to similar projects in Brazil and around the world. The main design characteristics of the project are shown below (Table 2):

Table 2 – Technical configuration of PCH Ferradura

Turbines	
Type	Double Francis
Quantity	2
Rotation (RPM)	600
Power (MW)	4.669
Nominal liquid head (m)	39.1
Manufactures	MOLLER
Generators	
Type	SPA 900
Quantity	2
Frequency (Hz)	60
Power (kVA)	5,500
Nominal voltage (V)	6,900
Manufacturer	WEG

[8] NTUA (2009). Department of mechanical engineering. Fluids section. National Technical University of Athens. Available at: <http://www.fluid.mech.ntua.gr/lht/PB0303011.JPG>. Accessed on 30 Apr 2009.

There is also a small turbine of 0.2 MW. This is a submerged asynchrounous turbine located on the bottom of the dam, which was manufactured by Rischbieter Engenharia e Comércio..

It is important to mention that hydropower plant of the project activity operate according to the installed capacities authorized by the environmental agency of Rio Grande do Sul State (which can be confirmed by the operation licenses) and authorizations issued by the Brazilian Electricity Regulatory Agency (from the Portuguese *Agência Nacional de Energia Elétrica* - *ANEEL*).

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

Estimated emission reductions were calculated based on the assured energy of the project and CO_2 emission factor of the grid applicable to grid-connected renewable power generation project activities. Detailed explanation related to the emission reduction calculation is presented in section B.6. The second crediting period of the project will generate the estimated annual reductions as presented in the table below.

Table 3 - Estimated emission reductions of the project during the second crediting period

Years	**Estimation of annual emission reductions in tonnes of CO_2e**
2011	7,167
2012	7,187
2013	7,167
2014	7,167
2015	7,167
2016	7,187
2017	7,167
Total estimated reductions (tonnes of CO_2e)	**50,209**
Total number of crediting years	7
Annual average of the estimated reductions over the crediting period over the crediting period (tCO_2e)	7,173

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

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

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

According to paragraph 2 of Appendix C1 of the Simplified Modalities and Procedures for Small-Scale CDM project Activities:

A proposed small-scale project activity shall be deemed to be a debundled component of a large project activity 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.*

There is currently no registered CDM project at the site either large or small scale. Hence, the project cannot be considered a debundled component of a large scale project activity.

SECTION B. Application of a baseline and monitoring methodology

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

AMS-I.D. – *"Grid connected renewable electricity generation"* (version 17);

"Assessment of the validity of the original/current baseline and to update the baseline at the renewal of a crediting period" (version 03.0.1).

"Procedures for renewal of the crediting period of a registered CDM project activity" (Version 06.0)[9].

According to approved methodology AMS-I.D, a combined margin (CM), consisting of the combination of operating margin (OM) and build margin (BM) shall be calculated in accordance with the procedures prescribed in the *"Tool to calculate the emission factor for an electricity system"* (version 2.2.1), which is also used.

Additionally, the procedures related to project emissions prescribed in the approved methodology ACM0002 - *"Consolidated baseline methodology for grid-connected electricity generation from renewable sources"* where also taken into account as established in AMS-I.D.

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

[9] An email was sent to UNFCCC on 29/06/2010 notifying the secretariat of the intention to request a renewal of crediting period of the registered CDM project activity. The confirmation of receipt was sent by UNFCCC on 01/07/2010. A copy of theses emails was supplied to the DOE.

Category I.D – ***Grid connected renewable electricity generation***

From AMS-I.D:

"1. *This category comprises renewable energy generation units, such as photovoltaic, hydro, tidal/wave, wind, geothermal and renewable biomass, that supply electricity to a national or a regional grid.*

2. This methodology is applicable to project activities that (a) install a new power plant at a site where there was no renewable energy power plant operating prior to the implementation of the project activity (Greenfield plant); (b) involve a capacity addition; (c) involve a retrofit of (an) existing plant(s); or (d) involve a replacement of (an) existing plant(s).

2. Hydro power plants with reservoirs that satisfy at least one of the following conditions are eligible to apply this methodology:

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

The project activity comprises the implementation of a small-hydro power plant connected to the grid with maximum output capacity of 10.1 MW[2], and which will not increase beyond 15 MW. The project implementation resulted in a new reservoir and the plant power density is equal to 18.93 W/m², value greater than the minimum required (4 W/m²) by the AMS I.D. criterion.

B.3. Description of the project boundary:

According to AMS-I.D methodology "*the spatial extent of the project boundary includes the project power plant and all power plants connected physically to the electricity system*[10] *that the CDM project power plant is connected to*."

Also, the project boundaries are defined by the emissions targeted or directly affected by the project activities, construction and operation. Hence, it encompasses the physical, geographical site of the hydropower generation source.

B.4. Details of the baseline and its development:

[10] According to the latest approved version of the "Tool to calculate the emission factor for an electricity system", is defined by the spatial extent of the power plants that are physically connected through transmission and distribution lines to the project activity (e.g. the renewable power plant location or the consumers where electricity is being saved) and that can be dispatched without significant transmissions constraints.

According to AMS-I.D (version 17), "*The baseline scenario is that the electricity delivered to the grid by the project activity would have otherwise been generated by the operation of grid-connected power plants and by the addition of new generation sources into the grid*".

In the absence of the project activity, all the energy would be generated by other plants in interconnected grid. Hence, the baseline scenario is identified as the continuation of the current (previous) situation of electricity supplied by a mix of electricity generation in the Brazilian interconnected grid, which includes fossil fuel in its energy matrix.

The baseline emissions are calculated through the parameters shown in the table below. For more details, see section B.6.1.

Table 4 – Parameter used to determine the baseline emissions

Parameter	Description	Unit	Source
$EG_{BL,y}$	Quantity of net electricity supplied to the grid as a result of the implementation of the CDM project activity in year *y*	MWh/y	Project activity site.
$EF_{CO2,grid,y}$	CO_2 emission factor of the grid electricity in year *y*	tCO_2e/MWh	The combined margin calculation is based on method a provided by the *"Tool to calculate the emission factor for an electricity system"*.
$EF_{grid,OM\text{-}adj,y}$	Simple adjusted operating margin CO_2 emission factor in year *y*	tCO_2e/MWh	Official publications (data from ONS), IPCC default values and default values provided by the *"Tool to calculate the emission factor for an electricity system"*
$EF_{BM,2010}$	Build margin CO_2 emission factor for the project electricity system in year *y*	tCO_2e/MWh	Official publications (data from ONS), IPCC default values and default values provided by the "*Tool to calculate the emission factor for an electricity system*".

According to the "*Procedures for renewal of the crediting period of a registered CDM project activity*", its annex I, with "*Tool to assess the validity of the original/current baseline and to update the baseline at the renewal of a crediting period*", shall be used. Therefore, the following steps were taken:

Step 1: Assess the validity of the current baseline for the next crediting period:

The "*Procedures for the renewal of the crediting period of a registered CDM project activity*" approved by the CDM Executive Board requires an assessment of the impacts of new relevant national and/or sectoral policies and circumstances on the baseline. The validity of the current baseline is assessed using the following Sub-steps:

Step 1.1: Assess compliance of the current baseline with relevant mandatory national and/or sectoral policies

A brief explanation of the history of the electricity sector is presented below.

Until the beginning of the 1990's, the energy sector was composed almost exclusively of state-owned companies. From 1995 onwards, due to the increase in international interest rates and the lack of state investment capacity, the government started the privatization process. However, by the end of 2000 results were still modest. Although further initiatives, aiming to improve electric generation in the country, were taken between the 1990's and 2003, they did not attract new investment to the sector.

In 2003, the recently elected government decided to fully review the electricity market institutional framework in order to boost investments in the electric energy sector. Market rules were changed and new institutions were created such as Energetic Research Company (in a free translation from the Portuguese *Empresa de Pesquisa Energética – EPE*) – an institution responsible for the long term planning of the electricity sector with the role of evaluating, on a perennial basis, the safety of the supply of electric power – and Chamber for the Commercialization of Electric Power (from the Portuguese *Câmara de Comercialização de Energia Elétrica – CCEE*) – an institution responsible for the management of electric power commercialization within the interconnected system. This new structure was approved by the House of Representatives and published in March of 2004[11].

Considering explanations above, the electricity sector in fact change after the project start. However the new national/sectoral policy did not impact the baseline scenario of the project, *i.e.* electricity generated by the operation of grid-connected power plants and, therefore, the baseline scenario continues to be the one identified in the first crediting period. This baseline scenario complies with all relevant mandatory national and/or sectoral policies.

Step 1.2. Assess the impact of circumstances

As mentioned above, there are no new relevant national and/or sectoral policies and/or circumstances in the electricity sector applicable to the Project Activity, in comparison to the time of the Project's start date, which could impact the validity of the current baseline for the next crediting period. Therefore, the current baseline scenario does not need to be updated for this crediting period.

However, circumstances related to CO_2 emission factor changed and, therefore, it were reviewed in this PDD (see section B.6.1 and B.6.3).

Step 1.3. Assess whether the continuation of the use of current baseline equipment(s) is technically possible

The current baseline scenario is the continuation of the current practice. In the absence of the project, the electricity produced by SHPP would have been generated by the National Interconnected System (from the Portuguese "*Sistema Interligado Nacional - SIN*"). The SIN is composed by 2.481

[11] <http://www.planalto.gov.br/CCIVIL/_Ato2004-2006/2004/Lei/L10.848.htm>.

plants[12] each one with specific characteristics and equipments. Thus this step does not apply, since the whole system would continue to supply energy independently of the lifetime of individual equipments.

Step 1.4. Assessment of the validity of the data and parameters

According to the "*Tool to assess the validity of the original/current baseline and to update the baseline at the renewal of a crediting period*", updates should be undertaken in the following cases:

- *Where IPCC default values are used, the values should be updated if any new default values have been adopted and published by the IPCC, for example, in guidelines for national GHG inventories, IPCC assessment report or special reports by the IPCC;*

- *Where emission factors, values or emission benchmarks are used and determined only once for the crediting period, they should be updated, except if the emission factors, values or emission benchmarks are based on the historical situation at the site of the project activity prior to the implementation of the project and cannot be updated because the historical situation does not exist anymore as a result of the CDM project activity.*

As mentioned above, the current baseline scenario is the electricity generation by the SIN, which have been enlarged to supply the increasing demand for electrical energy supply, fact that can be verified by the increase of the SIN´s installed capacity (Figure 4).

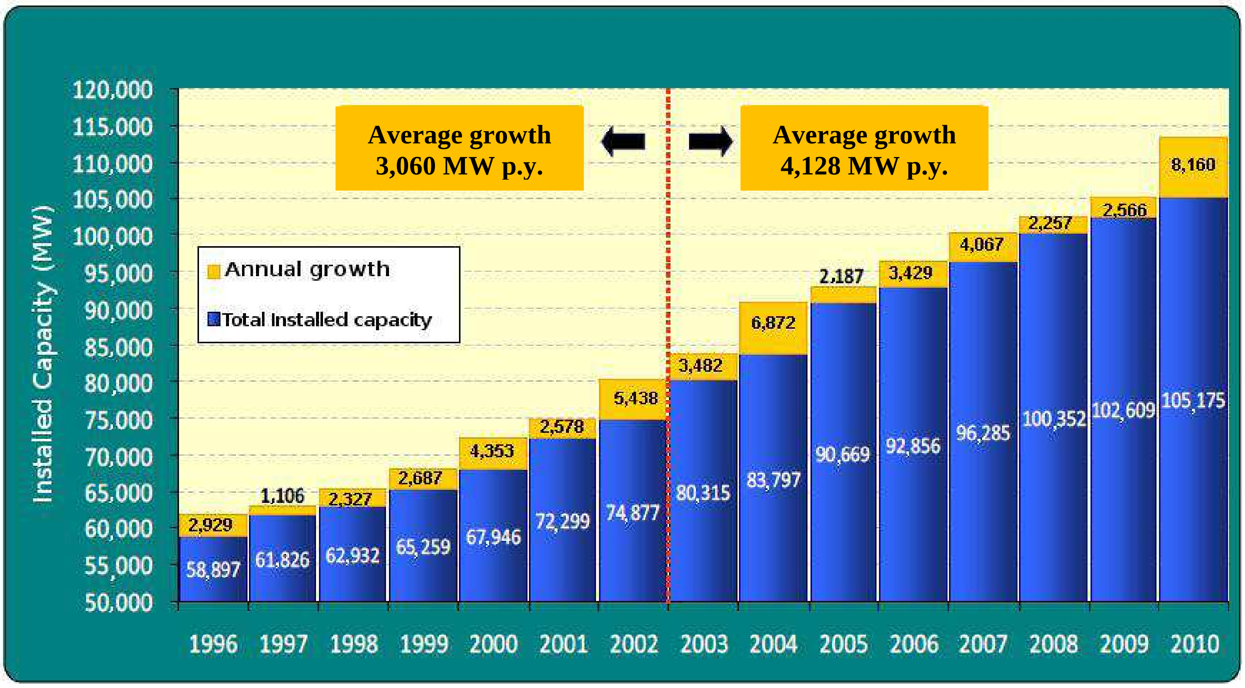

Figure 4 – Increase of the installed capacity of SIN

Source: CMSE – SIN (considering a projection for 2010) [13]

[12] ANEEL website: < http://www.aneel.gov.br/aplicacoes/capacidadebrasil/capacidadebrasil.asp>. Accessed on May 26th, 2010.

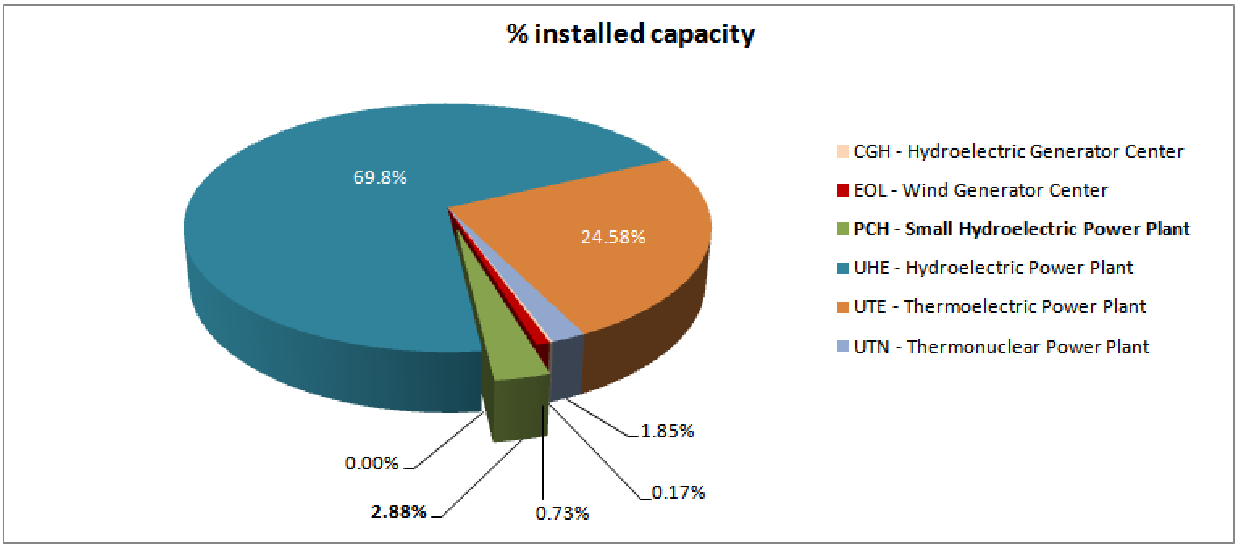

Figure 5 - Share of installed capacity

Source: ANEEL (2010)[14]

The dispatch of new energy plants altered the energy matrix profile. According to ANEEL latest data: 69.8 % of Brazil's installed capacity is composed by hydropower plants and 24.58 % by thermal power stations (Figure 5), during the time of the first registration, the profile was: 74.1% hydropower plants, and 12.3% by thermal power station[15]. As can be notice, the profile of the energy plants that dispatches energy to the SIN have altered, increasing the amount of fossil fuel participation in it. These facts reflect on the emission factor value, which must be recalculated.

An article prepared by three researchers from Universidade de São Paulo[16] in May 2009 analyzes the expansion of Brazilian electricity system and considers that the technical-economic limit of hydropower projects related to the socially acceptable issues is almost reached. In this context, the study points as a trend the implementation of fossil fuel thermal power plants or large projects in the Amazon region. The study states that although investment in renewable energy in a long-term planning is being made, the Brazilian energy supply tends towards a more intensive use of fossil fuels, mainly to the insertion of natural gas and coal thermal power plants.

[13] Data obtained from EPE´s presentation (from the Portuguese "*Empresa de Pesquisa Energética*"). Available at: <http://www.senado.gov.br/web/comissoes/ci/ap/AP20091210_Dr_Mauricio_Tolmasquin.pdf>, accessed on April 09th, 2010.

[14] Agência Nacional de Energia Elétrica (ANEEL). Banco de Informações de Geração (BIG). Available at: <http://www.aneel.gov.br/aplicacoes/capacidadebrasil/capacidadebrasil.asp>, accessed on May 26th, 2010.

[15] MME (2007). Brazilian National Energy Balance (from the Portuguese "*Balanço Energético Nacional*"). Available at: <http://www.mme.gov.br/mme/galerias/arquivos/publicacoes/BEN/8_-_Edicoes_Anteriores_BEN_e_Resenhas_-_pdf/1_-_BEN_Anteriores/4_-_BEN_2007_-_Ano_Base_2006.pdf>.

[16] Mitigação de gases de efeito estufa: a experiência setorial e regional no Brasil / coordenado por Jacques Marcovitch. São Paulo: FEA/USP, 2009. Link to this article: <http://www.usp.br/mudarfuturo/2009/cap4.htm>.

The article concludes that, besides of the optimization of the initiatives that already exist, barriers for the renewable energy generation shall be removed through:

a) A reduction of subsidy for conventional electricity generation, as the so-called Fuel Consumption Account (in a free translation from the Portuguese *Conta Consumo de Combustíveis – CCC*), created to finance the use of diesel oil for energy generation;

b) A revision of incentives for industries that for a long period received fiscal incentives to be installed in certain regions of the country;

c) An alteration in the rules of energy auctions considering that the current model privilege thermoelectric generation from fossil fuel.

Considering the item (c) mentioned above, in the energy auctions, which took place between 2005 and 2007 from the total of 9,594 MW sold, 5,888 MW (61.3%) will come from fossil fuel fired thermal power plants, from which 2,152 MW come from natural gas and 2,514 MW fuel oil fired thermal power plants, *i.e.*, 22.4% and 26.2% of the total sold respectively[17]. Considering the energy auctions which took place from 2008 to 2009[18], from the total 4,212 MW sold, 4,045 MW (96.0%) will come from fossil fuel fired thermal power plants. Only 3.96% will come from renewable energy projects: 45 MW from sugarcane bagasse and 122 MW from hydropower plant sources.

As can be concluded by the analyses, renewable energy projects similar to the project activity are not common practice at the Brazilian energy market, barriers for small renewable energy generation projects still exist and, the current baseline scenario is still valid and the related data must be updated.

Considering that emission factor calculation determined on the first crediting period of the project was changed, parameters related to its calculation were also reviewed in this second crediting period.

Step 2. Update the current baseline and the data and parameters

Step 2.1. Update the current baseline

As already mentioned, the current scenario still valid, thus there is no need to be updated.

However, the CO_2 emission factor and, consequently, the baseline emissions, were changed following the latest version of the "*Tool to calculate the emission factor for an electricity system*". See section B.6.1 and B.6.3 of this PDD.

Step 2.2. Update the data and parameters

[17] ESPARTA, A. R. J. (2008). Redução de emissões de gases de efeito estufa no setor elétrico brasileiro: a experiência do Mecanismo de Desenvolvimento Limpo do Protocolo de Quioto e uma visão futura. PhD Thesis, Universidade de São Paulo. Available at: <http://www.teses.usp.br/teses/disponiveis/86/86131/tde-29042008-160752/>.

[18] 6th, 7th and 8th energy auctions for new projects (from the Portuguese *leilão de energia nova*) held on September 17th / 30th, 2008 and August 27th, 2009. Available at: <http://www.ccee.org.br/cceeinterdsm/v/index.jsp?vgnextoid=d3caa5c1de88a010VgnVCM100000aa01a8c0RCRD>.

As mentioned above, there are no new relevant national and/or sectoral policies and circumstances in the electricity sector, which would alter the baseline scenario at the time of requesting renewal of crediting period.

However, considering the changes on circumstances related to calculation of CO2 emission factor, the baseline emissions were reviewed in this second crediting period following the latest version of the *"Tool to calculate the emission factor for an electricity system"*. See section B.6.1 and B.6.3 of this PDD for the calculations.

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:

Revision of the project additionality is not applicable for the second crediting period.

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

Baseline emissions (BE_y) calculation

Baseline emissions are the product of electrical energy baseline $EG_{BL,y}$ (in MWh) of electricity produced by the renewable generating unit multiplied by the CO_2 emission factor, calculated as follows:

$$BE_y = EG_{BL,y} \cdot EF_{CO_2,grid,y} \qquad \textbf{Equation 1}$$

Where,

BE_y = Baseline emissions in year *y* (tCO_2)

$EG_{BL,y}$ = Quantity of net electricity supplied to the grid as a result of the implementation of the CDM project activity in year *y* (MWh)

$EF_{CO2,grid,y}$ = CO_2 emission factor of the grid in year y (tCO_2/MWh)

Baseline emission factor ($EF_{CO2,grid,y}$) calculation

According to the selected approved methodology (AMS-I.D) the baseline emission factor of the grid ($EF_{CO2,grid,y}$) is calculated as per the methodology AMS-I.D (version 17) - option (a) – a combined margin (CM), consisting of the combination of operating margin (OM) and build margin (BM) according to the procedures prescribed in the "*Tool to calculate the emission factor for an electricity system*".

According to this tool Project Participants shall apply the following six steps to the baseline calculation:

STEP 1 - Identify the relevant electricity systems.

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

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

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

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

STEP 6 - Calculate the combined margin (CM) emissions factor.

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

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

Brazilian DNA has published the Resolution #8 issued on 26th May, 2008[19] that defines the Brazilian Interconnected Grid as a single system that covers all the five macro-geographical regions of the country (North, Northeast, South, Southeast and Midwest). Hence, this figure will be used to calculate the baseline emission factor of the grid.

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

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

Option I: only grid power plants are included in the calculation;

Option II: both grid power plants and off-grid power plants are included in the calculation.

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

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

The calculation of the operating margin emission factor ($EF_{grid,OM,y}$) is based on one of the following methods:

(a) Simple OM; or

(b) Simple adjusted OM; or

(c) Dispatch data analysis OM; or

[19] Available at: < http://www.mct.gov.br/upd_blob/0024/24719.pdf>.

(d) Average OM.

Dispatch data analysis is an available option for the calculation of the operating margin, however it is only applicable for the *ex-post* vintage. The simple operating margin can only be used where low-cost/must-run resources[20] constitute less than 50% of total grid generation in: 1) average of 5 most recent years, or 2) based on long-term normals for hydroelectricity production. Table 5 shows the share of hydroelectricity in the total electricity production for the Brazilian interconnected system. However, the results show the non-applicability of the simple operating margin to the proposed CDM Project Activity.

Table 5 - Share of hydroelectricity generation in the Brazilian interconnected system, 2006 to 2010

Year	Share of hydroelectricity (%)
2006	91.81%
2007	92.79%
2008	88.62%
2009	93.27%
2010	88.77%

Source: ONS (2011)[21]

The fourth alternative, an average operating margin, is an oversimplification and does not reflect at all the impact of the project activity in the operating margin. Therefore, the simple adjusted operating margin will be used in the project.

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

According to the tool "*the simple adjusted OM emission factor* ($EF_{grid,OM\text{-}adj,y}$) *is a variation of the simple OM, where the power plants / units (including imports) are separated in low-cost/must-run power sources (k) and other power sources (m)*".

The simple adjusted OM was calculated based on the net electricity generation and a CO_2 emission factor for each power unit – *i.e.* similarly to **Option A** of the simple OM method – as follows:

$$EF_{grid,OM-adj,y} = (1-\lambda_y)\cdot\frac{\sum_m EG_{m,y}\times EF_{EL,m,y}}{\sum_m EG_{m,y}} + \lambda_y\cdot\frac{\sum_k EG_{k,y}\times EF_{EL,k,y}}{\sum_k EG_{k,y}}$$ **Equation 2**

Where:

[20] Low operating cost and must run resources typically include hydro, geothermal, wind, low-cost biomass, nuclear and solar generation.

[21] Operador Nacional do Sistema: Histórico de Geração (2011). Available at <http://www.ons.org.br/historico/geracao_energia.aspx>.

$EF_{grid,OM\text{-}adj,y}$ = Simple adjusted operating margin CO_2 emission factor in year *y* (tCO_2/MWh);

λ_y = Factor expressing the percentage of time when low-cost/must-run power units are on the margin in year *y;*

$EG_{m,y}$ = Net quantity of electricity generated and delivered to the grid by power unit *m* in year *y* (MWh);

$EG_{k,y}$ = Net quantity of electricity generated and delivered to the grid by power unit *k* in year *y* (MWh);

$EF_{EL,m,y}$ = CO_2 emission factor of power unit *m* in year *y* (tCO_2/MWh);

$EF_{EL,k,y}$ = CO_2 emission factor of power unit *k* in year *y* (tCO_2/MWh);

m = All grid power units serving the grid in year *y* except low-cost/must-run power units;

k = All low-cost/must run grid power units serving the grid in year *y;*

y = The relevant year as per the data vintage chosen in Step 3.

Determination of $EG_{m,y}$

Information used to determine this parameter was supplied by The Electric System National Operator (from the Portuguese *Operador Nacional do Sistema – ONS*), which is an official source, as recommended by the tool. ONS is an entity of private right, non-profitable, created on 26 August 1998, responsible for coordinating and controlling the operation of generation and transmission facilities in the National interconnected Power System (NIPS) under supervision and regulation of the Electric Energy National Agency (ANEEL)[22].

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

In terms of vintage, **option 1** is chosen. In this sense, the build margin was calculated using the most recent information available on units already built for sample group *m* at the time of CDM-PDD submission to the DOE, *i.e.* 2010.

The sample group of power units *m* used to calculate the build margin was determined following the guidance provided by the tool as further discussed in section B.6.3. below. The build margin was calculated following the same approach described above in step 4.

- **STEP 6** – Calculate the combined margin (CM) emission factor

The combined margin calculation is based on method a provided by the tool, as follows:

[22] http://www.ons.org.br/institucional/modelo_setorial.aspx?lang=en

$$EF_{grid,CM,y} = EF_{grid,OM,y} \times w_{OM} + EF_{grid,BM,y} \times w_{BM}$$ **Equation 3**

Where,

$EF_{grid,BM,y}$ = Build margin CO_2 emission factor in year *y* (tCO_2/MWh);

$EF_{grid,OM,y}$ = Operating margin CO_2 emission factor in year *y* (tCO_2/MWh);

w_{OM} = Weighting of operating margin emissions factor (%);

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

According to the tool, for hydro power generation project activities, as is the case of the proposed project activity, the weights for the second crediting period are w_{OM} = 0.25 and w_{BM} = 0.75.

Project emissions (PE_y)

According to AMS I. D, paragraph 20, "*For most renewable energy project activities, PE_y = 0. However, for the following categories of project activities, project emissions have to be considered following the procedure described in the most recent version of ACM0002*".

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

$$PE_y = PE_{FF,y} + PE_{GP,y} + PE_{HP,y}$$ **Equation 4**

Where:

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

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

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

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

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

Considering that there is no fossil fuel combustion in the proposed project activity, $PE_{FF,y}$ = 0 tCO_2e/yr.

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

Considering that the proposed project activity consists on the construction of a small hydropower

plant, there are no emissions of non-condensable gases from the operation of geothermal power plants. Therefore, $PE_{GP,y} = 0$ tCO_2e/yr.

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

According to ACM0002 (version 12.2.0), new hydro electric power projects with single or multiple reservoirs, shall account for project emissions, estimated as follows:

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

$$PE_{HP,y} = \frac{EF_{Res} \cdot TEG_y}{1000} \quad \textbf{Equation 5}$$

Where:

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

EF_{Res} = is the default emission factor for emissions from reservoirs, and the default value as per EB23 is 90 Kg CO_2e/MWh;

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

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

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

$$PD = \frac{Cap_{PJ} - Cap_{BL}}{A_{PJ} - A_{BL}} \quad \textbf{Equation 6}$$

Where:

PD = Power density of the project activity (W/m^2);

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

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

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

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

<u>Leakage emissions (LE_y)</u>

According to AMS-I.D, "*if the energy generating equipment is transferred from another activity, leakage is to be considered*". Considering that none of the energy equipment used in this project was transferred from another activity, leakage is not being considered.

<u>Emission reductions (ER_y)</u>

According the selected approved methodology AMS-I.D emission reductions are calculated as follows:

$$ER_y = BE_y - PE_y - LE_y$$ **Equation 7**

Where:

ER_y = Emission reductions in year y (tCO_2/y);

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

PE_y = Project emissions in year y (tCO_2/y);

LE_y = Leakage emissions in year y (tCO_2/y).

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

Data / Parameter:	**Cap_{BL}**
Data unit:	W
Description:	Installed capacity of the hydro power plant before the implementation of the project activity.
Source of data used:	Equipment tag - project site
Value applied:	0
Justification of the choice of data or description of measurement methods and procedures actually applied :	According to the ACM0002 methodology for new hydro power plants, this value is zero.
Any comment:	

Data / Parameter:	***$EG_{m,y}$ and $EG_{k,y}$***
Data unit:	MWh

Description:	Net electricity generated by power plant/unit *m* or *k* in year *y*
Source of data used:	Official publications. Data from the Electric System National Operator was used.
Value applied:	Large amount of data. Please refer to the emission factor calculation spreadsheet which is attached to the PDD.
Justification of the choice of data or description of measurement methods and procedures actually applied :	Once for each crediting period using the most recent three historical years for which data is available at the time of submission of the CDM-PDD to the DOE for validation (*ex-ante* option).
Any comment:	For methodological choices details, please refer to section B.6.1.

Data / Parameter:	$EF_{grid,OM-adj,y}$
Data unit:	tCO_2/MWh
Description:	Simple adjusted operating margin CO_2 emission factor in year *y*
Source of data used:	Official publications (data from ONS), IPCC default values and default values provided by the *"Tool to calculate the emission factor for an electricity system"*
Value applied:	0.2609
Justification of the choice of data or description of measurement methods and procedures actually applied :	The *ex-ante* calculation vintage of this parameter was chosen as per the procedures of the *"Tool to calculate the emission factor for an electricity system"*.
Any comment:	For methodological choices details, please refer to section B.6.1.

Data / Parameter:	$EF_{BM, 2010}$
Data unit:	tCO_2e/MWh
Description:	Build margin CO_2 emission factor for the project electricity system in year *y*
Source of data to be used:	Official publications (data from ONS), IPCC default values and default values provided by the *"Tool to calculate the emission factor for an electricity system"*.
Value of data	0.1166
Description of measurement methods and procedures to be applied:	The *ex-ante* calculation vintage of this parameter was chosen as per the procedures of the *"Tool to calculate the emission factor for an electricity system"*.
QA/QC procedures to be applied:	-
Any comment:	For methodological choices details, please refer to section B.6.1.

B.6.3 Ex-ante calculation of emission reductions:

Baseline emissions (BE_y) calculation

Baseline emission factor ($EF_{grid,CM,y}$) calculation

Additionally, the calculation of the combined margin CO_2 emission factor for grid connected power generation ($EF_{grid,CM,y}$) follows the steps established in the "*Tool to calculate the emission factor for an electricity system*". The results are presented below.

- **STEP 1 -** Identify the relevant electric power system

Following Resolution #8, issued by the Brazilian DNA on 26th May, 2008, the Brazilian Interconnected Grid corresponds to the system to be considered. It covers all the five macro-geographical regions of the country (North, Northeast, South, Southeast and Midwest) as presented in the Figure 6 below.

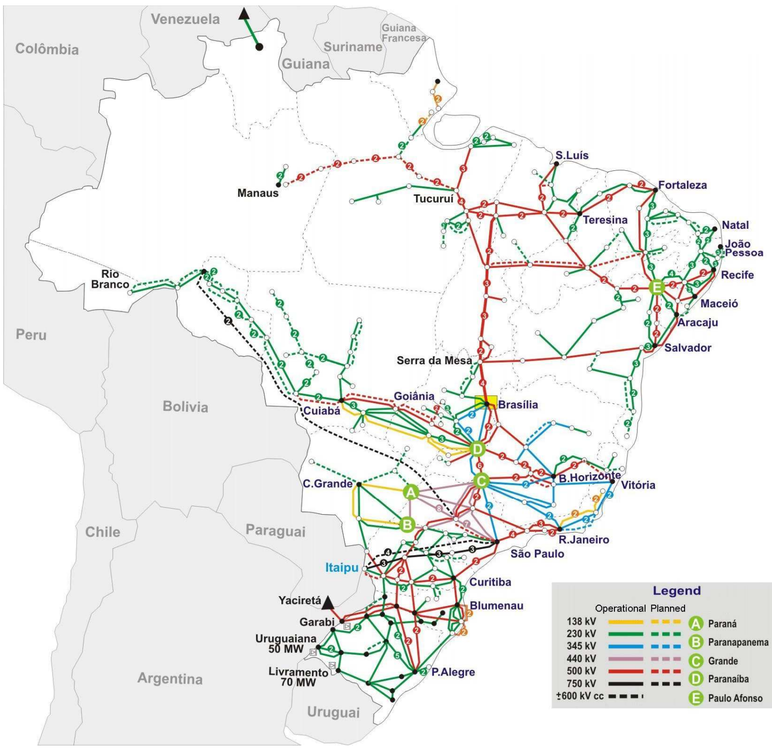

Figure 6 – Brazilian Interconnected System. (*Source:* Electric System National Operator)

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

Option I was chosen and only grid connected power plants are considered.

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

The simple adjusted operating margin was chosen method for the calculation of this parameter. Please refer to section B.6.1. for the proper justification.

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

A spreadsheet containing all data used to determine the operation margin was supplied to the DOE. The result is presented below.

$EF_{grid,OM\text{-}adj,y}$ = 0.2609 tCO_2e/MWh

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

As described above in section B.6.1., the *ex-ante* vintage was the option chosen to determine the build margin (option 1).

The sample group of power units *m* used to calculate the build margin was identified following the procedure provided by the tool. The result is discussed below and is detailed presented in the spreadsheet supplied to the DOE which is also attached to the PDD.

> *(a) Identify the set of five power units, excluding power units registered as CDM project activities, that started to supply electricity to the grid most recently ($SET_{5\text{-}units}$) and determine their annual electricity generation ($AEG_{SET\text{-}5\text{-}units}$, in MWh);*

From the most recent consolidated information the $SET_{5\text{-}units}$ are: UTE Linhares, UHE Salto Pilão, UTE Camaçari, UTE Tocantinópolis and UTE Viana. The electricity generated by these set of plants ($AED_{SET\text{-}5\text{-}units}$) in 2010 was 662,143 MWh.

> *(b) Determine the annual electricity generation of the project electricity system, excluding power units registered as CDM project activities (AEG_{total}, in MWh). Identify the set of power units, excluding power units registered as CDM project activities, that started to supply electricity to the grid most recently and that comprise 20% of AEG_{total} (if 20% falls on part of the generation of a unit, the generation of that unit is fully included in the calculation) ($SET_{\geq 20\%}$) and determine their annual electricity generation ($AEG_{SET\text{-}\geq 20\%}$, in MWh);*

Not considering the CDM project activities, in 2010, the Brazilian electricity System generated (AEG_{total}) 465,919,678 MWh. A large amount of plants comprise 20% of AEG_{total}. This information ($SET_{\geq 20\%}$) can be checked in the calculation spreadsheet attached to this PDD. The annual electricity generation of $SET_{\geq 20\%}$, corresponding to the parameter $AEG_{SET\text{-}\geq 20\%}$, is 93,183,936 MWh.

> *(c) From $SET_{5\text{-}units}$ and $SET_{\geq 20\%}$ select the set of power units that comprises the larger annual electricity generation (SET_{sample}); Identify the date when the power units in SET_{sample} started to supply electricity to the grid. If none of the power units in SET_{sample} started to supply electricity to*

> *the grid more than 10 years ago, then use SET_{sample} to calculate the build margin. Ignore steps (d), (e) and (f).*

From data presented in items (a) and (b), it can be observed that $SET_{\geq 20\%}$ is greater than $SET_{5\text{-}units}$. Therefore, SET_{sample} corresponds to $SET_{\geq 20\%}$. The oldest plant comprised in SET_{sample} started to supply electricity to the grid in January 1998. Hence, steps *(d), (e)* and *(f)* of the tool are applicable.

> *(d) Exclude from SET_{sample} the power units which started to supply electricity to the grid more than 10 years ago. Include in that set the power units registered as CDM project activity, starting with power units that started to supply electricity to the grid most recently, until the electricity generation of the new set comprises 20% of the annual electricity generation of the project electricity system (if 20% falls on part of the generation of a unit, the generation of that unit is fully included in the calculation) to the extent is possible. Determine for the resulting set ($SET_{sample\text{-}CDM}$) the annual electricity generation ($AEG_{SET\text{-}sample\text{-}CDM}$, in MWh);*

Plants which have started to supply electricity to the grid more than 10 years ago were excluded. Four registered CDM Projects were included in the SET_{smaple}. The electricity generation by resultant set of plants, corresponding to the parameter $AEG_{SET\text{-}sample\text{-}CDM}$, is 74,902,471MWh.

> *If the annual electricity generation of that set is comprises at least 20% of the annual electricity generation of the project electricity system (i.e. $AEG_{SET\text{-}sample\text{-}CDM} \geq 0.2 \times AEG_{total}$), then use the sample group $SET_{sample\text{-}CDM}$ to calculate the build margin. Ignore steps (e) and (f).*

From the results presented above, $AEG_{SET\text{-}sample\text{-}CDM}$ is lower than AEG_{total}. Then, steps (e) and (f) were applied.

> *(a) Include in the sample group $SET_{sample\text{-}CDM}$ the power units that started to supply electricity to the grid more than 10 years ago until the electricity generation of the new set comprises 20% of the annual electricity generation of the project electricity system (if 20% falls on part of the generation of a unit, the generation of that unit is fully included in the calculation);*
>
> *(b) The sample group of power units m used to calculate the build margin is the resulting set ($SET_{sample\text{-}CDM\text{-}>10yrs}$).*

Five power plants that have started to supply electricity to the grid more than 10 years ago were included. The resultant set is $SET_{sample\text{-}CDM\text{-}>10yrs}$ is identified in the grid emission factor calculation spreadsheet.

The build margin was calculated following the same approach described above in Step 4, and considered the set of plants identified above. As mentioned previously, this parameter will be validated since the *ex-ante* option was chosen.

The result for the build margin emission factor is presented below.

$EF_{grid,BM,y} = 0.1166\ tCO_2e/MWh$

- **STEP 6 –** Calculate the combined margin (*CM*) emissions factor EF_y

Applying the results presented above in STEPS 4 and 5 above to the **Erreur ! Source du renvoi introuvable.** presented in section B.6.1. and considering the weights w_{OM} = 0.75 and w_{BM} = 0.25 we obtain,

$$EF_y = w_{OM} \cdot EF_{OM,y} + w_{BM} \cdot EF_{BM,y}$$

$EF_y = 0.25 \times 0.2609 + 0.75 \times 0.1166$

$EF_{grid,CM,y} = 0.1526\ tCO_2e/MWh$

Quantity of net electricity supplied to the grid as a result of the implementation of the CDM project activity ($EG_{BL,y}$)

The quantity of net electricity generation supplied by the project plant/unit to the grid in year *y* ($EG_{faciclity,y}$, in MWh/yr) was determined, for the purpose of ex-ante estimative as being equal to the average assured power as estimated by the Brazilian Power Regulatory Agency multiplied by the number of hours in the year. Thus, we have 5.36 MW-ave x 8,670 hours of operation in a year = 46,954 MWh/year.

Finally, baseline emissions can be determined applying the results of $EG_{facility,y}$ and $EF_{grid,CM.y}$ to Equation 1 as follows,

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

$EG_{BL,y} = EG_{facility,y}$ = 46,954 MWh/year

BE_y = 46,954MWh/year x 0.1526 tCO_2/MWh

BE_y = 7,167 tCO_2/year

Project emissions (PE_y) calculation

As explained above in section B.6.1. project emissions by the proposed project activity are **zero**.

PE_y = 0 tCO_2e/year

Leakage (LE_y) emissions

The calculation of leakage emissions is not required by the methodology.

LE_y = 0 tCO_2/year

Emission reductions (ER_y) calculation

Applying the results discussed above to Equation 1 we obtain,

$ER_y = BE_y – PE_y - LE_y$

ER_y = 7,167 tCO_2/year

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

Table 6 - tCO_2e total estimation reduction of the project

Year	Estimation of project activity emissions (tCO_2e)	Estimation of baseline emissions (tCO_2e)	Estimation of leakage (tCO_2e)	Estimation of overall emission reductions (tCO_2e)
2011	0	7,167	0	7,167
2012	0	7,187	0	7,187
2013	0	7,167	0	7,167
2014	0	7,167	0	7,167
2015	0	7,167	0	7,167
2016	0	7,187	0	7,187
2017	0	7,167	0	7,167
Total (tonnes of CO_2e)	**0**	**50,209**	**0**	**50,209**

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

B.7.1 Data and parameters monitored:

Data / Parameter:	$EG_{facility,y}$
Data unit:	MWh/y
Description:	Quantity of net electricity supplied to the grid in year *y*
Source of data:	Project activity site. For estimative purposes 46,954 MWh/year was considered calculated based on 5.36 MW-ave assured power and 8,760 hour of operation in the year.
Measurement procedures (if any):	The electricity delivered to the grid is monitored both by the project owner (seller) as well as by the energy buyer. A Brazilian government entity, CCEE – *Câmara Comercializadora de Energia Elétrica* - controls and monitors the electricity available on the national interconnected grid. The amount of electricity delivered to the grid by the project activity shall be cross-checked with the Reports issued by CCEE (records for sold electricity).
Monitoring frequency	Continuously measurement and monthly recording.
QA/QC procedures:	Energy metering QA/QC procedures are explained in section B.7.2 (the equipments used have by legal requirements extremely low level of uncertainty).
Any comment:	-

Data / Parameter:	Cap_{PJ}
Data unit:	W

Description:	Installed capacity of the hydro power plant after the implementation of the project activity
Source of data:	Project site and official documents. For estimative purposes 10,100,000 installed capacity was considered based on the paragraph 4a of EB59, Annex 9, where the determination of the rated/installed capacity was based on the installed/rated capacity of generator.
Measurement procedures (if any):	Official data source. The installed capacity of the plant can also be evidenced by the Data Books of the equipment installed at the SHPP.
Monitoring frequency:	Yearly.
QA/QC procedures:	-
Any comment:	-

Data / Parameter:	$\mathbf{A_{PJ}}$
Data unit:	m^2
Description:	Area of the single or multiple reservoirs measured in the surface of the water, after the implementation of the project activity, when the reservoir is full.
Source of data:	Project site. For estimative purposes 533,500 m^2 was considered based on the Operation License nr. 3194/2009-DL.
Measurement procedures (if any):	Official data source.
Monitoring frequency	Yearly.
QA/QC procedures:	-
Any comment:	-

B.7.2 Description of the monitoring plan:

The monitoring plan of the emission reductions by the project activity is in accordance with the procedures set by the methodology "AMS-I.D - *Grid connected renewable electricity generation*".

It consists in using meter equipment projected to registry and verifies bidirectionally the energy generated by the facility. This energy measurement is fundamental to verify and monitor the GHG emission reductions. The Monitoring Plan permits the calculation of GHG emissions generated by the project activity in a straightforward manner, applying the baseline emission factor.

The project will proceed with the necessary measures for the power control and monitoring. Hence, it will be possible to monitor the power generation of the project. Beyond that, information about power generation and energy supplied to the grid are controlled by the Chamber of Electric Energy Commercialization CCEE (from the Portuguese *Câmara de Comercialização de Energia Elétrica*). CCEE makes feasible and regulates the electricity energy commercialization.

There are two meters at the Guarita Substation used for $EG_{facility,y}$ measurement (Table 7). These meters are bidirectional and redundant, so that, in case the first meter fails, the second automatically

replaces it. There are no transmission losses to be considered, since measurements are carried out at the output of the transmission line.

Table 7 - Energy Meters at the Substation

Description		***Type / Model***	***Number***
Energy Meter	Principal	ELO/2180 SE	# 90001661
	Back-up	ELO/2180 SE	# 90001696

Electricity dispatched to the grid will be continuous monitored, hourly measured and at least monthly recorded. CCEE has remote access to energy information. The energy generated by the plants is informed by the project owner to CCEE in an hourly frequency. CCEE verifies the consistency of information and accounts for all the energy generated and dispatched to the system as well as consumed, CCEE issues an official report named ME 001 that presents a consolidated data indicating, per week, the dispatched energy during the specific month.

Although Ferradura Small Hydropower Plants isn't obliged to follow the Grid Procedures as established by the Electric System National Operator (from the Portuguese *Operador Nacional do Sistema Elétrico* - ONS) the plant operator is committed to follow the procedures of calibration established by ONS, *i.e.* calibration of energy meters every two years[23]. In addition to that, the company will be responsible for the maintenance of the monitoring equipment; for dealing with possible monitoring data adjustments and uncertainties; for review of reported results/data; organising and training, as appropriate, the staff in the appropriate monitoring, measurement and reporting techniques.

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

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

Date of completion of the application of the baseline and monitoring methodology to the project activity: 27/02/2012.

Name of person/entity for completing the baseline section:

Company:	Ecopart Assessoria em Negócios Empresariais Ltda.
Address:	Rua Padre João Manoel, 222
Zip code + city:	01411-000 São Paulo, SP
Country:	Brazil
Phone number:	+55 (11) 3063-9068
Fax number:	+55 (11) 3063-9069
E-mail:	info@eqao.com.br

[23] Sub-módulo 12.3. Metering System Maintenance for Invoincing, in a free translation from the Portuguese *Manutenção do Sistema de Medição para Faturamento*.

Ecopart Assessoria em Negócios Empresariais Ltda. is Project Advisor, *i.e.* the responsible for the application of the baseline and monitoring methodology to the project activity and also Project Participant.

SECTION C. Duration of the project activity / crediting period

C.1 Duration of the project activity:

C.1.1. Starting date of the project activity:

31/12/2003.

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

30y – 0m.

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

The project activity opted for a renewable crediting period.

C.2.1. Renewable crediting period

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

01/01/2011[24].

C.2.1.2. Length of the second crediting period:

7y-0m.

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

Not applicable.

C.2.2.2. Length:

Not applicable.

[24] This Project Design Document corresponds to the *second* crediting period of the proposed CDM project activity. The *first* crediting period was from 01/01/2004 to 31/12/2010.

SECTION D. Environmental impacts

D.1. If required by the host Party, documentation on the analysis of the environmental impacts of the project activity:

As for the regulatory permits, BT Geradora de Energia Elétrica S.A. secured the authorization issued by ANEEL to operate as an independent power producer, which gives the right to operate the PCH Ferradura[25].

As for the environmental permits, the proponent of any project that involves the construction, installation, expansion, and operation of any polluting or potentially polluting activity or any activity capable of causing environmental degradation is required to secure a series of permits from the respective state environmental agency. In addition, any such activity requires the preparation of an environmental assessment report, prior to obtaining construction and operation permits. Three types of permits are required. The first is the preliminary permit (*Licença Prévia* or L.P.) issued during the planning phase of the project and which contains basic requirements to be complied with during the construction, and operating stages. The second is the construction permit (*Licença de Instalação* or L.I.) and, the final one is the operating permit (*Licença de Operação* or L.O.).

The preparation of an Environmental Impact Assessment is compulsory to obtain the construction and the operation licenses. In the process a report containing an investigation of the following aspects was prepared:

- Impacts to climate and air quality.
- Geological and soil impacts.
- Hydrological impacts (surface and groundwater).
- Impacts to the flora and animal life.
- Socio-economical (necessary infra-structure, legal and institutional, etc.).

The project had the following approved specific environmental plan, which involves 6 different programs:

- Environmental education with local communities;
- Water quality control and monitoring;
- Aquatic fauna monitoring program;
- Reforestation;
- Fauna and flora monitoring;
- Conservation units implementation program.

[25] ANEEL resolution nr. 180, dated 01st June, 2000. Available at: <http://www.aneel.gov.br/cedoc/res2000180.pdf>.

The project has the necessary environmental licenses. The operating permit/license were issued by the state environmental agency, State of Rio Grande do Sul Environmental Agency (*Fundação Estadual de Proteção Ambiental Henrique Luiz Roessler* - FEPAM), LO nº 3194/2009-DL. The operating license is valid until June 28th, 2013.

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

The growing global concern on sustainable use of resources is driving the requirement for more sensitive environmental management practices. Increasingly this is being reflected in countries' policies and legislation. In Brazil the situation is not different; environmental rules and licensing process policy are very demanding in line with the best international practices.

The environmental impacts of the Project are considered small by the host country definition of small-hydro plants. By legal definition of the Brazilian Power Regulatory Agency (from the Portuguese *Agência Nacional de Energia Elétrica* - *ANEEL*) - Resolution nr. 394 issued on December 4th, 1998 and Resolution nr. 652 issued on December 9th, 2003 - to be considered small hydro, the utilities must have an installed capacity greater than 1 MW, but not more than 30 MW, and have a reservoir area of less than 3 km². The present SHPP project is have 10.1 MW[2] of installed potency and its reservoir comprises an area equal to 0.5335 km².

The plant possesses preliminary, construction and operation licenses, those licenses must be verified by the National Authority to be renewed, and during the license´s revalidations process the project is submitted to an official audit. Only if all environmental requirements are satisfied, the Agency renews the SHPP operation license. The environmental licenses were issued by the Rio Grande do Sul Environmental Agency (from the Portuguese *Fundação Estadual de Proteção Ambiental Henrique Luiz Roessler* - FEPAM).

SECTION E. Stakeholders' comments

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

Not applicable.

E.2. Summary of the comments received:

Not applicable.

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

Not applicable.

Annex 1

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Annex 2

INFORMATION REGARDING PUBLIC FUNDING

No public funding was or will be used in the present project.

Annex 3

BASELINE INFORMATION

This section is intentionally left blank. For details please refer to section B.6.1. and B.6.3. above.

Annex 4

MONITORING INFORMATION

This section was intentionally left in blank. For details about the monitoring plant of the proposed project activity, please refer to section B.7.2. above.

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