"SALTO PILÃO" HYDROPOWER PLANT PROJECT ACTIVITY

Document Prepared By Ecopart Assessoria em Negócios Empresariais Ltda.

Project Title	"Salto Pilão" Hydropower Plant Project Activity
Version	7.1
Date of Issue	22-May-2019
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1 PROJECT DETAILS

1.1 Summary Description of the Project

The primary objective of Salto Pilão hydropower plant ("UHESP" *from Portuguese Usina Hidrelétrica Salto Pilão*) 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 (run-of-river power plant), social (job creation about 1000 workers in the construction phase, and infra-structure enhancements in surrounded municipalities), and economic sustainability by increasing the share of renewable energy in total electricity consumption for Brazil (and for the region of Latin America[1]).

UHESP consists of the construction of a hydropower plant[2] with a reservoir of 0.15 km^2 under 319m water level[3] and an installed capacity of 191.88 MW[4], located between the cities of Lontras, Ibirama and Apiúna, state of Santa Catarina, Southern region of Brazil. In the absence of the project, electricity would be generated by the operation of grid-connected power plants, including fossil fuel power plants and hydropower plants with large reservoirs. During the first crediting period, it is estimated to generate 311,049 tCO_2e/year.

UHESP is owned by an association of several companies called *Consórcio Empresarial Salto Pilão*. The current consortium structure is as follows[5]:

- Companhia Brasileira de Alumínio (CBA): 60%;
- Camargo Côrrea Geração de Energia S/A (CCGE): 20%; and
- DME Energética Ltda. (DMEE): 20%.

The timeline of the project is as follows:

- EPC (Engineering Procurement and Construction) contracts signature: 23 December 2003;
- Feasibility study for emissions reductions revenues: May 2006;
- Board Decision to re-start the UHESP project: 06 July 2006;
- Addendum EPC contract signing: 12 August 2006;
- Contract closure for carbon consultancy: 1 December 2007;
- Financial closure: 12 and 13 April 2007;
- Construction license issuance: 31 July 2007 / 22 October 2007;
- Operations starting: 11 December 2009.

Although the intent to construct the power plant had begun in 2003, it never took place until now and the construction never started. After a feasibility assessment for carbon revenues in May 2006, the project owner decided in a Meeting of the Consortium Board of Directors in July 2006 to re-start investment, and therefore, the addendum of the EPC contract was signed in August 2006 and project proponents started all procedures to construct the project, as obtaining the construction license and financing.

Although UHESP does not have alone a major relevant impact in the Host Country given its electric system size, it is undoubtedly part of a greater idea. The project activity contributes to sustainable

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[1] Brazil exports electricity for some countries of the Latin America region. Therefore, the project contributes for the increasing the share of renewable energy consumption in Brazil and, indirectly, for some countries in the Latin America region.

[2] "UHE" from the Portuguese Usina Hidrelétrica de Energia.

[3] Operation License # 4055/2012, issued on May 31st, 2012 by the environmental agency of Santa Catarina State (Fundação do Meio Ambiente – FATMA).

[4] Generator tag: 106.600kVA x 0.9 = 95,940 kW x 2 generating units = 191.880MW.

[5] 1st Addedum of the Concession Contract signed July 23rd, 2004 and ANEEL Resolution nr. 1,391 issued on June 3rd, 2008.

development since it meets the needs of the present without compromising the ability of future generations to meet their own needs, as defined by the Brundtland Commission (1987). In other words, the implementation of hydroelectric power plants ensures renewable energy generation, reduces the national electric system demand, avoids negative social and environmental impacts caused by the construction of large hydropower plants with large reservoirs and fossil fuel thermo power plants, and drives the regional economy, increasing quality of life in local communities.

Therefore, it is indisputable that 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 associated to social and economic justice, definitely contributes for the host country's sustainable development.

1.2 Sectoral Scope and Project Type

Salto Pilão Project Activity is not a grouped project. It falls in the category of renewable electricity generation for a grid (energy industries –renewable/non- renewable sources) as established by the Clean Development Mechanism (CDM). Methodologies approved under CDM are also approved under Voluntary Carbon Standard (VCS) as demonstrated at the VCS website: <http://www.v-c-s.org/methodologies.html>.

1.3 Project Proponent

Organization name	Consórcio Empresarial Salto Pilão – CESAP
Contact person	Mr. Luís Cláudio Ribeiro
Title	Manager
Address	Av. Desembargador Vitor Lima, nº. 260 – ático, 88040-400, Florianópolis, SC, Brazil
Telephone	+55 (47) 3353-9116
Email	luis@usinasaltopilao.com.br

1.4 Other Entities Involved in the Project

Organization name	Ecopart Assessoria em Negócios Empresariais Ltda.
Role in the project	VCS advisory company
Contact person	A. Ricardo J. Esparta
Title	Technical director
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1.5 Project Start Date

According to the VCS 2007.1 (18 November 2008), the project starting date is the "*date on which the project began reducing or removing GHG emissions*". Therefore, the UHESP starting date is December 11th, 2009[6], when the first generating unit started operation.

The starting date of the crediting period is considered as the date on which both generating units of UHESP started operations, *i.e.* January 19th, 2010[7]. UHESP will have a maximum of 10 years of crediting period (which can be renewed two times).

1.6 Project Crediting Period

1st crediting period: 19-January-2010[8] to 18-January-2020.

UHESP will have a maximum of 10 years of crediting period (which can be renewed two times).

1.7 Project Scale and Estimated GHG Emission Reductions or Removals

Project Scale	
Project	
Large project	X

Year	Estimated GHG emission reductions or removals (tCO_2e)
Year 2010	295,710
Year 2011	311,049
Year 2012	311,049
Year 2013	311,049
Year 2014	311,049
Year 2015	311,049
Year 2016	311,049
Year 2017	311,049
Year 2018	311,049
Year 2019	311,049
Year 2020	15,339
Total estimated ERs	3,110,494
Total number of crediting years	10
Average annual ERs	311,049

1.8 Description of the Project Activity

[6] ANEEL Ordinance nr. 4,597 issued on December 10th, 2009. Available at ANEEL's website: <http://www.aneel.gov.br/>.

[7] ANEEL Ordinance nr. 102 issued on January 18th, 2010. Available at ANEEL's website: <http://www.aneel.gov.br/>.

[8] ANEEL Ordinance nr. 102 issued on January 18th, 2010. Available at ANEEL's website: <http://www.aneel.gov.br/cedoc/dsp2010102.pdf>.

(i) UHESP is a run-of-river hydropower plant

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 1).

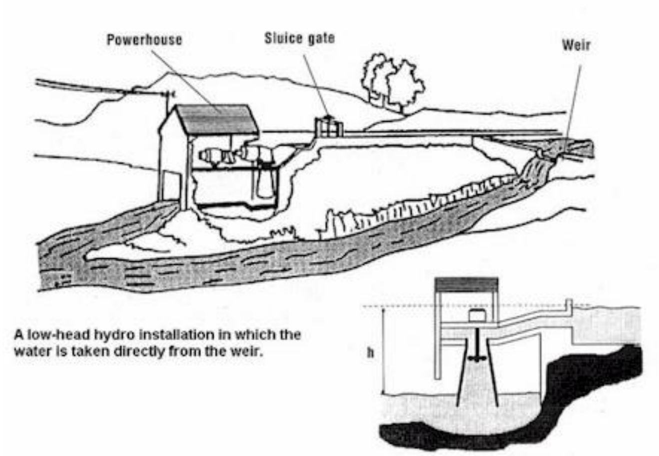

Figure 1 - Schematic view of run-of-river power plant

According to the World Commission of Dams[9], run-of-river projects are defined as:

> "*Dams that create a hydraulic head in the river to divert some portion of the river flows to a canal or power station… Often (they) have no storage reservoir or limited daily pondage. Within these general classifications there is considerable diversity in scale, design, operation and potential for adverse impacts".*

In the case of UHESP[10]:

- Maximum volume of the reservoir: 1,582,827 m^3;
- Average volume of the reservoir: 21,520 m^3;
- Days of pondage at maximum volume of the reservoir (residence time): 0.16 day;
- Days of pondage at average volume of the reservoir (residence time): 0.002 day.

Considering data above, water in UHESP's reservoir has limited daily pondage; it remains in the reservoir less than 1 day. Therefore, the project can be considered a run-of-river power plant according to the presented criteria

In addition, the Operation License of the project nr. 202/2009 issued on July 13th, 2009 by the Environmental Agency of Santa Catarina State (Fundação do Meio Ambiente – FATMA) states that since the project dam has 206 meters and the reservoir has no purpose of water storage for the water flow regularization, the project is classified as a run-of-river project.

(ii) Turbine Technology

The technology employed at UHESP project is established in the industry. The Francis turbine (Figure 2) is the most widely used among water turbines. This turbine is a type of hydraulic reactor turbine in which the flow exits the turbine blades in the radial direction. Francis turbines 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 the penstock and is directed onto the blades by wicket gates. The low momentum water then exits the turbine through a draft tube. In the model, water flow is supplied by a variable speed

[9] WCD (2000). Dams and Development: a new framework for decision-making. World Commision on Dams. UK and USA: Earthscan Publications Ltd. Available at <http://www.unep.org/dams/WCD/report.asp>.

[10] Information was taken from the Consolidated Project Design (from the Portuguese *Projeto Básico Consolidado*) prepared by CNEC Engenharia S/A in May 2008 (chapters 7.2 2 and 11).

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.

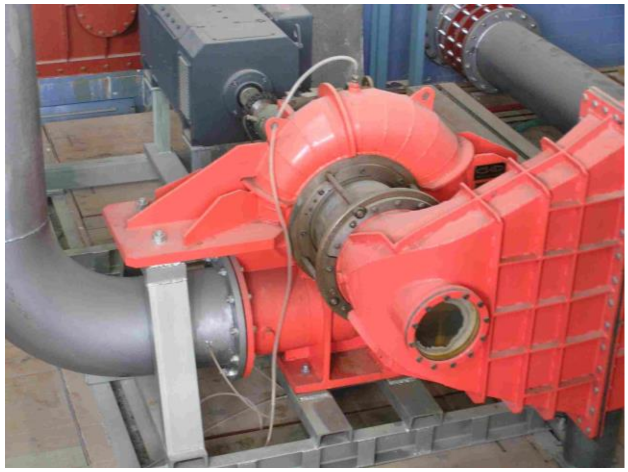

Figure 2 - Example of a Francis turbine

Source: NTUA (2009)[11]

The technology and equipment used in the project were developed and manufactured locally and has been successfully applied to similar projects in Brazil and around the world. Specifications and equipments used in UHESP are presented in Table 1 below.

Table 1- Specifications of the equipment used at UHESP[12]

Turbines	
Type	Francis
Quantity	2
Power (MW)	97.65
Nominal flow (m^3/s)	55.5
Water head (meters)	194
Manufacturer	Voith Siemens
Generators	
Type	Vertical-shaft
Quantity	2
Nominal Power (MVA)	106.6 (95.94 MW)
Tension (kV)	13.8
Frequency (Hz)	60
Manufacturer	Voith Siemens

UHESP reservoir's size is 0.15 km² and gross power density of 1,279.2 W/m^2. As a matter of comparison, the average power density of the Brazilian hydropower plants, totalizing 74,442 MW of installed capacity, is 2.03 W/m^2[13].

[11] 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.

[12] Equipment tag verified during the site visit.

[13] MME (2009). Plano Decenal de Expansão de Energia Elétrica: 2008-2017 / Ministério de Minas e Energia; colaboração Empresa de Pesquisa Energética. – Brasília: MME: EPE, 2009.

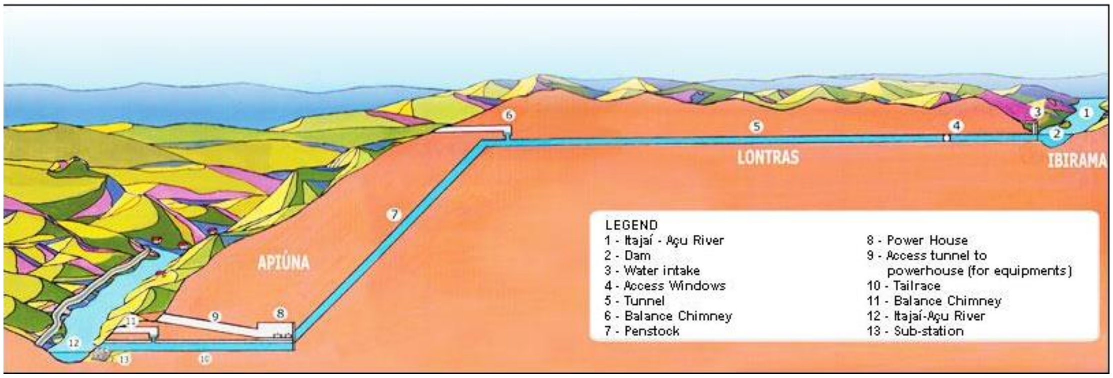

Figure 3 – Simplified Diagram of the UHESP

Source: UHESP (2009)[14]

1.9 Project Location

The project is located in Itajaí-Açú River, between the cities of Lontras, Ibirama and Apiúna, Santa Catarina State, Southern region of Brazil[1].

Figure 4 - Physical location of the cities involved in the project activity

Source: GOOGLE EARTH (2009)[15]

[14] UHESP. Desenho técnico. Consórcio Empresarial Salto Pilão. Available at: <http://www.usinasaltopilao.com.br/>. Accessed on 12 Nov 2009.

[15] GOOGLE EARTH (2009). Brazil's map. Available at: < http://earth.google.com/>. Accessed on 12 Nov 2009.

According to the project license[16], the geographic coordinates of the project activity are 27º 06’ and 27º 08’ S and 49º 28’ and 49º 31’ W.

1.10 Conditions Prior to Project Initiation

Prior to the project activity implementation, there was no hydropower plant or other project activity been implemented in the location of the UHESP 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 (see explanations related to the baseline scenario in section 2.4). In conclusion, the baseline scenario and the scenario without the project activity are the same.

1.11 Compliance with Laws, Statutes and Other Regulatory Frameworks

The project activity is in compliance with all laws and regulations, on the contrary, permissions and licenses would not be issued. The relevant local law and regulations are mentioned below:

Table 2 – Main applicable legislation

Date	Regulation	Regulator	Description
13/04/2009	Law nr. 14,675	Santa Catarina State	It establishes the Environmental Code of the State
10/09/1996	Decree nr. 2,003	Federal	It regulates the electric energy generation.
07/07/1995	Law nr. 9,074	Federal	It establishes regulations for concessions and permissions for public services.
27/05/1998	Law nr. 9,648	Federal	It establishes financial compensations for water use.
19/12/1997	Resolution nr. 237	National Environmental Council	Revision of the procedures and criteria used in the licensing process as a tool for environmental management.
16/09/1987	Resolution nr. 6	National Environmental Council	It establishes the publication default for licensing request, in any other modalities, renewal and concession of licenses
23/01/1986	Resolution nr. 1	National Environmental Council	It establishes general criteria and guidelines for the use and implementation of environmental impact assessment.

1.12 Ownership and Other Programs

1.12.1 Project Ownership

Consócio Empresarial Salto Pilão is the owner of Salto Pilão project. This can be evidenced by contracts and governmental authorizations to explore the hydro potential of Salto Pilão project. All documents was presented to DOE during the on-site visit.

[16] Operation License nr. 202/2009, issued on July 13th, 2009 by the Environmental Agency of Santa Catarina State (FATMA).

1.12.2 Emissions Trading Programs and Other Binding Limits

Not applicable.

1.12.3 Other Forms of Environmental Credit

The project did/does not receive another form of GHG-related environmental credit.

1.12.4 Participation under Other GHG Programs

The project did/does not participate nor seek registration under any other GHG Programs.

1.12.5 Projects Rejected by Other GHG Programs

UHESP project was not rejected by any other GHG program. The VCS Program is the only GHG program that the project participates.

1.13 Additional Information Relevant to the Project

Eligibility Criteria

Not applicable.

Leakage Management

Not applicable.

Commercially Sensitive Information

Not applicable.

Sustainable Development

Not applicable.

Further Information

Not applicable.

2 APPLICATION OF METHODOLOGY

2.1 Title and Reference of Methodology

The project uses the Clean Development Mechanism (CDM) methodology: ACM0002 – "Consolidated baseline methodology for grid-connected electricity generation from renewable sources" (version 11), also approved by the VCS Program.

The ACM0002 also refers to the following tools:
- Tool to calculate the emission factor for an electricity system (version 2);
- Tool for the demonstration and assessment of additionality (version 5.2);
- Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion (version 2);
- Combined tool to identify the baseline scenario and demonstrate additionality (version 2.2).

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

2.2 Applicability of Methodology

ACM0002 methodology is applicable to grid-connected renewable power generation project activities that (a) install a new power plant at a site where no renewable power plant was operated prior to the implementation of the project activity (greenfield plant); (b) involve a capacity addition; (c) involve a retrofit of (an) existing plant(s); or (d) involve a replacement of (an) existing plant(s).

In the case of hydropower plants:

- The project activity is implemented in an existing reservoir, with no change in the volume of reservoir; or
- 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; or
- 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.
- Considering the applicability conditions, UHESP can use ACM0002 methodology as it is a new hydropower plant with a power density greater than 4 W/m^2.

2.3 Project Boundary

According to ACM0002, baseline determination shall only account CO_2 emissions from electricity generation in fossil fuel fired power that is displaced due to the project activity. GHG and emission sources included in or excluded from the project boundary are shown in the table below.

Table 3 – GHG emissions and sources in the baseline and project activity

Source		Gas	Included?	Justification/Explanation
Baseline	CO_2 emissions from electricity generation in fossil fuel fired power plants that are displaced due to the Project Activity.	CO_2	Yes	Main emission source.
		CH_4	No	Minor emission source.
		N_2O	No	Minor emission source.
Project	Emission of CH_4 from the reservoir.	CO_2	No	Minor emission source.
		CH_4	No	No significant emission from reservoir is identified in the project activity, according to the power density calculation.
		N_2O	No	Minor emission source.

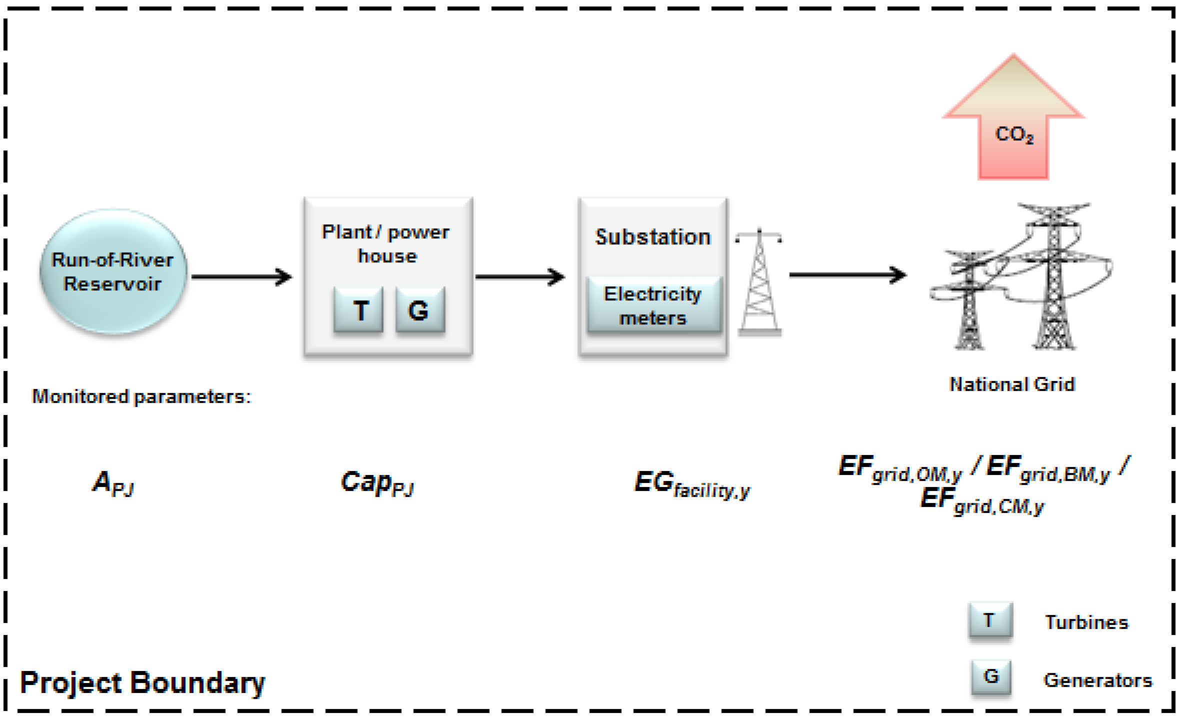

Figure 5 – Flow diagram of the project boundary

2.4 Baseline Scenario

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

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

In the absence of the project activity, electricity delivered to the grid by the project would have otherwise been supplied from other plants of the grid-connected emitting larger quantities of carbon dioxide (CO_2). Therefore, the baseline scenario is identified as the continuation of the current (previous) situation of electricity supplied by large hydro with large reservoirs and thermal power stations operated by fossil fuel (see figure 6 based on information available at ANEEL's website[17]). More information about the baseline scenario is presented in the common practice analysis of the section below.

The baseline emission factor is defined as EF_y and is calculated as a combined margin (*CM*), consisting of the combination of operating margin (OM) and build margin (BM) factors, following the "Tool to calculate the emission factor for an electricity system". Following this tool, UHESP Project utilizes the "*delineation of the project electricity system and connected electricity systems*" published by the Brazilian DNA in its Resolution nr. 8, which defines a single system for the Brazilian Interconnected Grid, covering all the five geographical regions of the country (North, Northeast, South, Southeast and Midwest).

2.5 Additionality

The description of how the emissions of GHG by source in baseline scenario are reduced below those that would have occurred in the absence of the project activity is demonstrated through the "Tool for the demonstration and assessment of additionality", as referred in ACM0002 used in this project, which is very similar to VCS 2007.1 (Test 1 – project test).

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

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

The project is not mandated by any enforced law, statute or other regulatory framework.

Alternatives to the proposed project activity are:

Alternative 1: Continuation of the present scenario, with the supply of electricity from the Brazilian interconnected grid;
Alternative 2: The implementation of the project without incentives/revenues from voluntary carbon markets.

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

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

- The National Electric System Operator (*ONS* from the Portuguese *Operador Nacional do Sistema Elétrico*);
- The Electricity Regulatory Agency (*ANEEL* from the Portuguese Agência Nacional de Energia Elétrica);
- The Mines and Energy Ministry (*MME* from the Portuguese *Ministério de Minas e Energia*);
- The Chamber of Electric Energy Commercialization (*CCEE* from the Portuguese *Câmara de Comercialização de Energia Elétrica*);
- The Santa Catarina Environmental Agency (*FATMA* from the Portuguese *Fundação do Meio Ambiente*);
- The VCS Board.
- Relevant local law and regulations related to the project activity are presented in section 1.10 of this PD.

SATISFIED/PASS – Proceed to Step 2

[17] ANEEL (2009a). Capacidade de geração do Brasil. Banco de Geração de Informação – BIG. Available at: <http://www.aneel.gov.br/aplicacoes/capacidadebrasil/capacidadebrasil.asp>. Accessed on 12 Nov 2009.

Step 2. Investment analysis

The "Tool for the demonstration and assessment of additionality" refers to the "Guidelines on the assessment of investment analysis" and, therefore, these guidelines were used in the following analysis.

Sub-step 2a. Determine appropriate analysis method:

Once the project activity generates other financial benefit other than the carbon generation related income (sale of energy) Option I could not be chosen. Option III is more appropriate when compared to Option II because there are no other options of investment from the project owner perspective. Therefore, additionality is demonstrated through benchmark analysis (option III).

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

According to the "Tool for the demonstration and assessment of additionality", discount rates and benchmarks shall be derived from:

(a) Government bond rates, increased by a suitable risk premium to reflect private investment and/or the project type, as substantiated by an independent (financial) expert or documented by official publicly available financial data;
(b) Estimates of the cost of financing and required return on capital (*e.g.* commercial lending rates and guarantees required for the country and the type of project activity concerned), based on bankers views and private equity investors/funds' required return on comparable projects;
(c) A company internal benchmark (weighted average capital cost of the company), only in the particular case referred to above in paragraph 5. The project developers shall demonstrate that this benchmark has been consistently used in the past, *i.e.* that project activities under similar conditions developed by the same company used the same benchmark;
(d) Government/official approved benchmark where such benchmarks are used for investment decisions;
(e) Any other indicators, if the project participants can demonstrate that the above Options are not applicable and their indicator is appropriately justified.

The benchmark used to be compared with the IRR of UHESP project is the Weighted Average Cost of Capital (WACC) calculated based on standard parameters well known and used in the electricity sector. Therefore, option (e) is chosen[18].

The financial indicator identified for the Salto Pilão project is the project Internal Rate of Return (IRR). The IRR here presented is compared to the appropriate benchmark, which is the Weighted Average Cost of Capital (WACC) as presented above.

Weighted Average Cost of Capital (WACC)

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

The WACC calculation is based on parameters that are standard in the market, considers the specific characteristics of the project type, and is not linked to the subjective profitability expectation or risk profile

[18] Detailed information related to the option chosen is presented in the Validation Protocol (Project Participants response of CAR BQA 1).

of this particular project developer. The WACC as of the project's financial analysis decision date was of 9.36%. For the WACC calculation, the following equation was used:

WACC = Wd x Kd + We x Ke, where:

We and **Wd** are, respectively, the weights of equity and debt typically observed at the sector. **We** is of 35%, and **Wd** of 65%. These numbers derive from the typical leverage of similar projects in the sector in Brazil, based on the rules for available long term loans from Brazilian Development Bank (from the Portuguese *Banco Nacional de Desenvolvimento Econômico e Social - BNDES*).

Kd is the cost of debt, which is observed in the market related to the project activity, and which already accounts for the tax benefits of contracting debts. **Kd** is of 5.02%, and also derives from long term loans applied to the sector in Brazil, and therefore is based on BNDES financing endeavour credit line's interest rates.

Ke is the cost of equity, estimated through the Capital Asset Pricing Model (CAPM). **Ke** is of 17.43%. **Ke** derives from a risk free rate plus the market risk premium adjusted to the sector through Beta. The risk-free rate, the market risk premium, and the Beta have been calculated based on publicly available data and presented to the DOE.

Plugging these numbers into WACC formulae:

WACC = 65% X 5.02% + 35% X 17.43% = 9.36%

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

Internal Rate of Return (IRR)

The cash flow of the project activity, containing the calculation of the project IRR of the project activity have been presented to the DOE in a separate annex to this VCS-PD.

During the 4th verification of the project the DOE has requested to reflect changes in the installed capacity and assured energy occurred in the VCS-PD independently of previous verifications and Monitoring Reports, which already considered the change. In order to demonstrate that the project remains additional, the cash flow of the project was revised to reflect these changes. Therefore, three analyses are evaluated in this PD considering:

a) The original cash flow: all parameters considered at the time of investment decision as required by the "Guidelines on the assessment of investment analysis", which all documented evidence was made available at the time of the project validation and registration;
b) The revised cash flow – assured energy: all parameters considered at the time of the investment decision, changing the assured energy of the project only (the key parameter), based on the following legislation:

Table 4 – Assured energy of the project

Assured Energy	Applied Period	Legislation
106.7MW-ave	2010-2011	Concession contract # 15/2002
109MW-ave	2012-2017	MME Ordinance #35 issued on 22/05/2012
114.1MW-ave	2018 onwards	MME Ordinance #178 issued on 3/05/2017

c) The revised cash flow – monitored electricity generation: all parameters considered at the time of the investment decision, changing the electricity generated by the project according to previous verifications.

The analysis resulted in the following Internal Rates of Return:

Table 5 – Project IRR analysis

Scenario	IRR (%)
a) Investment decision timing	7.25
b) Revision of assured energy	7.64
c) Monitored electricity	8.22

While reassessing additionality, scenario b) is applicable since it considers what would be the project IRR if the assured energy increase was considered since the conception of the project (at the time of the investment decision). In addition, the DOE has requested to present scenario c) in order to demonstrate that the project is still additional while considering electricity monitored during verifications.

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

This number shows that the IRR of the project is lower than the benchmark. Hence, it is evident that the project activity is not financially attractive to the investor (Table 6).

Table 6– Comparison between Project's IRR and investor's WACC

Project	IRR (%)	WACC (%)
a) Investment decision timing	7.25	9.36
b) Revision of assured energy	7.64	
c) Monitored electricity	8.22	

Sub-step 2d: Sensitivity analysis

The sensitivity analysis, as established by the "Guidelines on the Assessment of Investment Analysis", is to be conducted considering variables that constitute more than 20% of either total project costs or total project revenues, including initial investment costs. In addition, it suggests that variations should cover a range of +10% and -10%. Hence, variations were done increasing project's revenues (varying the energy price and plant load factor) and, reducing investment expenses and operation and maintenance costs. The results are presented below.

Table 7– Results of IRR while conducting a sensitivity analysis

Salto Pilão	Investment decision timing (%)	Revision of assured energy (%)	Monitored electricity(%)
Original	7.25	7.64	8.22
Price Sensitivity	8.94	9.36	10.07
PLF Sensitivity	8.14	8.54	8.65
Investment Sensitivity	8.24	8.64	9.29
Costs Sensitivity	8.08	8.48	9.12

Under scenarios analyzed above, the only scenario which IRR surpasses the benchmark is when the energy price increase 10% while considering the verified electricity generation during verifications. According to the *"Guidelines on the assessment of investment analysis"*, the probability of the occurrence of scenario which IRR surpasses the benchmark shall be analyzed. However, as the project is already implemented, a reasonable approach is to analyze incurred revenues (energy generation and price), as well as incurred costs (investment and operational costs). Therefore, another analysis was conducted:

d) Realized cash flow: actual values incurred to the project (electricity monitored, capex, opex, operational costs, depreciation, etc) based on financial statements.

Table 8 – Project IRR analysis – incurred values

Scenario	IRR (%)	Benchmark (%)
d) Realized values	8.84	9.36

Up to 2017, realized investment and operating expenses considered in the cash flow revision are based on annual financial statements. Regarding the energy price, the companies commercialized electricity differently: Cia. Geração de Energia Pilão (CGEP) and DME Energética have signed power purchase agreements and CBA uses electricity for self-consumption. Therefore, the energy price of CGEP and DME is based on power purchase agreements adjusted to the Extended Consumer Price Index (IPCA). For the CBA energy price, 2019 DCIDE market curve is deflated for the previous period. From 2019 onwards, the expected inflation on average term from the Focus Bulletin is considered.

For 2018 and 2019, operating expenses consider the forecast budget approved on the 27th Minutes of Meeting of the Consortium Board. For the uncoming years, operating expenses were inflated based on the expected inflation on average term from the Focus Bulletin.

Regarding capex for the 2018 – 2023 period, the forecast budget approved on the 27th Minutes of Meeting of the Consortium Board is considered. From 2024 onwards, estimative is based on 0.3% of total assets[19]. All documented evidence was presented to DOE during validation.

While analyzing the realized scenario (operational project), the IRR remains lower to the benchmark. It can be concluded that, in spite of the assured energy revision and a higher energy price, investment and costs also increased.

Outcome: The IRR of the project at the time of the investment decision was 7.25%, which is lower than the benchmark of 9.36%. Even if the increase in the assured energy and installed capacity were considered at the time of the investment decision, the project attractiveness (7.64%) remains below the benchmark. Under the sensitivity analysis, the project is not financially attractive to the investor even when variables change in favor of the project; the only possible scenario which IRR is higher than then benchmark is when applying +10% in energy price for scenario c) monitored electricity above. However, while assessing the realized values incurred to the project, it can be concluded that the project remains financially not attractive to investor. Therefore, the assured energy increase does not change the initial conclusion of the project additionality. For this reason, the most plausible alternative to the project continues to be the electricity supply by other grid-connected power plants (alternative 1).

SATISFIED/PASS – Proceed to Step 3 or 4

Step 3. Barrier analysis

Not applicable.

Step 4. Common practice analysis

For the common practice analysis, the GHG Protocol for Project Accounting (chapter 7) is used. All information required in the Additionality Tool is also required in the GHG Protocol, however the GHG Protocol has a more detailed/objective criteria than the "Tool for the demonstration and assessment of additionality". Therefore, the following steps are assessed:

(i) Define the product or service provided by the project activity;
(ii) Identify possible types of baseline candidates;
(iii) Define and justify the geographic area and the temporal range used to identify baseline candidates;

[19] Due to the forecast investment inclusion, the fair value of the project was included in the end of the assessment period following the "Guidelines on the assessment of investment analysis".

(iv) Define and justify any other criteria used to identify baseline candidates;
(v) Identify a final list of baseline candidates;
(vi) Identify baseline candidates that are representative of common practice (for the project-specific baseline procedure).

(i) Define the product or service provided by the project activity

The product that will be provided by Salto Pilão project activity is the kilowatt-hours of electricity supplied to the interconnected grid.

(ii) Identify possible types of baseline candidates

As mentioned above, alternatives to the project activity are: the continuation of the current situation (with electricity generated by large hydroelectric with large reservoirs and thermal power fossil fuel stations) or the implementation of the proposed project activity without carbon credits incentives. Therefore, both alternatives deliver the same product.

Considering explanations above, baseline candidates should be all the electricity-generating technologies connected to the grid.

In the Figure 6, it is presented Brazil's electricity matrix, which clearly demonstrates that the main source of electricity generation comes from hydropower plants.

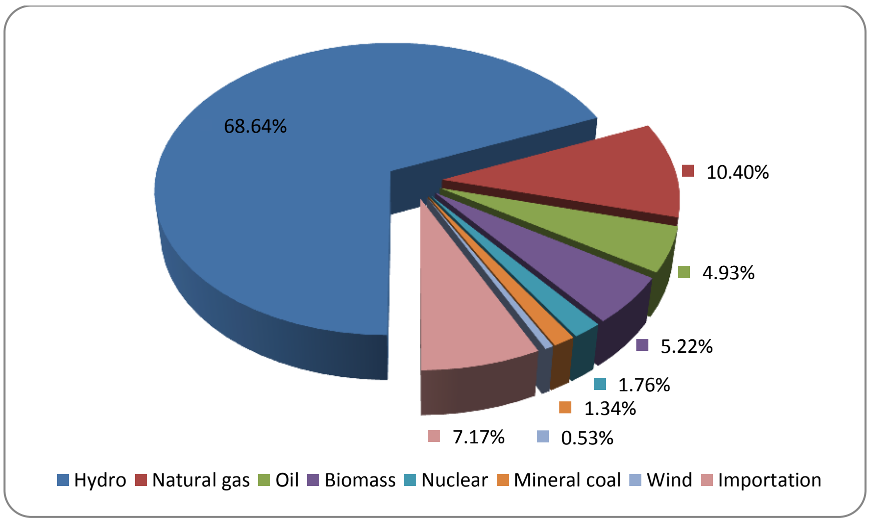

Figure 6 – Brazil's electricity matrix

Source: ANEEL (2009a)[20]

However, as mentioned in the GHG Protocol for Project Accounting, the *"availability and nature of substitute products or services for the project activity should be considered in identifying baseline candidates with the 'same' product or service*". Therefore, since Salto Pilão is a hydropower plant project and, thus, generates renewable energy to the grid, the nature of electricity generation of a renewable energy project cannot be compared to the ones provided through fossil fuel consumption. Even among

[20] ANEEL (2009a). Capacidade de geração do Brasil. Banco de Geração de Informação – BIG. Available at: <http://www.aneel.gov.br/aplicacoes/capacidadebrasil/capacidadebrasil.asp>. Accessed on 12 Nov 2009.

renewable generation technologies, differences are huge and it is not reasonable to compare a hydropower plant, as it is the case of Salto Pilão, with wind, solar or small hydro power plants[21] projects.

Considering explanations above, only **hydropower plants**, *i.e.*, hydropower plant with installed capacity above 30 MW, were included in this common practice analysis. Furthermore, only plants with installed capacity 50% lower and 50% higher than Salto Pilão project were analyzed (*i.e.* between 95.94 and 287.82 MW).

(iii) Define and justify the geographic area and the temporal range used to identify baseline candidates

- Geographic area

Brazil has an extension of 8,514,876.599 square kilometres[22] (with over 4,000 km distance in the north-south as well as in the east-west axis) and 6 distinct climate regions: sub-tropical, semi-arid, equatorial, tropical, highland-tropical and Atlantic-tropical (humid tropical). These varieties of climate obviously have strong influence in the technical aspects related to a hydropower plant implementation.

In addition, hydroelectric projects can differ significantly from each other considering the region to be implemented, climate, topography, availability of transmissions lines, river flow regularity, etc. For those reasons alone it is extremely difficult and not reasonable to compare different hydropower potential and plants. Moreover, hydro-power plants cannot be optimally placed (close to load centers and transmission lines) and easily transferred (moved to a new region where a better tariff is offered) as, for example, modular fossil-fuel-fired (diesel, natural gas) power plants. Differences may be even larger if no big water storage is possible.

Considering information above, only hydropower plants located in the same region of Salto Pilão project were analyzed – **Southern region of Brazil**, which is composed by Paraná (PR), Santa Catarina (SC) and Rio Grande do Sul (RS) States.

It is important to mention that, as mentioned above, depending on the project location, differences related to the technical aspects have influence for hydropower plant projects implementation even if hydro projects are located in the same region. Considering that technical differences obviously have influence in the investment/financing of a project and that project sponsors have different investment capacity, financial information should be considered when hydro projects are analyzed. However, Project Participants decided to do their upmost in making a reasonable comparison for the purpose of common practice analysis even without investment information available.

- Temporal range

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 investment capacity of the State, the government started the privatization process. However, by the end of 2000 results were still modest. Further initiatives, aiming to improve electric generation in the country, were taken between the 1990’s and 2003; however it 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 the investments in the electric energy sector. The market rules were changed and new institutions were created as Energetic Research Company (in a free translation from the Portuguese *Empresa de Pesquisa Energética – EPE*) – an institution that would become responsible for the long term planning of the electrical sector with role of evaluating, on a perennial basis, the safety of the supply of electric power – and Chamber for the Commercialization of Electric Power (in a free translation from the Portuguese *Câmara de Comercialização de Energia Elétrica – CCEE*) – an institution

[21] According to the Brazilian legislation (ANEEL Resolution nr. 652 dated December 9th, 2003), small hydropower plant must have installed capacity between 1 MW and 30 MW, and have a reservoir area smaller than 3 km².

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

to manage the commercialization of electric power within the interconnected system. This new structure was approved by the House of Representatives and published in March of 2004[23]. Given the new regulatory framework and investment climate, Project Participants considered only projects starting after **March of 2004**.

(iv) Define and justify any other criteria used to identify baseline candidates

Generally, hydropower plants constructed in Brazil have large reservoirs, conferring a low power density. Hydropower plants with large reservoirs are preferred from the government's point of view than those that have small reservoirs or run-of river plants since they have fewer risks of supply. Therefore, the average of power density of the Brazilian hydropower plants is 2.03 W/m^2[24].

Considering explanations above, the technology used in Salto Pilão project - conferring a power density of 1,279.2 W/m^2 -, cannot be compared to the ones with large reservoirs. Thus, only hydropower plants with **power density greater than 4 W/m^2** (under ACM002 methodology eligibility criteria) were included in this common practice analysis.

(v) Identify a final list of baseline candidate

According to the criteria mentioned above, only hydropower plants (*i.e.* between 95.94 and 287.82 MW) located in the Southern region of Brazil (Paraná, Santa Catarina and Rio Grande do Sul States) with operations started from March 2004 and under the ACM0002 eligibility criteria (power density greater than 4 W/m^2) were analyzed.

Considering information above, Project Participants researched about the generating units of hydropower plants from 2004 to 2008 (the most recent data available at the time of completing this document). Also, it can be identified the hydropower plants that received carbon credits incentives or not.

Table 9 - Projects considered for the common practice analysis

Year	Project	State	Total installed capacity (MW)	Reservoir area (km^2)	Power density	Incentive
2004	Monte Claro	RS	130.0	1.0	130.0	CDM
2005	Santa Clara	PR	120.0	20.1	6.0	CDM
2006	Fundão	PR	120.2	2.5	48.1	CDM
2007	-					
2008	Castro Alves	RS	130.0	5.0	26.0	CDM
	14 de Julho	RS	100.0	5.0	20.0	CDM

Source: ANEEL (2009b)[25] and UNFCCC (2009)[26]

Considering Table 9, all hydropower plants that started operations in the Southern region received carbon credits incentives to be developed. In spite of the revision in the installed capacity of the project (from

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

[24] MME (2009). Plano Decenal de Expansão de Energia Elétrica: 2008-2017 / Ministério de Minas e Energia; colaboração Empresa de Pesquisa Energética. – Brasília: MME: EPE, 2009.

[25] ANEEL (2009b). Fiscalização dos serviços de geração. Acompanhamento da expansão da oferta de geração de energia elétrica. Resumo geral do acompanhamento das usinas de geração elétrica - Versão fevereiro de 2009. Available at: <http://www.aneel.gov.br/area.cfm?idArea=37&idPerfil=2>. Accessed on 26 Feb 2009.

[26] UNFCCC. Project activities. Validation. Available at: <http://cdm.unfccc.int/Projects/Validation/index.html>. Accessed on 12 Nov 2009.

182.3MW to 191.88MW), it does not change the results of the common practice analysis and no additional hydropower plant was found similar to UHESP. This result demonstrates that is required a strong incentive to develop renewable energy projects in Brazil. In the case of hydropower plants, large reservoirs are the common practice and the small ones require some kind of incentive to reduce risks related to the nature of this technology.

All projects included in this analysis are in accordance with legal requirements according to publicly available information.

(vi) Identify baseline candidates that are representative of common practice (for the project-specific baseline procedure).

Common practice in Brazil has been the construction of large-scale hydroelectric plants with large reservoirs – which present low risks for the energy supply and, therefore, are preferred from the government's point of view – and, more recently, of thermal fossil fuel plants, with natural gas, which also receive incentives from the government. As of January 2009 17.73% of the power generated in the country comes from thermal power plants, and this number tends to increase in the next years, once 37.47% of projects approved between 1998 and 2009 were thermal power plants[27].

In the most recent energy auctions, which took place on September 17th, 2008 and September 30th, 2008 34 plants negotiated their electricity to be sold from 2011 on (10 plants are expected to become operational on 2011 and the other 24 plants are scheduled to export energy from 2013 on), of which only one was a hydropower plant, one was a thermal plant fuelled with sugar cane bagasse, and the other 24 plants were fossil fuel thermal plants[28].

In summary, the proposed project activity cannot be considered as common practice and therefore is not a business as usual type scenario. And it is clear that, in the absence of the incentive created carbon credits incentives, this project would not be the most attractive scenario. Thus, the most plausible alternative would be the continuation of the present scenario, with the electricity supplied by other plants of the Brazilian interconnected grid (alternative 1).

SATISFIED/PASS – Project is ADDITIONAL

2.6 Methodology Deviations

No methodology deviations are applied to the project activity. However, during the 4th verification of the project, the PD was revised to reflect changes in the installed capacity and assured energy already indicated in the Monitoring Report from previous verifications of the project.

Revisions in energy assured and installed capacity are due to lower loss load than estimated given the expansion of the headrace tunnel during the construction period. It causes a decrease in the pressure drop and, consequently, an increase in the net head, allowing the increase in the electricity generation and, consequently, in installed capacity and assured energy. Specifications of the equipment installed in the plant allowed this power increase.

[27] ANEEL – *Agência Nacional de Energia Elétrica* (Brazilian power regulatory agency). Banco de informação de Geração. 2009. Available at <http://www.aneel.gov.br/area.cfm?idArea=15&idPerfil=2>.

[28] All information of the actions is publicly available at CCEE's website: <www.ccee.org.br>.

Additionally, the installed capacity of the project increased from 182.3 MW to 191.88 MW[29] and assured energy increased from 106.7MW-ave to 109MW-ave and, later, to 114.1MW-ave due to underestimated historic of river flow rate.

Assured Energy	Legislation
106.7MW-ave	Concession contract # 15/2002
109MW-ave	MME Ordinance #35 issued on 22/05/2012
114.1MW-ave	MME Ordinance #178 issued on 3/05/2017

Detailed description on project changes is presented in CNEC Technical Report which was presented to ANEEL. ANEEL approved the project changes, including installed capacity, as can be seen in ANEEL Resolution #3,303 issued on 17/01/2012. Regarding the revision of assured energy, it was approved by the Brazilian Mines and Energy Ministry ("MME" from the Portuguese Ministério de Minas e Energia) as can be seen in MME Ordinance #35 issued on 22/05/2012 (109MW-ave) and MME Ordinance #178 issued on 03/05/2017 (114.1MW-ave).

In order to demonstrate that changes do not impact applicability of the methodology, additionality and the appropriateness of the baseline scenario, the Project Participant analyzed each criteria based on ACM0002 (v.11) as follows.

1) Applicability of the Methodology

The project was registered under ACM0002 (v. 11), which is applicable under the following conditions:

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

Changes in the project do not impact on the conclusion in the registered PD, *i.e.* UHESP continues to be a hydropower plant ("UHE" from the Portuguese Usina Hidrelétrica de Energia) located in Santa Catarina State, Southern region of Brazil, with the purpose of renewable electricity generation to the National Interconnected Grid.

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

Condition above remains not applicable since the project continues to not involve capacity additions, retrofits or replacements. No equipment was installed or replaced due to changes in the project.

- ✓ *In case of hydro power plants, one of the following conditions must apply:*
  - *The project activity is implemented in an existing reservoir, with no change in the volume of reservoir; or*

[29] Regarding the installed capacity, the Project Proponent – through a VCS advisory company – exchanged e-mails with the VCS Team requesting procedures in this case. Then, an official letter was sent by the VCS Team on March 30th, 2012 stating that the Project Proponent should include project changes in the Monitoring Report (monitoring deviation section) as changes did not result in modification or retrofit.

- *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; or*
- *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.*

Considering the project revised installed capacity, its power density is 1,279.2 W/m^2 (191.88 MW ÷ 0.15km^2 = 1,279.2 MW/km^2 or 1,279.2 W/m^2), *i.e.* continues to be higher than 4W/m^2.

2) Re-assessment of Additionality

Regarding the project additionality, changes in the project installed capacity and energy assured do not impact on the alternatives to project activity or the common practice results since project scale, location and generated products remained the same. In spite of post-changes have no impact on the timing of the investment decision nor assumptions available and considered at that time, a re-assessment of additionality was conducted in section 2.5 above. As presented in section 2.5, the project activity remains additional.

3) Applicability of the Baseline Scenario

According to the registered PD, the baseline scenario is the one described in ACM0002 (v.11):

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

As concluded in the re-assessment of the investment analysis, the baseline scenario identified to the project activity remained the same.

In conclusion, the UHESP remains additional.

3 QUANTIFICATION OF GHG EMISSION REDUCTIONS AND REMOVALS

3.1 Baseline Emissions

Baseline emissions are calculated using the annual electricity dispatched to the grid (EG_y) times the CO_2 baseline emission factor (EF_y), as follows:

$$BE_y = EG_{\mathrm{PJ,y}} \cdot EF_{grid,CM,y} \qquad \textbf{Equation 1}$$

Where:
BE_y = Baseline emissions in year y (tCO_2/yr);
$EG_{PJ,y}$ = Quantity of net electricity generation that is produced and fed into the grid as a result of the implementation of the CDM project activity in year y (MWh/yr);
$EF_{grid,CM,y}$ = Combined margin CO_2 emission factor for grid connected power generation in year y calculated using the latest version of the "*Tool to calculate the emission factor for an electricity system*" (tCO_2/MWh).
For Greenfield projects installed at a site where no electricity generation occurred previously, as it is the case of the proposed project activity, the calculation of $EG_{PJ,y}$ is as follows:

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

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

Baseline emission factor ($EF_{grid,CM,y}$)
According to the selected approved methodology ACM0002, the baseline emission factor (EF_y) is calculated using the methodological tool "*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 - Identify the group of power units to be included in the build margin (BM).
STEP 6 - Calculate the build margin emission factor.
STEP 7 - 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 this information is 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 May 26th, 2008, which defines the Brazilian Interconnected Grid as a single system that covers all the five macro-geographical regions of the country (North, Northeast, South, Southeast and Midwest). Hence, this figure will be used to calculate the baseline emission factor of the grid.

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

Project participants may 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.

The Brazilian DNA made available the emission factor calculation based on information of the grid power plants only – option (i) – following the "*Tool to calculate the emission factor for an electricity system*". More information of the methods applied can be obtained in the DNA's website (http://www.mct.gov.br/index.php/content/view/4016.html).

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

The calculation of the operating margin emission factor ($EF_{grid,OM,y}$) is based on one of the following methods:
(a) Simple OM, or
(b) Simple adjusted OM, or
(c) Dispatch data analysis OM, or
(d) Average OM.

The Brazilian DNA made available the operating margin emission factor calculated using option c – Dispatch data analysis OM. Accordingly to the "*Tool to calculate the emission factor for an electricity system*", when this is the chosen option to calculate the operating margin the emission factor has to be up-dated annually. Hence, and the *ex-post* vintage will be used in the project activity.

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

The dispatch data analysis OM emission factor ($EF_{grid,OM-DD,y}$) is determined based on the power units that are actually dispatched at the margin during each hour *h* where the project is displacing electricity. This approach is not applicable to historical data and, thus, requires annual monitoring of $EF_{grid,OM-DD,y}$.
It will be calculated using the below formulae:

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

Equation 3

Where:
$EF_{grid,OM-DD,y}$= Dispatch data analysis operating margin CO_2 emission factor in year *y* (tCO_2/MWh);
$EG_{PJ,y}$ $EG_{PJ,h}$ = Electricity displaced by the project activity in hour *h* of the year *y* (MWh);
$EF_{EL,DD,h}$ $EF_{EL,DD,h}$ = CO_2 emission factor for power units in the top of the dispatch order in hour *h* in year *y* (tCO_2/MWh);
$EG_{PJ,y}$ = Total electricity displaced by the project activity in year *y* (MWh);
h = Hours in year *y* in which the project activity is displacing grid electricity;
y = Year in which the project activity is displacing grid electricity.

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

- **STEP 5** – Identify the group of power units to be included in the build margin (BM)

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.

The build margin will also be calculated by the DNA. The number is published on the website and for estimation purposes the data for the most recent year will be used.

- **STEP 6** – Calculate the build margin mission factor ($EF_{BM,y}$)

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

$$EF_{grid,BM,y} = \frac{\sum_{m} EG_{m,y} \times EF_{EL,m,y}}{\sum_{m} EG_{m,y}}$$

Equation 4

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

The Brazilian DNA made available the build margin emission factor calculated following the "Tool to calculate the emission factor for an electricity system", approved by the CDM Executive Board. This parameter will be annually up-dated applying the numbers provided by the Brazilian DNA. The number is published on the website and for estimation purposes the data for the most recent year will be used.

- **STEP 7** – Calculate the combined margin (CM) emissions factor $EF_{y.}$

The combined margin is calculated as follows:

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

Where:
w_{OM} = weighting of operating margin emissions factor (%);
$EF_{OM\ y}$ = Operating margin CO_2 emission factor in year y (tCO_2/MWh);
w_{BM} = weighting of build margin emissions factor (%);
$EF_{BM,\ y}$ = Build margin CO_2 emission factor in year y (tCO_2/MWh).

According to the emission factor tool, wind and solar power generation project activities shall use the default values of w_{OM} = 0.75 and w_{BM} = 0.25 for the first crediting period and for subsequent crediting periods. All other projects shall use the default values of w_{OM} = 0.5 and w_{BM} = 0.5 for the first crediting period, and w_{OM} = 0.25 and w_{BM} = 0.75 for the second and third crediting period, unless otherwise specified in the approved methodology which refers to this tool.

For estimation purposes, the most recent available data (2008) from the hourly emission factor provided by the Brazilian DNA was applied. When applying the estimate figures in the formula presented above, the $EF_{grid,OM\text{-}DD,y}$ obtained is:

$EF_{grid,OM\text{-}DD,\ 2008}$ = 0.4766 tCO_2e/MWh.

The average building margin for the considered years is:

$EF_{BM,\ 2008}$ = 0.1458 tCO_2e/MWh.

With these numbers, applying in the formula presented in step 6 above, we have:

$EF_{2008} = 0.5 \times 0.4766 + 0.5 \times 0.1458$

EF_{2008} = 0.3112 tCO_2e/MWh

Quantity of net electricity generation supplied by the project plant/unit to the grid ($EG_{facility,y}$)

Estimated electricity exported to the grid by the project is estimated based on the energy assured as established by the MME Ordinance #178 issued on 03/05/2017. Considering an energy assured of 114.1 MW-average and 8,760 hour of operation in a year, Salto Pilão is expected to export 999,516 MWh/year.

Considering Equation 2 and the expected annual electricity delivery to the grid by the project, baseline emissions are as follows:

Table 10– Baseline emissions of Salto Pilão project during the first crediting period

Years	Net energy generation (MWh)	Days of operation	Baseline emissions (tCO2e)	Nr. years
2010	950,225	347	295,710	1st
2011	999,516	365	311,049	2nd
2012	999,516	365	311,049	3rd
2013	999,516	365	311,049	4th
2014	999,516	365	311,049	5th
2015	999,516	365	311,049	6th
2016	999,516	365	311,049	7th
2017	999,516	365	311,049	8th
2018	999,516	365	311,049	9th
2019	999,516	365	311,049	10th
2020	49,291	18	15,339	11th
TOTAL	9,995,160	3,650	3,110,494	**11**

3.2 Project Emissions

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

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

Where:
PE_y = Project emissions in year y (tCO_2e/yr);
$PE_{FF,y}$ = Project emissions from fossil fuel consumption in year y (tCO_2/yr);
$PE_{GP,y}$ = Project emissions from the operation of geothermal power plants due to the release of non-condensable gases in year y (tCO_2e/yr);
$PE_{HP,y}$ = Project emissions from water reservoirs of hydro power plants in year y (tCO_2e/yr).

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

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

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

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

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

New hydro electric power projects resulting in new reservoirs, shall account for CH_4 and CO_2 emissions from reservoirs, estimated as follows:
a) if the power density (*PD*) of power plant is greater than 4 W/m^2 and less than or equal to 10 W/m^2:

$$PE_y = \frac{EF_{Res} \times TEG_y}{1000}$$ **Equation 7**

Where:
PEy = Emission from reservoir expressed as tCO_2e/year;
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 (*PD*) of the project is greater than 10W/m^2, PE_y = 0.
The power density of the project activity is calculated as follows:

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

Where:
PD = Power density of the project activity, in W/m^2.
Cap_{PJ} = Installed capacity of the hydro power plant after the implementation of the project activity (W).
Cap_{BL} = Installed capacity of the hydro power plant before the implementation of the project activity (W). For new hydro power plants, this value is zero.
A_{PJ} = Area of the 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.

As mentioned in section 4.1 above, the only GHG emissions applicable to Salto Pilão project is from water reservoirs of hydro power plants ($PE_{HP,y}$). However, considering that the project has a power density of 1,279.2 W/m^2, there are no project emissions involved in the project.

3.3 Leakage

According to the methodology, "*no leakage emissions are considered. The main emissions potentially giving rise to leakage in the context of electric sector projects are emissions arising due to activities such as power plant construction and upstream emissions from fossil fuel use (e.g. extraction, processing, and transport). These emissions sources are neglected".* Therefore, leakage of Salto Pilão is 0 tCO_2/year.

3.4 Net GHG Emission Reductions and Removals

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

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

Where:
ER_y = Emission reductions in year y (tCO_2e/yr);
BE_y = Baseline emissions in year y (tCO_2e/yr);
PE_y = Project emissions in year y (tCO_2e/yr).

Considering equation 1, estimated emission reductions of Salto Pilão project is presented in the table below.

Table 11– Emission reductions of Salto Pilão project during the first crediting period

Year	Estimated baseline emissions or	Estimated project emissions or	Estimated leakage	Estimated net GHG emission

	removals (tCO_2e)	removals (tCO_2e)	emissions (tCO_2e)	reductions or removals (tCO_2e)
Year 2010	295,710	0.00	0.00	295,710
Year 2011	311,049	0.00	0.00	311,049
Year 2012	311,049	0.00	0.00	311,049
Year 2013	311,049	0.00	0.00	311,049
Year 2014	311,049	0.00	0.00	311,049
Year 2015	311,049	0.00	0.00	311,049
Year 2016	311,049	0.00	0.00	311,049
Year 2017	311,049	0.00	0.00	311,049
Year 2018	311,049	0.00	0.00	311,049
Year 2019	311,049	0.00	0.00	311,049
Year 2020	15,339	0.00	0.00	15,339
Total	3,110,494	0.00	0.00	3,110,494

4 MONITORING

4.1 Data and Parameters Available at Validation

All data and parameters for emission reduction calculation is monitored during the credit period. For details, please refer to the section 4.2 below.

4.2 Data and Parameters Monitored

Data / Parameter	$EG_{facility,y}$
Data unit	MWh/year
Description	Quantity of net electricity generation supplied by the project plant/unit to the grid in year *y*.
Source of data	Project sponsor and the power utility/CCEE.
Description of measurement methods and procedures to be applied	Electricity supplied by the project activity to the grid. Double checked by Project Sponsors internal control and sales receipt or documents from the power utility/CCEE. CCEE is a Brazilian government entity which monitors the electricity on the national interconnected grid.
Frequency of monitoring/recording	Hourly measurement and monthly recording.
Value applied	999,516 The estimated net electricity dispatched to the grid was calculated through the energy assured of the project 114.1 MW-ave (as established by the MME Ordinance #178 issued on 03/05/2017) and 8,760 hours of operation in a year (114.1MW-ave x 8,760 hours).
Monitoring equipment	Electricity meters
QA/QC procedures to be applied	The equipments used have by legal requirements extremely low level of uncertainty.
Purpose of data	Calculation of baseline emissions
Calculation method	N/A
Comments	-

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 data source.
Description of measurement methods and procedures to be applied	Installed capacity determined by official entities and can be confirmed during on-site visit verifications.
Frequency of monitoring/recording	At every verification
Value applied	191,880,000 Based on generator tag: 106.600kVA x 0.9 = 95,940 kW x 2 generating units = 191.880MW.
Monitoring equipment	N/A
QA/QC procedures to be applied	Determined based on recognized standards with no possibility of uncertainty.
Purpose of data	Calculation of project emissions
Calculation method	N/A
Comments	-

Data / Parameter	A_{PJ}
Data unit	m^2
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	Project site and official data source.
Description of measurement methods and procedures to be applied	Measured from topographical surveys, maps, satellite pictures, etc. (once at the time of the project conception) and water levels (during the project crediting period).
Frequency of monitoring/recording	Monthly measurement and recording.
Value applied	150,000 The reservoir area of the project is based on the Operation License nr. 202/2009, issued on July 13th, 2009 by the Environmental Agency of Santa Catarina State (FATMA).
Monitoring equipment	Limnimetric rulers or sensors
QA/QC procedures to be applied	Determined based on recognized standards with extremely low level of uncertainty.
Purpose of data	Calculation of project emissions
Calculation method	Comparison between monitored water levels and reservoir studies of quota x volume x area curve
Comments	-

Data / Parameter	$EF_{grid,CM,y}$
Data unit	tCO_2/MWh
Description	Combined margin CO_2 emission factor for grid connected power generation in year *y* calculated using the latest version of the "*Tool to calculate the emission factor for an electricity system*".
Source of data	The Brazilian DNA (Comissão Interministerial de Mudança Global do Clima – CIMGC)

Description of measurement methods and procedures to be applied	Since option C) for the calculation of the operating margin was chosen, this value will be up-dated annually according to data from the Brazilian DNA and following the prescription of the emission factor tool.
Frequency of monitoring/recording	Yearly
Value applied	0.3112 Calculated based on an average of the operating and build margin emission factors for the year of 2008 published by the Brazilian DNA: <http://www.mct.gov.br/index.php/content/view/4016.html>.
Monitoring equipment	N/A
QA/QC procedures to be applied	Official source of data.
Purpose of data	Calculation of baseline emissions
Calculation method	N/A
Comments	-

Data / Parameter	$EF_{grid.OM.y}$
Data unit	tCO_2/MWh
Description	Operating Margin CO_2 emission factor for grid connected power generation in year *y* calculated using the latest version of the "*Tool to calculate the emission factor for an electricity system*".
Source of data	The Brazilian DNA (Comissão Interministerial de Mudança Global do Clima – CIMGC)
Description of measurement methods and procedures to be applied	Option C) was chosen to calculate the operating margin. This option does not permit the *ex-ante* vintage for the calculation of the emission factor. Therefore, the emission factor will be calculated ***ex-post*** applying the numbers provided by the Brazilian DNA.
Frequency of monitoring/recording	Yearly
Value applied	0.4766 Calculated based on an average of the operating margin emission factor for the year of 2008 published by the Brazilian DNA: <http://www.mct.gov.br/index.php/content/view/4016.html>.
Monitoring equipment	N/A
QA/QC procedures to be applied	Official source of data.
Purpose of data	Calculation of baseline emissions
Calculation method	N/A
Comments	-

Data / Parameter	$EF_{grid.BM.y}$
Data unit	tCO_2/MWh
Description	Build margin CO_2 emission factor for grid connected power generation in year *y* calculated using the latest version of the "Tool to calculate the emission factor for an electricity system".
Source of data	The Brazilian DNA (Comissão Interministerial de Mudança Global do Clima – CIMGC)
Description of measurement methods and procedures to be	Option 2 was chosen to calculate the build margin. Therefore, the emission factor will be calculated ***ex-post*** applying the numbers provided by the Brazilian DNA.

applied	Numbers provided by the Brazilian DNA will be applied during the project verification.
Frequency of monitoring/recording	Yearly
Value applied	0.1458 Calculated based on an average of the build margin emission factor for the year of 2008 published by the Brazilian DNA: <http://www.mct.gov.br/index.php/content/view/4016.html>.
Monitoring equipment	N/A
QA/QC procedures to be applied	Official source of data.
Purpose of data	Calculation of baseline emissions
Calculation method	N/A
Comments	-

4.3 Monitoring Plan

The purpose of the project monitoring is to ensure transparency, validity and reliability of the emission reductions generated by UHESP. All information related to the project monitoring will be available at the time of the project verification and will be archived at least for 2 years after the end of the last crediting period with the project sponsor.

Salto Pilão project will proceed with the necessary requirements according to the ACM0002 – "Consolidated baseline methodology for grid-connected electricity generation from renewable sources". According to this methodology, the following parameters will be monitored:

(i) Quantity of net electricity generation supplied by the project plant/unit to the grid (**$EG_{facility,y}$**);
(ii) Installed capacity of the hydro power plant after the implementation of the project activity (**CAP_{PJ}**);
(iii) Area of the reservoir measured in the surface of the water, after the implementation of the project activity, when the reservoir is full (**A_{PJ}**);
(iv) All parameters to calculate the combined margin CO_2 emission factor for grid connected power generation in year y calculated using the latest version of the "Tool to calculate the emission factor for an electricity system" (**$EF_{grid.CM.y}$**).

Procedures for the monitoring of parameters mentioned above are described as follows.

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

Project sponsor proceeded with the necessary measures for the power control and monitoring. Together with the information produced by both project sponsor and the power utility/Electric Energy Commercialization Chamber (CCEE), it will be possible to monitor the power generation of the project (in MWh/year). CCEE makes feasible and regulates the electricity energy commercialization in Brazil.

There are six energy meters (principal and backup) specified by CCEE: 2 installed at the power plants (which measure the gross energy) and 4 installed at the local substation (which measure the net energy). CCEE has on-line access to the energy readings from meters located at the substation.

Energy data is measured by the meters in real time. Monthly, consolidations are made for payment purposes. Cross check is made between reports from CCEE/power utility and power plant. However, energy data from meters located at the power plant is higher than data from meters at the substation, considering transmission losses from the power plant to the substation. The table below presents the meters description. In case of any failure or high discrepancy readings, meters will be displaced.

Table 12 – Meters description

Model	Manufacturer	Quantity	Location
ION 8600B	Schneider Electric	2	Power plant
ION 8600A		4	Substation

Previous to 2017 year, calibration should be conducted each 2 years. However, according to updated ONS procedures[30] valid on 01/01/2017 onwards, energy meter calibration shall be conducted in a 5-year period. All meters calibration will be made following the necessary requirements and the established calibration frequency by ONS.

Electricity from CCEE/power utility reports will be considered for emission reduction purposes. Therefore, these monthly reports will be available during the project verification (estimated to happen yearly) as well as the calibration certificates from meters involved in the project activity.

(ii) Installed capacity of the hydro power plant after the implementation of the project activity (CAP_{PJ})

The installed capacity of the power plant (W) will be checked by DOE through an on-site visit during verification (estimated to be yearly). And can be cross-checked with official documents, *e.g.* environmental license, ANEEL Resolutions, and others.

(iii) Area of the reservoir measured in the surface of the water, after the implementation of the project activity, when the reservoir is full (A_{PJ})

Although the project reservoir is very small (150,000 m^2) and results in a power density of 1,279.2 W/m^2, project sponsors will monitor the reservoir area (in m^2) of the project through topographical data made once at the time of the project design conception (before the project construction) and monitoring of the water levels in the reservoir. This monitoring of water levels will be made by project sponsor and will be available during the project verification (estimated to happen yearly).

(iv) All parameters to calculate the combined margin CO_2 emission factor for grid connected power generation in year *y* calculated using the latest version of the "Tool to calculate the emission factor for an electricity system" ($EF_{grid.CM.y}$)

As mentioned in section 3 "Quantification of GHG Emission Reductions and Removals", the Brazilian DNA will made available the operating margin and build margin emission factors (tCO_2/MWh) yearly. Thus, Project Participants will use data from the Brazilian DNA at the time of the project verification.

Salto Pilão Consortium is responsible for the maintenance of the equipments' monitoring, for dealing with possible monitoring data adjustments and uncertainties, for review of reported results/data, for internal audits of GHG project compliance with operational requirements and for corrective actions. Salto Pilão Consortium is also responsible for the project management, as well as for organizing and training of the staff in the appropriate monitoring, measurement and reporting techniques.

In addition, the Brazilian Power Regulatory Agency (ANEEL) can visit the plant to inspect the operation and maintenance of the facility assuring that project sponsors are carrying out the necessary procedures for the project operation.

Salto Pilão Consortium has hired expert companies to execute their environmental programs. After the beginning of the commercial operations, renovation of degraded areas and of permanent preservation

[30] ONS procedures. "Sub-module 12.3 Maintenance of the metering system for invoicing" (in a free translation from the Portuguese *Submódulo 12.3. Manutenção do sistema de medição para faturamento*). Available at ONS's webiste: <http://ons.org.br/pt/paginas/sobre-o-ons/procedimentos-de-rede/vigentes>

areas will be done according to the regulations of the environmental agencies, through a team of environment experts, who will also monitor the compliance with the environmental agencies' regulations. Studies done during the design phase of the project activities have shown the environmental impacts and the interference on the social development in the region of the plant, indicating the mitigation measures to be adopted during the construction phase. These measures are being taken seriously. Data about environmental impact are being archived by the hydropower plant and the environmental agency.

5 SAFEGUARDS

5.1 No Net Harm

Accordingly to article 3 of this Resolution and Complementary Law nr. 38 dated November 21st, 1995, in order to issue licenses, the Environmental Impact Study (from the Portuguese *Estudo de Impacto Ambiental – EIA*) and the Environmental Impact Report (from the Portuguese *Relatório de Impacto Ambiental – RIMA*) are required for hydropower projects with installed capacity greater than 10 MW.

The UHESP Environmental Impact Study was prepared by Ambiental Consultoria e Planejamento Ltda. in September 1997 and is composed by three volumes:

I) Methodological aspects and information related to the project;
   a) General description of the project (identification, objectives, preferential area of installation and justifications for the project implementation);
   b) Technical description of the project (project alternative locations studies: introduction, basic types of hydro projects, inventory, preliminary feasibility study, feasibility study, UHESP general description, datasheet, costs and schedule);
   c) Environmental legislation (introduction, environmental licensing and environment impact study, issues related to environmental juridical aspects of the electrical sector);
   d) Methodology (methodological references, study limits, research techniques and source of information).

II) Diagnosis of the current situation;
   a) Occupation history;
   b) Recent trends and current situation of the physical and biotic medium (hydro resources, soil, flora and vegetation, geology, geomorphology and landscape, terrestrial fauna, ictus fauna);
   c) Recent trends and current situation of the socio-economic-cultural environment (area of influence and directly affected area).

III) Impact analysis and mitigation measures proposals, as well as programs and plans;
   a) Qualification of the main Works and Actions of the project;
   b) Interactions matrix between the project actions and associated impacts;
   c) Interaction network of the associated impacts of the main project actions;
   d) Impacts characterization (physical, biotic and socio-economic);
   e) Classification of the associated impacts of the works and actions related to the project.

The main concerns of the community and technicians were presented in the environmental study and were related to the possibility of flooding in the municipalities of Lontras and Rio do Sul, possibility of drying the river between the dam and the power house, the quality of the water (for bathing and fishing), blockade of the fishes immigration, deforestation, fauna impact, resettlement, consequences in the activities of ecotourism in Ilha das Cotias, impacts on Archeological sites and cultural heritages, job creation and financial compensation.

The following plans are been implemented in order to reduce the impacts of the project construction, raised in the environmental study analysis:

I) <u>Environmental control.</u> It involves 17 (seventeen) programs, which includes: climates conditioning observations, water quality monitoring, monitoring and conservation of local fauna, reservoir cleaning, geological impacts monitoring, environmental control of the engineering works, degraded areas recuperation, ecological station implementation, terrestrial fauna monitoring and conservation, population resettlement, social communication, infrastructure improvement, workers training, public health control, support of the municipalities, landscape memory conservation, archeological rescue.

II) Expropriation. The expropriation plan was chosen to ensure a fair compensatory condition for the local community and a fair value to the areas involved in the project boundaries.

III) Multiple use of the reservoir. This plan involves the conservation and protection of the reservoir and other areas direct and indirect affected. The plan is divided in 2 (two) main programs: a) utilization program and; b) multiple use of the reservoir.

Besides of the above mentioned plans, there are several actions that are been implemented, which includes river flow maintenance, complementary environmental studies for the project monitoring, maintenance and monitoring of Ilha das Cotias (with hunters surveillance), treatment of the residues generated by the project construction, and others. All information related to the environmental programs and plans is presented in the project PBA (as mentioned below) and conditioning licenses. All information related to the licensing process is available with the project sponsors and the environmental agency of Santa Catarina State.

Environmental Impact Study and report were made publicly available to local stakeholders and public entities. Furthermore, according to the CONAMA Resolution nr. 1 dated January 23rd, 1986, the environmental agency – State or National – is responsible to issue licenses and decide the necessity in making public consultations and forums for the project implementation. When public consultation is required, it usually happens in parallel with the Preliminary License issuance. In the case of UHESP, the stakeholder forum was held on September 25th, 2002 together with the environmental agency of Santa Catarina. Considering the positive contribution of UHESP for the region, the public forum resulted in the Preliminary License issuance on July 24th, 2003.

After the Preliminary License issuance, the environmental agency requires a report containing environmental and social programs to be implemented aiming the mitigation of impacts caused by the project construction (from the Portuguese "*Projeto Básico Ambiental – PBA"*), which shall contain:

- Archeological rescue program;
- Reservoir cleaning and conservation program;
- Fauna rescue, conservation and monitoring;
- Water quality monitoring;
- Degraded area recuperation program;
- Erosion control program.

The PBA of UHESP was prepared by ECSA Engenharia Sócio-Ambiental S/C Ltda. in November 2003, which presented 24 programs. The UHESP PBA was approved by the environmental agency and, therefore the Construction License was issued on December 11th, 2003.

In parallel with the power plant construction, programs described in the PBA were implemented and, when the power plant construction finished, the Operating License was issued.

In order to keep the Operating License valid, many social and environmental requirements have to be quarterly assessed, thus this license is constantly revalidated during the project's lifetime. This ensures that the project continuously meets its environmental obligations and the goals that are established in the project PBA.

The necessary documents and requirements for the licensing process are presented in the CONAMA Resolution nr. 6. All licenses and environmental studies are available with the project sponsor and the environmental agency of Santa Catarina State (FATMA).

In spite of the installed capacity change of UHESP from 182.3MW to 198.88MW, a new environmental impact study was not required as impacts identified in the report remained the same.

5.2 Environmental Impact

The growing global concern on sustainable use of resources is driving a 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 policies are very demanding in line with the best international practices.

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

Project sponsors have to obtain all licenses required by the Brazilian environmental regulation (National Environmental Council Resolution "Conselho Nacional do Meio Ambiente - CONAMA" nr. 6/87):

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

The project activity has all above mentioned licenses, which are available with the project sponsor and the environmental agency of Santa Catarina State (FATMA).

Table 13 – History of UHESP licenses issued by FATMA

Type	Number	Date of issuance
Preliminary License	228/03	24/07/2003
Construction License	076/03	11/12/2003
	076/05	30/11/2005
	063/GELAO/07	31/07/2007
	085/07	22/10/2007
Operation License	202/09	13/07/2009
	4055/12	31/05/2012

5.3 Local Stakeholder Consultation

As mentioned in section 5.1, in order to issue licenses, the Environmental Impact Study (from the Portuguese *Estudo de Impacto Ambiental – EIA*) and the Environmental Impact Report (from the Portuguese *Relatório de Impacto Ambiental – RIMA*) are required for hydropower projects with installed capacity greater than 10 MW.

Both studies shall be made publicly available to local stakeholders and public entities. Furthermore, according to the CONAMA Resolution nr. 1 dated January 23rd, 1986, the environmental agency – State or National – is responsible to issue licenses and decide the necessity in making public consultations and forums for the project implementation. When public consultation is required, it usually happens in parallel with the Preliminary License issuance.

In the case of Salto Pilão project, the public forum was held by the environmental agency of Santa Catarina State (FATMA) on September 25th, 2002. Considering the positive contribution of Salto Pilão implementation, no concerns were raised in this meeting and the Preliminary License was issued on July 24th, 2003.

5.4 Public Comments

No major concerns were raised during the public hearing regarding the project implementation. All suggestions and comments raised during the licensing process were taken into account while executing the environmental plans and programs with the environmental agency supervision.