BAESA PROJECT

Document Prepared By Ecofinance Negócios Eireli

eduardo@grupoecofinance.com.br / 55 51 3392 1500

Project Title	BAESA Project
Version	03
Date of Issue	13-November-2017
Prepared By	Ecofinance Negócios Eireli
Contact	361, Lageado Avenue, 701. Porto Alegre, Rio Grande do Sul, Brazil. Telephone: 55 51 3392 1500 eduardo@grupoecofinance.com.br www.grupoecofinance.com.br

Table of Contents

1 PROJECT DETAILS

1.1 Summary Description of the Project

BAESA project activity is the construction and operation of Barra Grande Hydro Power Plant (HPP), a greenfield hydro power plant implemented in single reservoir, where the power density of the reservoir calculated using the applicable methodology is greater than 4 W/m2.

Barra Grande Hydro Power Plant is owned by BAESA - Energética Barra Grande S.A (BAESA). The plant generates electricity through clean and renewable source and it contributes to attend the growing demand for electricity in Brazil, due to the country's economic and population growth, contributing, thus, to the environmental, social and economic sustainability, by increasing the share of renewable energy in the country's total electricity consumption.

Barra Grande HPP is located in the Southern Region of Brazil, between the cities of Anita Garibaldi, state of Santa Catarina and Pinhal da Serra, state of Rio Grande do Sul. The plant uses hydraulic potential of Pelotas River to generate electricity with an installed capacity of 708 MW and assured energy (medium energy) of 380.6 MWaverage.

The technology applied in the project is well established in the sector. All equipment employed in the project have already been successfully applied to similar projects in the country and in the world. The project uses three Francis Turbines (each one with 236 MW of installed capacity). Each generation unit has three meters. One (1) meter for each turbine located at the Power House measures total electricity generation and two (2) meters for each generation unit located at the substation are responsible for net electricity measurement.

Prior to the implementation of the project activity no hydropower plant was operational in the location where Barra Grande HPP is implemented. Barra Grande HPP reduces GHG emissions by avoiding electricity generation from fossil fuel sources, which would be generated (and emitted) in the absence of the project. Then, the baseline scenario and the scenario without the project activity are the same.

During the second crediting period, the project activity is expected to reduce 608,686 tCO2e/year, resulting in 6,086,860 tCO2e during the crediting period.

Through this VCS PD, we require the renewal of the crediting period of BAESA Project. Below we describe the main steps of the project under VCS:

- **February 2009**: Bureau Veritas Certification issues the Validation Report;
- **March 2009**: Verified Carbon Standard (VCS) registered BAESA Project with Project ID number 10
- **March 2009**: Bureau Veritas Certification issues the Verification Report for Verified Carbon Units (VCUs) related to the following period: 01/01/2006 to 31/12/2008;

- **April 2009**: VCS issues VCUs for the period 01/01/2006 to 31/12/2008[1];
- **March 2012**: Bureau Veritas Certification issues the Verification Report for Verified Carbon Units (VCUs) related to the period 01/01/2009 to 31/12/2010;
- **April 2012**: VCS issues VCUs for the period 01/01/2009 to 31/12/2010[2];
- **31/12/2015**: End of the first crediting period;
- **October 2017**: BAESA starts the process for crediting period renewal.

1.2 Sectoral Scope and Project Type

The sectoral scope applied to BAESA Project is sectoral scope 1 – Energy (Renewable/Non-Renewable). BAESA Project is not a grouped project

1.3 Project Proponent

Table 01 – Project Proponents

Organization name	**BAESA - Energética Barra Grande S.A**
Contact person	Juliano Natal or Peter Eric Volf
Title	Director
Address	1168, Madre Benvenuta Avenue, Sobreloja. Florianopolis/Santa Catarina, Brazil. Zipcode: 88035-000.
Telephone	55 48 3331 0000
Email	juliano.natal@cscenergia.com.br or pvolf@baesa.com.br
Organization name	**Ecofinance Negócios Eireli[3] (Former Enerbio Consultoria Ltda)**
Contact person	Eduardo Baltar de Souza Leão
Title	Director
Address	361, Lageado Avenue, 701. Porto Alegre/Rio Grande do Sul, Brazil. Zipcode: 90460-110.

[1] More information, please acess: http://vcsprojectdatabase.org/#/vcus/p_10
[2] More information, please acess: http://vcsprojectdatabase.org/#/vcus/p_10
[3] Ecofinance Negócios Eireli is the new name for Enerbio Consultoria Ltda. The name of the company was changed in 2012 as showed in the estatutes of the company.

Telephone	55 51 3392 1500
Email	eduardo@grupoecofinance.com.br

1.4 Other Entities Involved in the Project

Not applicable.

1.5 Project Start Date

According to the VCS Standard, version 3.7, the project start date is the date on which the project began generating GHG emission reductions or removals. Therefore, the project start date of BAESA Project is *11/01/2005* (mm/dd/yyyy) *(Operation Starting Date of the First Turbine),* as validated for the first crediting period.

1.6 Project Crediting Period

The project crediting period shall be a maximum of ten years which may be renewed at most twice. The first crediting period of the project was from 01/01/2006 to 31/12/2015. Project Proponents require **more 10 years of crediting period**, considering for the following period: from **01/01/2016 to 31/12/2025.**

1.7 Project Scale and Estimated GHG Emission Reductions or Removals

Table 02 – Project Scale

Project Scale	
Project	
Large project	X

Table 03 – Estimated GHG emission reductions

Year	Estimated GHG emission reductions or removals (tCO_2e)
2016	608,686
2017	608,686
2018	608,686
2019	608,686
2020	608,686
2021	608,686
2022	608,686
2023	608,686
2024	608,686
2025	608,686
Total estimated ERs	6,086,860
Total number of crediting years	10 years
Average annual ERs	608,686

1.8 Description of the Project Activity

The project activity is the installation of a Greenfield power plant called Barra Grande Hydropower Plant. Prior to the implementation of the project activity no hydropower plant was operational in the location where Barra Grande HPP is implemented.

The baseline scenario is 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”.

The clean and renewable electricity delivered to Brazilian Interconnected System by Barra Grande HPP provides an important contribution to environmental sustainability by reducing carbon dioxide emissions that otherwise would have occurred in the absence of the project. The project activity reduces emissions of greenhouse gases (GHG) by avoiding electricity generation from fossil fuel sources (and CO2 emissions), which would be generated (and emitted) in the absence of the project.

The emission reduction provided by the project is the difference between the baseline emissions and the project emissions, according indicated in version 17.0 of the Large Scale Consolidated Methodology ACM0002 – Grid-Connected Electricity Generation from Renewable Sources (hereafter called ACM0002 Methodology).

HPP Barra Grande will use the hydraulic potential of Pelotas River to generate electricity with an installed capacity of 708 MW and assured energy of 380.6 MWaverage. All equipment and technologies employed in the project have already been successfully applied to similar projects in the country and in the world. The technology applied in the project is well established in the sector. There are three turbines with an installed capacity of 236MW each, totalizing a maximum installed capacity of 708 MW.

Francis turbine are used in the project, which is a well-tested turbine in the world for hydro electrical projects. Each generation unit have three meters. One (1) meter for each turbine located at the Power House measures total electricity generation. There are two (2) other meters for each generation unit located at the substation, responsible for net electricity measurement.

National companies were responsible for construction activities. Construções e Comércio Camargo Correa was responsible for construction and equipment assembly of the plant. Alstom do Brasil was responsible for equipment supply and Engevix Engenharia was responsible for executive and basic project of the plant, as well as for its substation (supplying and equipment assembly). Below, it is described some characteristics of the entrepreneurship structures.

Detour Tunnels

The first structure of the plant built were the detour tunnels, whose objective was to redirect the waters of the river, allowing the construction of the main dam. They were totally excavated on rock. The tunnels remained open to the conclusion of other structures and liberation of the area of the future reservoir. With the issuance of the License for Operation, they were closed, having begun the filling of the reservoir.

To the construction of HPP Barra Grande, it was excavated two detour tunnels, one with 864 meters of length and the other with 935 meters. Both are 17-meters high and are located to the right margin of Pelotas River, in Santa Catarina's side.

Forced tunnels and penstock

The forced tunnels or forced conducts were excavated on rock and have the function of conducting the water, in order to spin the axis of the turbines. The penstock is the structure that captures and directs water to the forced tunnels.

In HPP Barra Grande, three are the forced tunnels, each one composed of two parts: one vertical, with 98 meters, and the other slightly inclined, with approximately 310 meters. The water of the reservoir passes the tunnels to the turbines, when the electricity is generated. After passing through the turbine, the water returns to its normal course in Pelotas River.

Dam

The main dam was also built in embankment, with its upstream face covered by reinforced concrete slab. It is a definitive structure destined to the obstruction of the river and to the formation of the reservoir.

The formation of the main dam consisted in the execution of a compacted embankment. In the upstream face, it was executed extruded concrete, whose objective was regularizing the face of the dam and confining the transition.

Powerhouse

The Powerhouse is the structure that shelters the turbines, generators and other equipment and systems of the electricity generation.

It is in the Powerhouse that all the electricity of Barra Grande HPP is being generated. There are three turbines which have an installed capacity of 236 MW each, totalizing a maximum installed capacity of 708 MW. Each generation unit has three meters. One of them is located in the Powerhouse and the other two in the substation.

Spillway

The spillway has the function of controlling the level of water in the reservoir through its floodgates. In Barra Grande HPP, there will be 6 floodgates, each one 15-meter wide and 20.98-meter high. Table below shows the main technical information of the project:

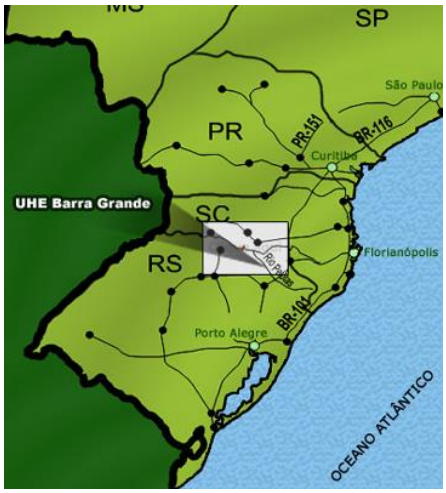
Table 04 – Main technical information of the project

Parameter	Data	Source
Installed Capacity	708 MW	Operation License 447/2005 – 2º Renewal
Reservoir Area	94 km2	Operation License 447/2005 – 2º Renewal
Plant Load Factor (Assured Energy)	380.6 MWaverage	ANEEL Concession Contract 036/2001 (Clause 03)
Number of Turbines	3	ANEEL Concession Contract 036/2001 (Clause 03)
Turbines Type	Francis	ANEEL Concession Contract 036/2001 (Clause 03)

1.9 Project Location

Barra Grande HPP is located in Pelotas River, about 43 km from its confluence with Canoas River, between the municipalities of Anita Garibaldi/SC and Pinhal da Serra/RS. The geographic coordinates are: Latitude 27º46'South and Longitude of 51º13' West. The map below shows HPP Barra Grande location:

Map 1 – Localization of HPP Barra Grande



1.10 Conditions Prior to Project Initiation

BAESA project activity consists of a construction and operation of a greenfield Hydro Power Plant that generates electricity with an installed capacity of 708 MW and assured energy of 380.6 MW average, using a small reservoir, with low environmental impact in relation to the installed capacity.

Prior to the implementation of the project activity, no hydropower plant was operational in the location where Barra Grande is implemented. The baseline scenario is the same as the conditions existing prior to project initiation as described at section 2.4.

1.11 Compliance with Laws, Statutes and Other Regulatory Frameworks

BAESA project has all licenses necessary for building and operation of the entrepreneurship. Besides a concession contract was established with ANEEL, National Agency of Electric Energy, where the permission to explore the hydraulic electrical potential of Pelotas River, between the states of Rio Grande do Sul and Santa Catarina, is granted to Energética Barra Grande – BAESA, for a period of 35 years.

The most relevant local laws and regulations related to BAESA project activity correspond to the environmental laws. The environmental licensing is a legal obligation prior to the installation of any entrepreneurship or activity potentially pollutant or degrading to the environment in Brazil. The Brazilian licensing process presents as an important characteristic the community participation on decision through Public Audiences.

As the project is operational since 2005, the current License is Operational License 447/2005, issued by IBAMA and renewed, by the second time, at March 2014, with 10 years validity.

1.12 Ownership and Other Programs

1.12.1 Project Ownership

The concession contract, signed between ANEEL, National Agency of Electric Energy, Brazilian Public Authority, and BAESA Energética Barra Grande S.A constitute the evidence of BAESA's right over the hydroelectric power plant of Barra Grande and over the project's emission reductions. Operation License issued by IBAMA, Environmental Brazilian Authority, is also a evidence of project ownership.

1.12.2 Emissions Trading Programs and Other Binding Limits

Not applicable. The project is not included in any other emission trading program or mechanism.

1.12.3 Other Forms of Environmental Credit

Not applicable. The project has not sought of received any other form of GHG-related environmental credit, including renewable energy certificate.

1.12.4 Participation under Other GHG Programs

Not applicable. The project was not registered and is not seeking registration under any other GHG programs

1.12.5 Projects Rejected by Other GHG Programs

Not applicable. The project was not rejected by any other GHG programs.

1.13 Additional Information Relevant to the Project

Eligibility Criteria

BAESA project is not a grouped project. BAESA Project is a greenfield hydro power plant implemented in single reservoir, where the power density of the reservoir(s) calculated using the applicable methodology is greater than 4 W/m2. 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".

ACM0002 Large Scale Consolidated Methodology - Grid Connected Electricity Generation from Renewable Sources is applied to the project.

Leakage Management

Not applicable. According ACM0002, no leakage emissions are considered. The emissions potentially arising due to activities such as power plant construction and upstream emissions from fossil fuel use (e.g. extraction, processing, transport etc.) are neglected.

Commercially Sensitive Information

Not applicable. No commercially sensitive information has been excluded from the public version of this project.

Sustainable Development

BAESA Project contributes to the sustainable development once contributing to the economic growth without compromising the future generations, respecting the concept of Sustainable Development, established by Brundtland Report, elaborated by the World Commission on Environment and Development. This report defines the term "sustainable development" as "the development that satisfies the present necessities, without compromising the capacity of future generations of supplying their own necessities"[4].

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

Through the following actions, BAESA Project contributes to the sustainable development of its region and country:

- BAESA Project supplies clean and renewable electricity to the Brazilian National Interconnected System, displacing plants that would generate electricity through fossil fuels, avoiding, thus, the greenhouse gases emission and preserving the environment to future generations. This action is aligned with the first Brazilian NDC[5].

- More than 5,000 direct and indirect jobs has been created during construction and operation of the project. Besides regional economic activities were improved with the implantation of the entrepreneurship, creating income to the communities of the municipalities. Moreover, through taxes and tributes generated by its activities to the municipalities involved and to the Union, BAESA Project provides financial resources that can be re-invested to the population of the region and of the country. It is estimated that during the construction period (1) R$ 240 million were brought to the local, regional and state economy through the purchase of materials, payment of salaries and hiring of services; (2) 8.5 million were directly applied to health, education, leisure, security and social assistance infra-structure of the cities; (3) R$ 7.5 million were collected by the municipalities of Anita Garibaldi and Pinhal da Serra through Taxes over Services (ISSQN) and (4) R$ 9.0 million were collected to the states of Rio Grande do Sul and Santa Catarina, referring to the Tax over Circulation of Goods and Services (ICMS). It is still estimated that with total operation of the entrepreneurship, City Halls will receive about R$ 25.5 million annually, referring to the Financial Compensation for the Utilization of Hydro Resources (CFURH) which, if well managed by the public power, can create to the region a long-term path of socio-economic development.

- Despite the project presents low environmental impacts, with small reservoir formation and elevated power density, BAESA makes considerable investments in environmental programs and actions[6]. Twenty-six programs are being developed, distributed in 6 programs, which totalize an invested amount of approximately R$ 209 million. Among the environmental projects, it can be highlighted the reforestation program that reached the goal of planting one million seedlings. To achieve this goal, BAESA implanted in 2007 a plant nursery of forest seedlings along with the Power Plant, with a capacity of production of 150 thousand seedlings per year, destined to the reforestation project and environmental education. The resettlement of

[5] Source: http://www4.unfccc.int/ndcregistry/PublishedDocuments/Brazil%20First/BRAZIL%20iNDC%20english%20FINAL.pdf

[6] More information about social and environmental programs developed by BAESA Project are presented on section 04 of this VCS PD.

people affected by the entrepreneurship also must be emphasized. Some families that lived in houses nearby the river, without electricity and minimum sanitation conditions were relocated to with excellent infra-structure conditions. The participation of government and social movement representatives has contributed to the project success. The collaborative work among company, government and social movement allowed better conditions for the families involved.

- Since Barra Grande HPP is located in the rural area of Rio Grande do Sul and Santa Catarina, the project demanded training people to be hired or sub-hired in the region. Through environmental education program, BAESA Project has invested to form multipliers in the cities involved, targeting public and private school's teachers, members of the organized civil society and local authorities to spread principles and techniques of environmental education. Besides, training activities are also performed with sub-hired construction workers and educational activities with inhabitants from the reservoir's surroundings. Through this action, BAESA Project seeks to train employees to the market and contributes to the growth of knowledge and to the level of education of the cities where it acts.

Further Information

Not applicable.

2 APPLICATION OF METHODOLOGY

2.1 Title and Reference of Methodology

The methodology applied to the Project is ACM0002: "Grid-connected electricity generation from renewable sources" (version 17.0)[7]. This methodology also refers to the following tools:

(a) "Tool to calculate the emission factor for an electricity system", version 06.0;

(b) "Tool for the demonstration and assessment of additionality", version 7.0.0;

(c) "Combined tool to identify the baseline scenario and demonstrate additionality", version 7.0;

(d) "Tool to calculate project or leakage CO2 emissions from fossil fuel combustion", version 3;

(e) "Tool to determine the remaining lifetime of equipment", version 1;

(f) "Assessment of the validity of the original/current baseline and update of the baseline at the renewal of the crediting period", version 03.0.1;

(g) "Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation", version 03.0.

2.2 Applicability of Methodology

In this section, project proponents will show how the project activity meets each of meets each of the applicability conditions of the methodology(s), and tools (where applicable) applied by the project.

Applicability Condition 01:

ACM0002 methodology is applicable to grid-connected renewable energy power generation project activities that:

(a) Install a Greenfield power plant;

(b) Involve a capacity addition to (an) existing plant(s);

(c) Involve a retrofit of (an) existing operating plants/units;

(d) Involve a rehabilitation of (an) existing plant(s)/unit(s); or

(e) Involve a replacement of (an) existing plant(s)/unit(s).

[7] Available on the UNFCCC CDM website.

Baesa Project has installed a greenfield hydro power plant. Therefore, option "a" is applied.

Applicability Condition 02:

2. The methodology is applicable under the following conditions:

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

   (b) In the case of capacity additions, retrofits, rehabilitations or replacements (except for wind, solar, wave or tidal power capacity addition projects the existing plant/unit started commercial operation prior to the start of a minimum historical reference period of five years, used for the calculation of baseline emissions and defined in the baseline emission section, and no capacity expansion, retrofit, or rehabilitation of the plant/unit has been undertaken between the start of this minimum historical reference period and the implementation of the project activity.

Baesa has installed a greenfield hydro power plant with reservoir. Therefore, option "a" is applied.

Applicability Condition 03:

3. In case of hydro power plants, one of the following conditions shall apply:[8]

   (a) The project activity is implemented in existing single or multiple reservoirs, with no change in the volume of any of the reservoirs; or

   (b) The project activity is implemented in existing single or multiple reservoirs, where the volume of the reservoir(s) is increased and the power density calculated using equation (3), is greater than 4 W/m^2; or

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

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

      (i) The power density calculated using the total installed capacity of the integrated project, as per equation (4), is greater than 4 W/m^2;

      (ii) Water flow between reservoirs is not used by any other hydropower unit which is not a part of the project activity;

[8] Project participants wishing to undertake a hydroelectric project activity that result in a new reservoir or an increase in the volume of an existing reservoir, in particular where reservoirs have no significant vegetative biomass in the catchments area, may request a revision to the approved consolidated methodology.

(iii) Installed capacity of the power plant(s) with power density lower than or equal to 4 W/m^2 shall be:

a. Lower than or equal to 15 MW; and

b. Less than 10 per cent of the total installed capacity of integrated hydro power project.

In case of BAESA Project, the project activity was implemented in new single reservoir and the power density, calculated using equation (3), is greater than 7.53 W/m2. Therefore, the power density of the project is greater than 4 W/m2.

Applicability Conditions 04 and 05:

In the case of integrated hydro power projects, project proponent shall:

4. Demonstrate that water flow from upstream power plants/units spill directly to the downstream reservoir and that collectively constitute to the generation capacity of the integrated hydro power project; or

5. Provide an analysis of the water balance covering the water fed to power units, with all possible combinations of reservoirs and without the construction of reservoirs. The purpose of water balance is to demonstrate the requirement of specific combination of reservoirs constructed under CDM project activity for the optimization of power output. This demonstration has to be carried out in the specific scenario of water availability in different seasons to optimize the water flow at the inlet of power units. Therefore, this water balance will take into account seasonal flows from river, tributaries (if any), and rainfall for minimum five years prior to implementation of CDM project activity.

BAESA project is not an integrated hydro power project. Therefore, applicability conditions 04 and 05 are not applied to the project.

Applicability Condition 06:

6. The methodology is not applicable to:

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

(b) Biomass fired power plants/units.

BAESA Project consists of a greenfield power plant connected to the Brazilian Interconnected System. Therefore, applicability condition 06 is not applied to the project.

Applicability Condition 07:

7. In the case of retrofits, rehabilitations, replacements, or capacity additions, this methodology is only applicable if the most plausible baseline scenario, as a result of the identification of baseline scenario, is "the continuation of the current situation, that is to use the power generation equipment that was already in use prior to the implementation of the project activity and undertaking business as usual maintenance".

BAESA Project consists of a greenfield power plant connected to the Brazilian Interconnected System. Therefore, applicability condition 07 is not applied to the project.

Applicability Condition 08:

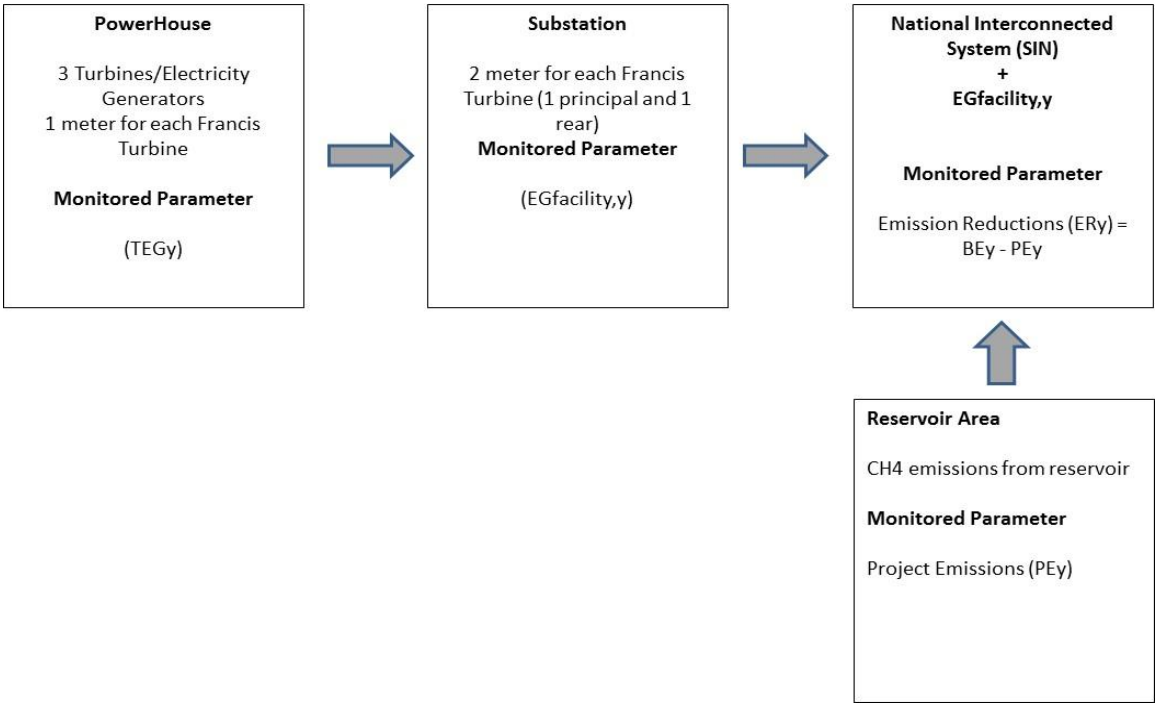
8. In addition, the applicability conditions included in the tools referred in section 2.1 are also applied to the project.

2.3 Project Boundary

Table 05 – Project Boundary

Source		Gas	Included?	Justification/Explanation
Baseline	CO_2 emissions from electricity generation in fossil fuel fired power plants that are displaced due to the project activity	CO_2	Yes	Main emission source
		CH_4	No	Minor emission source
		N_2O	No	Minor emission source
		Other	Not applicable	Not applicable
Project	For hydro power plants, emissions of CH4 from the reservoir	CO_2	No	Minor emission source
		CH_4	Yes	Main emission source
		N_2O	No	Minor emission source
		Other	Not applicable	Not applicable

In the diagram below, the project boundary is presented, showing physical location of installations and measurement activities taking place as part of the project activity.



Where:

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

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

BE_y = Baseline emissions in year y (t CO_2e/yr)

PE_y = Project emissions in year y (t CO_2e/yr)

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

2.4 Baseline Scenario

According to item 3.8.5 of the VCS Standard, version 3.7, The validity of the original baseline scenario shall be assessed. Such assessment shall include an evaluation of the impact of new relevant national and/or sectoral policies and circumstances on the validity of the baseline scenario.

According to ACM0002 methodology, if the project activity is the installation of a Greenfield power plant, the baseline scenario is 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".

The baseline scenario is the same as the previous baseline scenario identified in the first crediting period. There is no relevant national and/or sectoral policy and circumstances that affect the baseline scenario.

Besides that, the VCS Standard indicates that "where it is determined that the original baseline scenario is still valid, the GHG emissions associated with the original baseline scenario shall be reassessed using the latest version of the CDM Tool to assess the validity of the original/ current baseline and to update the baseline at the renewal of a crediting period."

Steps of the CDM Methodological Tool – "Assessment of the Validity of the Original/current baseline and update of the baseline at the renewal of the crediting period", version 03.0.1

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

The validity of the current baseline is assessed using the following Sub-steps:

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

The current baseline scenario complies with all relevant mandatory national and/or sectoral policies which have come into effect after the submission of the project activity for validation or the submission of the previous request for renewal of the crediting period and are applicable at the time of requesting renewal of the crediting period, go to Step 1.2.

Step 1.2: Assess the impact of circumstances

To assess the impact of circumstances existing at the time of requesting renewal of the crediting period on the current baseline emissions, project proponents show in this section a comparison between the conditions of the Brazilian Electric System prior to the project initiation (presented in the section 1.9 of the PDD registered for the first crediting period) and the current conditions of the Brazilian Electric

System, according to National Authorities official data. This comparison shows that the conditions used to determine the baseline emissions in the previous crediting period are still valid.

Next table below shows the evolution of the installed capacity in the Brazilian Interconnected System between 2005 and 2017. Data from 2005 was presented on the VCS PD registered for the first crediting period and the original source was the Ministry of Mines and Energy[9]. Current data is obtained from ANEEL, National Agency of Electric Energy[10].

Despite the installed capacity of hydropower plants increased 43,8%, the relevance of hydro plants in the Brazilian Electric Installed Capacity decreased almost 9.5% in the period. Thermal plants increased importance. In 2017, they represent 26.9% of the installed capacity of the country. More than double of its number in 2005. Wind power plants also have gained relevance. In 2017, they represent more than 7% of the country installed capacity.

Table 06 – Comparison between Brazilian Installed Capacity in 2005 and 2017

Fuel	Installed Capacity (MW) - 2005	%	Installed Capacity (MW) - 2017	%
Hydro[11]	68,637	73.23	98,739	63,8
Thermal	12,407	13.24	41,021	26,9
Nuclear	2,007	2.14	1,990	1.13
Wind	-	-	10,701	7,0
Photovoltaic	-	-	0,144	0,1
Interligation with Argentina	2,178	2.32	-	**-**
Itaipu Portion of ANDE	5,600	5.97	-	**-**
Other sources	2,899	3.09		
Total	**93,728**	**100**	**152,596**	**100**

The table clearly shows that, the installed capacity of thermal plants, more greenhouse gases (GHG) intensive technologies than Hydro Plants, more than double relevance in Brazilian Installed Capacity.

This fact impacts the CO2 emission factor of the Brazilian Interconnected Grid. In 2008, through the resolution nº 8, Brazilian Designated National Authority for CDM (DNA) defined that the National Interconnected System should be considered a unique electricity system and that this configuration is

9 Source: This data was presented in the PDD registered by VCS in the first crediting period. The original source was the Ministry of Mines and Energy. Decennial Plan for Energy Expansion 2006-2015.

[10]Source: ANEEL, 2017. Available at: http://www.aneel.gov.br/documents/656877/14854008/Boletim+de+Informa%C3%A7%C3%B5es+Gerenciais+2%C2%BA+trimestre+de+2017/6f1fac17-8146-4a17-508a-567419d35fae . Accessed on 2017, October.

[11] This information considers also small hydro plants (installed capacity less than 30 MW).

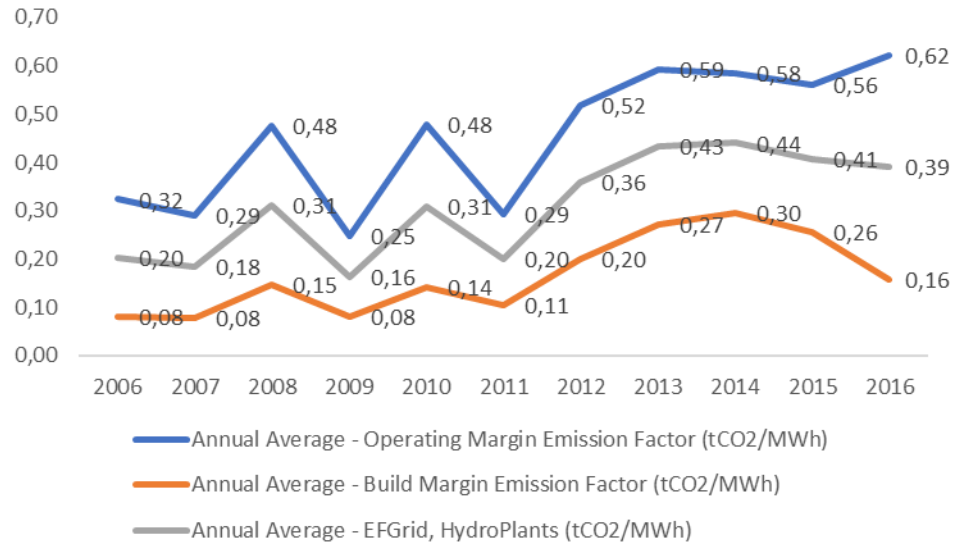
valid for calculating the CO2 emission factors used to estimate the greenhouse gases emissions reductions for electricity generation projects.

The graph below was based on data provided by Brazilian Ministry of Science, Technology, Innovation and Communications, institution that chairs Brazilian DNA. The graph shows data of operating margin emission factor (tCO2/MWh), build margin emission factor (tCO2/MWh) and grid emission factor for hydropower plants. All data are from Brazilian Interconnected Grid for the period 2006-2016.

CO2 emission factors are calculated according to the "Tool to calculate the emission factor for an electricity system", approved by CDM Executive Board. Dispatch Data Analysis was used. Its objective is to estimate the emission reductions contribution of a project that generates electricity to the grid.

In summary, the emission factor for an electricity system is a combination between operating margin, that shows CO2 intensity of electricity dispatched at the margin and the build margin that reflects the CO2 intensity of the last plants built connected to the system. More information will be presented on section 03.

Graph 01 – CO2 Emission Factor of Brazilian Interconnected Grid 2006 - 2016



The graph shows that from 2005 to 2016, both operating margin, build margin and Ef,Grid emission factors increased more than 93%. This shows that electricity that is being used by Brazilian Interconnected System and the carbon intensity of new plants are more GHG intensive. This shows that conditions used to determine the baseline emissions in the previous crediting period are still valid.

Step 1.3: Assess whether the continuation of use of current baseline equipment(s) or an investment is the most likely scenario for the crediting period for which renewal is requested.

In the absence of the project, the electricity would be generated by grid connected power plants. The National Interconnected System (SIN, from the Portuguese "Sistema Interligado Nacional") is composed by 4,683 plants[12] and each one has specific characteristics and equipment.

Therefore, this step does not apply, since the interconnected system would continue to supply energy independently of the lifetime of individual equipment. Regarding the project lifetime, the project has 35 years lifetime (according to ANEEL Concession Contract) without any further relevant investment required as validated in the VCS PDD. Since the concession contract established with ANEEL dates from 2001, the project is expected to be operational up to 2036. Then, the remaining technical lifetime exceeds the end of the crediting period for which the renewal is requested (2025).

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

All data and parameters that were determined at the start of the crediting period and not monitored during the crediting period are still valid. In the VCS PD registered for the first crediting period, CO2 emission factors are calculated ex post according the tool to calculate the emission factor, latest version, and data supplied by Brazilian DNA. This is still valid. Therefore, there is no need for update data and parameters. Detailed description of data and parameters applied for the calculation of emission reductions are presented on section 3.

The step 2 of the CDM Tool "Assessment of the Validity of the Original/current baseline and update of the baseline at the renewal of the crediting period" is not applied once the application of steps 1.1 to 1.4 confirmed that the current baseline as well as data and parameters are still valid for the subsequent crediting period, then this baseline, data and parameters can be used for the renewed crediting period.

2.5 Additionality

According to item 3.8.5 of the VCS Standard, version 3.7.0, a full reassessment of additionality is not required when renewing the project crediting period, once the additionality of the project was already validated on the VCS PD validated and registered for the first crediting period. However, regulatory surplus shall be demonstrated in accordance with Section 4.6.3 of the VCS Standard, same version, and the project description shall be updated accordingly.

According to Item 4.6.3 of the VCS Standard, version 3, "The project shall not be mandated by any law, statute or other regulatory framework, or for UNFCCC non-Annex I countries, any systematically enforced law, statute or other regulatory framework. For UNFCCC non-Annex I countries, laws, statutes,

[12] Source: ANEEL Management Report, 2017.

regulatory frameworks or policies implemented3 since 11 November 2001 that give comparative advantage to less emissions-intensive technologies or activities relative to more emissions-intensive technologies or activities need not be taken into account. For all countries, laws, statutes, regulatory frameworks or policies implemented since 11 December 1997 that give comparative advantage to more emissions-intensive technologies or activities relative to less emissions-intensive technologies or activities shall not be taken into account".

BAESA Project is voluntary project that installed a greenfield hydro power plant. It is not mandate by any law, statute or other regulatory framework, or for UNFCCC non-Annex I countries, any systematically enforced law, statute or other regulatory framework

2.6 Methodology Deviations

Not applicable. There is no methodology deviation in this project.

3 QUANTIFICATION OF GHG EMISSION REDUCTIONS AND REMOVALS

3.1 Baseline Emissions

Baseline emissions include only CO2 emissions from electricity generation in fossil fuel fired power plants that are displaced due to the project activity. The methodology assumes that all project electricity generation above baseline levels would have been generated by existing grid-connected power plants and the addition of new grid-connected power plants. The baseline emissions are to be calculated as follows:

Equation 01

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

Where:

BE_y	=	Baseline emissions in year *y* (t CO_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" (t CO_2/MWh)

If the project activity is the installation of a Greenfield power plant, then:

$$EG_{PJ,y} = EG_{facility,y}$$ Equation 02

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)

Calculation of Combined margin CO_2 emission factor for grid connected power generation in year ($EF_{grid,CM,y}$)

According to the "Tool to calculate the emission factor for an electricity system", version 06.0, Project participants shall apply the following six steps:

(a) **Step 1:** Identify the relevant electricity systems;

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

(c) **Step 3:** Select a method to determine the operating margin (OM);

(d) **Step 4:** Calculate the operating margin emission factor according to the selected method;

(e) **Step 5:** Calculate the build margin (BM) emission factor;

(f) **Step 6:** Calculate the combined margin (CM) emission factor.

In this section, project participants describe how these six steps are applied to this project:

(a) **Step 1:** Identify the relevant electricity systems;

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

As already mentioned on this VCS PD, Brazilian DNA defined in 2008, through the resolution nº 8, that the National Interconnected System should be considered a unique electricity system and that this

configuration is valid for calculating the CO2 emission factors used to estimate the greenhouse gases emissions reductions electricity generation CDM projects.

(b) **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 option I was chosen for the project activity, once the operation margin and build margin emission factor calculated by the Brazilian DNA or alternatively calculated by the project developer are based on data of plants connected to the grid.

(c) **Step 3:** Select a method to determine the operating margin (OM);

The calculation of the operating margin emission factor (EFgrid,OM,y) is based on one of the following methods:

(a) Simple Operation Margin; or
(b) Simple adjusted Operation Margin; or
(c) Dispatch data analysis Operation Margin; or
(d) Average Operation Margin.

The method chosen for the calculation of operation margin emission factor of the BAESA Project is the dispatch data analysis operation margin method.

(d) **Step 4:** Calculate the operating margin emission factor according to the selected method;

The method chosen for the calculation of the operation margin emission factor of this project was the dispatch data analysis.

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

According to the “tool to calculate the emission factor for an electricity system”, for the dispatch data analysis OM it must be used the year in which the project activity displaces grid electricity and the emission factor must be updated annually during monitoring. This way, data are ex-post.

Dispatch data OM for 2016 will be used for emission reductions ex-ante estimation.

Step 5: Calculate the build margin emission factor

In terms of data vintage, project participants can choose between one of the following two options:

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

Option 2. For the first crediting period, the build margin emission factor shall be updated annually, ex-post, including those units built up to the year of registration of the project activity or, if information up to the year of registration is not yet available, including those units built up to the latest year for which information is available. **For the second crediting period, the build margin emission factor shall be calculated ex-ante, as described in option 1 above**. For the third crediting period, the built margin emission factor calculated for the second crediting period should be used.

The option that was chosen by project participants was Option 2. The build margin emission factor is calculated by Brazilian DNA. Build Margin emission factor for 2016 will be used for emission reductions calculations, once 2016 is the latest year for which information is available.

(f) **Step 6:** Calculate the combined margin (CM) emission factor.

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

(a) Weighted average Combined Margin; or

(b) Simplified Combined Margin.

BAESA Project uses option (a) to calculate the combined margin emission factor. The combined margin emission factor is calculated according to the following equation:

$$EF_{grid,CM,y} = w_{OM} * EF_{grid,OM,y} + w_{BM} * EF_{grid,BM,y} \quad \textbf{Equation 03}$$

Where:

$EF_{grid,BM,y}$ = Build margin CO_2 emission factor in year *y* (tCO_2/ MWh)
$EF_{grid,OM,y}$ = Operating margin CO_2 emission factor in year *y* (tCO_2/ MWh)
W_{OM} = Weighting of operating margin emissions factor (%)
W_{BM} = Weighting of build margin emissions factor (%)

The "*Tool to calculate the emission factor for an electricity system"* recommends that the following default values should be used for W_{OM} and W_{BM}:

- Wind and Solar power generation project activities: W_{OM} = 0.75 and W_{BM} = 0.25 for the first crediting period and for subsequent crediting periods.
- All other projects: W_{OM} = 0.5 and W_{BM} = 0.5 for the first crediting period, and W_{OM} = 0.25 and W_{BM} = 0.75 for the second and third crediting period, unless otherwise specified in the approved methodology which refers to this tool.

This way, for BAESA Project second crediting period, it was adopted the following weights: W_{OM} = 0.25 and W_{BM} = 0.75.

3.2 Project Emissions

According to ACM0002, version 17.0, for hydro power project activities that result in new single or multiple reservoirs and hydro power project activities that result in the increase of single or multiple existing reservoirs, project proponents shall account for CH_4 and CO_2 emissions from the reservoirs.

If the power density (PD) of power plant is greater than 4 W/m² and less than or equal to 10 W/m², emissions from the reservoirs are calculated as follows:

$$PE_{HP,y} = \frac{EF_{Res} * TEG_y}{1000}$$ **Equation 04**

Where:

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

EF_{Res} = Default emission factor for emissions from reservoirs of hydro power plants (kg CO_2e/MWh), and the default value as perEB23 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)

If the power density of the project activity is greater than 10 W/m², $PE_{HP,y}$ = 0.

The power density of the project activity, according ACM0002 methodology, is calculated as demonstrated as follows:

Equation 05

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

Where:

PD	=	Power density of the project activity (W/m²)
Cap_{PJ}	=	Installed capacity of the hydro power plant after the implementation of the project activity (W)

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

A_{PJ} = Area of the single or multiple reservoirs measured in the surface of the water, after the implementation of the project activity, when the reservoir is full (m2)

A_{BL} = Area of the single or multiple reservoirs measured in the surface of the water, before the implementation of the project activity, when the reservoir is full (m2). For new reservoirs, this value is zero

Table 07 below evidences that HPP Barra Grande has a power density greater than 4 W/m2:

Table 07: Barra Grande HPP Power Density

Item	HPP Barra Grande
Cap_{PJ}	708,000,000
Cap_{BL}	0
A_{PJ}	94,000,000
A_{BL}	0
PD	**7.53**

As Barra Grande HPP, presents power density greater than 4 W/m2 and less than or equal to 10 W/m2, project emissions are calculated using equation 4.

It is important to mention that, according to ACM0002, version 17.0, for all renewable energy power generation project activities, emissions due to the use of fossil fuels for the backup generator can be neglected. Therefore, these emissions are neglected for BAESA project.

3.3 Leakage

No other leakage emissions are considered. The emissions potentially arising due to activities such as power plant construction and upstream emissions from fossil fuel use (e.g. extraction, processing, transport etc.) are neglected.

3.4 Net GHG Emission Reductions and Removals

Emission reductions are calculated as follows:

$$ER_y = BE_y - PE_y$$ **Equation 06**

Where:

ER_y = Emission reductions in year *y* (t CO_2e/yr)

BE_y = Baseline emissions in year *y* (t CO_2/yr)

PE_y = Project emissions in year *y* (t CO_2e/yr)

Baseline Emissions Calculations

As presented on section 3.6.1, the baseline emissions are calculated as follows:

Equation 01

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

Where:

BE_y = Baseline emissions in year *y* (t CO_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" (t CO_2/MWh)

As Barra Grande HPP is a greenfield power plant, then:

$$EG_{PJ,y} = EG_{facility,y}$$

Equation 02

$EG_{facility,y}$ is the product between assured energy less internal loads and losses (378.235 $MW_{average}$) and 8,760 hours per year. **$EG_{facility,y}$ = 3,313,338 MWh/year**.

To calculate the combined margin emission factor, the following equation is used.

$$EF_{grid,CM,y} = w_{OM} * EF_{grid,OM,y} + w_{BM} * EF_{grid,BM,y}$$

Equation 3

Where:

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

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

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

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

As this is the second crediting period of the project, **W_{OM} = 0.25** and **W_{BM} = 0.75**. As BAESA uses Dispatch data analysis OM method for operating margin emission factor, $EF_{grid,OM,y}$ is calculated ex post. For ex ante emission reductions estimations, $EF_{grid,OM,y}$ for 2016 calculated by Brazilian DNA will be used, as this the latest information available. **$EF_{grid,OM,2016}$ = 0.6228 tCO2e/MWh**[13]. For $EF_{grid,BM,y}$, also data from 2016 will be used, once 2016 is the latest year for which information is available. **$EF_{grid,BM,2016}$ = 0.1581 tCO2e/MWh**[14].

Applying these values to Equation 03, **$EF_{grid,CM,y}$ = 0.25 X 0.6228 + 0.75 X 0.1581 = 0.2743 tCO2/MWh**.

Applying $EG_{PJ,y}$ = 3,313,338 MWh/year and $EF_{grid,CM,y}$ = 0.2743 tCO2/MWh to equation 02, BEy = 3,313,338 X 0.2743 = **908,752 tCO2e**

Project Emissions Calculations

As the power density (PD) of Barra Grande HPP is greater than 4 W/m2 and less than 10 W/m2, emissions from the reservoirs are calculated as equation 04. For TEG_y, it is considered the assured energy value (380.6 $MW_{average}$ x 8,760 hours/year) and for EF_{Res} is used the default emission factor for emissions from reservoirs of hydro power as perEB23 (90 Kg CO2e/MWh).

Applying these values to equation 04: $PE_{HP,y} = \frac{90*3,334,056}{1000}$ = 300,065 tCO2e/year

Net Emission Reductions Calculations

Applying baseline emissions and project emissions results to equation 06, ex ante emission reductions estimations for the second crediting period of the project are 608,686 tCO2e/year (ER_y =908,752 - 300,065 = 608,686 tCO2e/year)

Ex-ante calculation (estimate) of baseline emissions, project emissions/, leakage emissions and net GHG emission reductions and removals are presented in the following table.

[13] Source: MCTI, 2017. http://www.mctic.gov.br/mctic/opencms/ciencia/SEPED/clima/index.html . Accessed on October, 2017.
[14] Source: MCTI, 2017. http://www.mctic.gov.br/mctic/opencms/ciencia/SEPED/clima/index.html . Accessed on October, 2017.

Table 08: Emission Reductions Estimation

Year	Estimated baseline emissions or removals (tCO_2e)	Estimated project emissions or removals (tCO_2e)	Estimated leakage emissions (tCO_2e)	Estimated net GHG emission reductions or removals (tCO_2e)
2016	908,752	300,065	0	608,686
2017	908,752	300,065	0	608,686
2018	908,752	300,065	0	608,686
2019	908,752	300,065	0	608,686
2020	908,752	300,065	0	608,686
2021	908,752	300,065	0	608,686
2022	908,752	300,065	0	608,686
2023	908,752	300,065	0	608,686
2024	908,752	300,065	0	608,686
2025	908,752	300,065	0	608,686
Total	**9,087,520**	**3,000,650**	**0**	**6,086,860**

4 MONITORING

4.1 Data and Parameters Available at Validation

Data / Parameter	GWP_{CH4}
Data unit	t CO2e/t CH4
Description	Global warming potential of methane valid for the relevant commitment period
Source of data	IPCC
Value applied	For the first commitment period: 21 t CO2e/t CH4 For the second commitment period: 25 t CO2e/t CH4
Justification of choice of data or description of measurement methods and procedures applied	Default value provided by IPCC
Purpose of Data	Calculation of baseline emissions (emission factors)
Comments	

Data / Parameter	EF_{Res}
Data unit	$kgCO_2e/MWh$
Description	Default emission factor for emissions from reservoirs
Source of data	Decision at EB 23
Value applied	90 $kgCO_2e/MWh$
Justification of choice of data or description of measurement methods and procedures applied	Value indicated by ACM0002 and EB23.
Purpose of Data	Calculation of project emissions

Comments	Provide any additional comments

Data / Parameter	Cap_{BL}
Data unit	W
Description	Installed capacity of the hydro power plant before the implementation of the project activity. For new hydro power plants, this value is zero
Source of data	Project site
Value applied	0
Justification of choice of data or description of measurement methods and procedures applied	For new hydro power plants, this value is zero
Purpose of Data	Calculation of baseline emissions and project emissions
Comments	

Data / Parameter	A_{BL}
Data unit	m^2
Description	Area of the single or multiple reservoirs measured in the surface of the water, before the implementation of the project activity, when the reservoir is full (m^2). For new reservoirs, this value is zero
Source of data	Project site
Value applied	0
Justification of choice of data or description of measurement methods and procedures applied	For new reservoirs, this value is zero
Purpose of Data	Calculation of project emissions
Comments	

Data / Parameter	$EF_{grid,BM,y}$
Data unit	tCO_2/ MWh
Description	Build margin CO_2 emission factor in year *y*

Source of data	Ministry of Science, Technology, Innovation and Communication[15] and *Tool to calculate the emission factor for an electricity system*
Value applied	0.1581
Justification of choice of data or description of measurement methods and procedures applied	It was used 2016 data latest year for which information is available at the submission for crediting period renewal. Data was calculated by Ministry of Science, technology, Innovation and Communication, institution that chairs Brazilian CDM DNA.
Purpose of Data	Calculation of baseline emissions
Comments	

Data / Parameter	The percentage share of total installed capacity of the specific technology
Data unit	%
Description	The percentage share of total installed capacity of the specific technology in the total installed grid connected power generation capacity in the host country
Source of data	ANEEL
Value applied	61.1%
Justification of choice of data or description of measurement methods and procedures applied	Data provided by ANEEL[16]
Purpose of Data	Calculation of baseline emissions
Comments	

Data / Parameter	The total installed capacity of the technology
Data unit	MW
Description	the total installed capacity of the technology in the host country
Source of data	ANEEL
Value applied	93,216,340
Justification of choice of	Data provided by ANEEL[17]

[15] Source: MCTI, 2017. http://www.mctic.gov.br/mctic/opencms/ciencia/SEPED/clima/index.html . Accessed on October, 2017.
[16] Source: ANEEL, 2017. http://www.aneel.gov.br/documents/656877/14854008/Boletim+de+Informa%C3%A7%C3%B5es+Gerenciais+2%C2%BA+trimestre+de+2017/6f1fac17-8146-4a17-508a-567419d35fae

data or description of measurement methods and procedures applied	
Purpose of Data	Calculation of baseline emissions
Comments	

4.2 Data and Parameters Monitored

All data collected as part of monitoring will be archived electronically and be kept at least for two years after the end of the last crediting period

Data / Parameter	$EG_{facility,y}$
Data unit	MWh/yr
Description	Quantity of net electricity generation supplied by the project plant/unit to the grid in year *y* (MWh/yr)
Source of data	Meters at substation
Description of measurement methods and procedures to be applied	Electricity Meters
Frequency of monitoring/recording	Continuous measurement and at least monthly recording
Value applied	3,313,338
Monitoring equipment	Each turbine/generator has two specific meters (one principal and one rear) located in the Substation that registers net electricity generation supplied to the grid by the turbine/generator. **Principal Meter - Turbine 01** Supplier: Schneider Electric Type: ION 8600 Class: D (0.2%) Serial Number: PT-1201A372-01 **Rear Meter - Turbine 01** Supplier: Schneider Electric

[17] Source: ANEEL, 2017. http://www.aneel.gov.br/documents/656877/14854008/Boletim+de+Informa%C3%A7%C3%B5es+Gerenciais+2%C2%BA+trimestre+de+2017/6f1fac17-8146-4a17-508a-567419d35fae

	Type: ION 8600 Class: D (0.2%) Serial Number: PT-1201A373-01 **Principal Meter - Turbine 02** Supplier: Schneider Electric Type: ION 8600 Class: D (0.2%) Serial Number: PT-1201A394-01 **Rear Meter - Turbine 02** Supplier: Schneider Electric Type: ION 8600 Class: D (0.2%) Serial Number: PT-1201A434-01 **Principal Meter - Turbine 03** Supplier: Schneider Electric Type: ION 8600 Class: D (0.2%) Serial Number: PT-1201A498-01 **Rear Meter - Turbine 03** Supplier: Schneider Electric Type: ION 8600 Class: D (0.2%) Serial Number: PT-1201A505-01
QA/QC procedures to be applied	The uncertainty level for these data is low. The electricity supplied to the grid is monitored by the project participants directly from the meters. Spreadsheets will be used, obtained directly from the meters. Monthly, the meter's information will be checked with the generation spreadsheets available at the CCEE's Website (Electric Power Commercialization Chamber). Besides, information of electricity generation can be checked by receipt of sales, if it is necessary to do so. Meter are calibrated each 2 years, according to National Operator of the System (ONS) Procedures.
Purpose of data	Calculation of baseline emissions
Calculation method	Each Generation Unit has two specific meters located in the Substation that registers net electricity generated by the Unit to the Grid. No calculation is necessary.
Comments	CCEE - Entity responsible for measurements, accounting and

	settlement on Brazilian electric energy market.

Data / Parameter	$EF_{Grid,CM,y}$
Data unit	tCO2e/MWh
Description	Combined margin emission factor for the grid in year y
Source of data	The combined margin emission factor will be calculated using the procedures of the "Tool to calculate the emission factor for an electricity system", version 06.0. $EF_{grid,OM,y}$ data will be supplied by Brazilian DNA. The combined margin emission factor used on BAESA Project will be calculated based on National Interconnected System supplied by Brazilian DNA.
Description of measurement methods and procedures to be applied	As per the "Tool to calculate the emission factor for an electricity system". Project Participants will use Dispatch Data Analysis for OM Operating Margin Emission Factor. Data supplied by Brazilian CDM DNA will be used.
Frequency of monitoring/recording	Annually
Value applied	0.2743
Monitoring equipment	Not applicable
QA/QC procedures to be applied	As per the "Tool to calculate the emission factor for an electricity system".
Purpose of data	Calculation of baseline emissions
Calculation method	As per the "Tool to calculate the emission factor for an electricity system". Dispatch Data Analysis for OM Operating Margin Emission Factor. Data supplied by Brazilian CDM DNA will be used.
Comments	More information was described on item 3.

Data / Parameter	TEG_y
Data unit	MWh/yr
Description	Total electricity produced by the project activity, including the electricity supplied to the grid and the electricity supplied to

	internal loads, in year *y*
Source of data	Project activity site (Meters located at the turbines/generators)
Description of measurement methods and procedures to be applied	Electricity Meters
Frequency of monitoring/recording	Continuous measurement and at least monthly recording
Value applied	3,334,056
Monitoring equipment	Each turbine/generator has one specific meter located in the Powerhouse that registers total electricity generated by the turbine/generator. **Meter - Turbine 01** Supplier: Schneider Electric Type: ION 8600 Class: D (0.2%) Serial Number: PT-1201A467-01 **Meter - Turbine 02** Supplier: Schneider Electric Type: ION 8600 Class: D (0.2%) Serial Number: PT-1201A475-01 **Meter - Turbine 03** Supplier: Schneider Electric Type: ION 8600 Class: D (0.2%) Serial Number: PT-1201A508-01
QA/QC procedures to be applied	The uncertainty level for these data is low. The electricity generated is monitored by the project participants directly from the meters. Meter are calibrated each 2 years, according to National Operator of the System (ONS) Procedures
Purpose of data	Calculation of project emissions
Calculation method	Each Generation Unit has one specific meter located in the Powerhouse that registers total electricity generated by the Unit.

	No calculation is necessary.
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
Description of measurement methods and procedures to be applied	Sum of Installed capacity of the turbines (3 turbines of 236 MW) as indicated by manufacturer's specifications.
Frequency of monitoring/recording	Once at the beginning of each crediting period
Value applied	708,000,000
Monitoring equipment	Not applicable.
QA/QC procedures to be applied	Installed capacity can be cross-checked with environmental licenses, operational Handbook or manufacturer's specifications.
Purpose of data	Calculation of Baseline Emissions
Calculation method	Not applicable.
Comments	

Data / Parameter	A_{PJ}
Data unit	m^2
Description	Area of the single or multiple reservoirs measured in the surface of the water, after the implementation of the project activity, when the reservoir is full
Source of data	Project site
Description of	Measured from topographical surveys, maps, satellite pictures,

measurement methods and procedures to be applied	etc.
Frequency of monitoring/recording	Once at the beginning of each crediting period
Value applied	94,000,000
Monitoring equipment	Not applicable.
QA/QC procedures to be applied	Data can be checked with the project environmental licenses
Purpose of data	Calculation of project emissions.
Calculation method	Not applicable.
Comments	

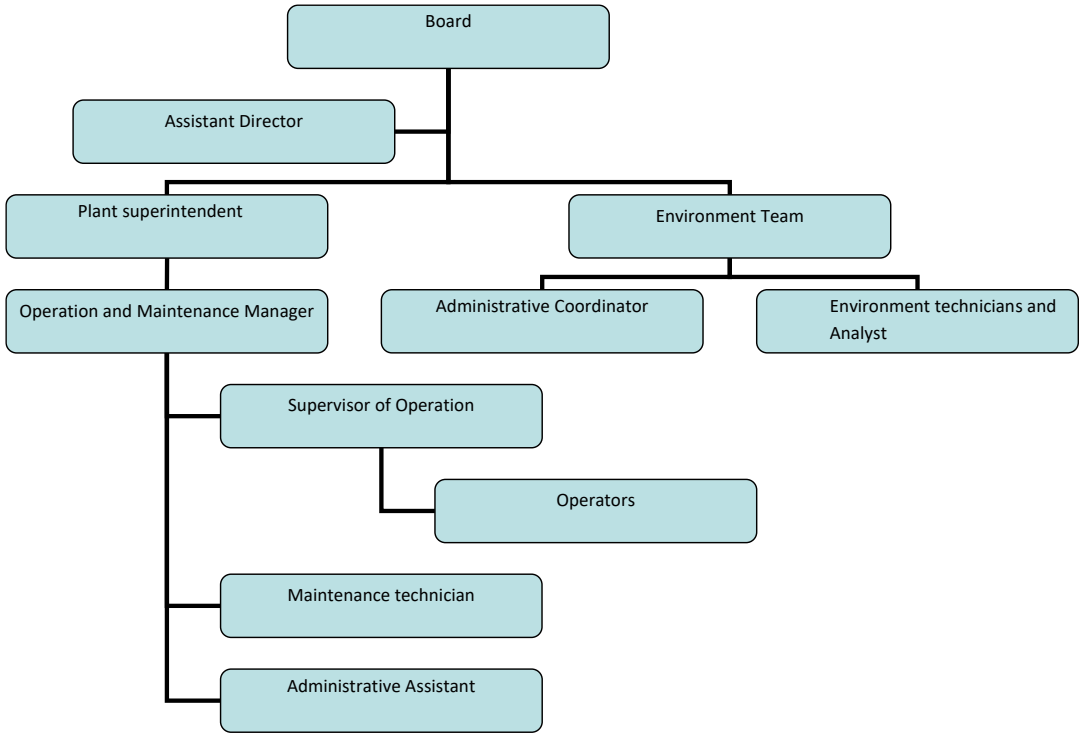
4.3 Monitoring Plan

Monitoring has the objective of measuring the emission reductions achieved by the project. The monitoring plan follows the Monitoring Methodology of consolidated baseline methodology for grid-connected electricity generation from renewable sources ACM0002, version 17.0. All data collected as part of monitoring should be archived electronically and be kept at least for two years after the end of the last crediting period. All measurements will be conducted with calibrated measurement equipment according to Brazilian industry standards. The main parameters that will be monitored are:

- Total electricity produced by the project activity, including the electricity supplied to the grid and the electricity supplied to internal loads, in year *y* (TEG_y);
- Quantity of net electricity generation supplied by the project plant/unit to the grid in year *y* (MWh/yr) ($EG_{facility,y}$);
- Installed capacity of the hydro power plant after the implementation of the project activity (Cap_{PJ});
- Area of the single or multiple reservoirs measured in the surface of the water, after the implementation of the project activity, when the reservoir is full (A_{PJ})
- Combined margin emission factor for the grid in year y ($EF_{Grid,CM,y}$);

Monitoring of TEG_y and $EG_{facility,y}$

Operation and Maintenance Manager is responsible for the operation and maintenance activities of the plant. He is responsible for consolidating and analysing TEG_y and $EG_{facility,y}$ data measurements activities are carried out by the operators of the operation team. The organizational structure of the company is presented below:



Each turbine/generator has three measurement instruments (meters). One meter for each turbine/generator is located in the Powerhouse. This meter registers TEG_y. Also, each turbine/generator has two meters located at the substation. There is one “principal” and one “retaguarda” (rear) that register $EG_{facility,y}$. ONS Grid Procedures (Sub-module 12.3) defines the calibration frequency and other maintenance procedures. All nine meters are calibrated according to Brazilian Standards.

Daily, members of the operation team collect electricity generation data from each meter. Information of net electricity supplied by the three principal meters are consolidated in one spreadsheet. Information of total electricity is consolidated in another spreadsheet.

This internal control is supplied every day for one of the shareholders (CPFL) which is responsible for the relations with CCEE. Data of net electricity supplied to the grid may be compared with the information present in CCEE website (Câmara de Comercialização de Energia Elétrica/ Electric Power Commercialization Chamber).

Consulting Company cross-checks internal control generation spreadsheet with electricity generation data supplied by CCEE. If non-conformities are identified, an email is sent to Operation and Maintenance BAESA Manager. The non-conformity is analysed and if the problem is in the internal control, the spreadsheet is corrected. Up to now, no non-conformity has happened.

It is important to say that electricity generation information impacts directly the revenues of BAESA once electricity is the main product of the project. Therefore, a straight control is performed about this information. These controls follow the internal auditing processes presented in the management system of the company. It is important to highlight that the company is ISO 9001 and ISO 14001 certified.

Periodically, the Information Technology Area accomplishes an insurance backup for all plant data through *backup tape.*

Monitoring of $EF_{Grid,CM,y}$

The Combined margin emission factor for the grid in year y is calculated by consulting company hired by BAESA Energética Barra Grande S.A. Calculations follows Tool to calculate the emission factor for an electricity system, version 06.0 as described on section 02. Data supplied by Brazilian CDM DNA will be used.

Monitoring of Cap_{PJ}

The Installed capacity of the hydro power plant after the implementation of the project activity must be monitored once at the beginning of each crediting period. This parameter does not change over the project period. The value can be checked with environmental licenses, operational handbook or manufacturer's specifications.

Monitoring of A_{PJ}

Area of the single reservoirs measured in the surface of the water, after the implementation of the project activity, when the reservoir is full must be monitored once at the beginning of each crediting period. This area does not change and can be checked with Operation Licenses of the project.

5 SAFEGUARDS

5.1 No Net Harm

As described on item 5.2 of this VCS PD, the environmental impact assessment is part of the environmental licensing, which is a legal obligation in Brazil. During construction phases, some impacts were identified, and monitoring programs were designed to mitigate these impacts.

In Barra Grande HPP Environmental Basic Project (PBA), six (6) programs and twenty-six (26) projects were designed with the objective of providing the minimum environmental impact on the region. Throughout the construction period and start up, BAESA invested approximately R$209 million on these PBA projects and conditions of the environmental licensing, as it is demonstrated in the summary-table below. Each program is related to one potential impact identified before and during construction period.

Table 09 – Financial Resources Invested in the Programs of Environmental Basic Project

PROGRAMS OF ENVIRONMENTAL BASIC PROJECT	**R$ (thousand)**
Social-economic and cultural program	**129,761**
Rearrangement and compensation of population	116,501
Restructure and Revitalization of surrounding communities	2,980
Recuperation and Preservation of Historical and Cultural Heritage	437
Recuperation and Preservation of Landscape Heritage	127
Recuperation and preservation of Archeological Heritage	2,597
Adequacy of the infra-structure of Municipal Services	6,446
Environmental Education	673
Hydrology, climatology and water quality Program	**5,180**
Hydrological Conditions Monitoring	520
Climate Conditions Monitoring	450
Limnological and of water quality conditions Monitoring	1,200
Water Macrophytes Monitoring	250
Ichthiofauna Monitoring	2,000
Hydro Sediments Conditions Monitoring	250
Integrated Actions of Soil and Water	510
Geo technology Program	**10,371**
Seismic Monitoring	500
Monitoring of the exploitation of Mineral Resources	8
Monitoring of aquifers	450

PROGRAMS OF ENVIRONMENTAL BASIC PROJECT	**R$ (thousand)**
Monitoring of marginal slopes	230
Handling and recuperation of flora and fauna	2,500
Reforestation	3,700
Partnership with Embrapa Recursos Genéticos (Embrapa Genetic Resources)	1,500
Monitoring of *Dyckia*	650
Application of Financial Resources on Conservation Units	833
Physical environment programs	**15,784**
Accumulation Basin Cleanness	15,481
Management and Restructure of construction areas	303
Management program	**3,730**
Reservoir Management	803
Monitoring and assessment of Environmental Basic Project	827
Social communication	**2,100**
Conditions of ASV	**23,706**
Social Agreement	**19,885**
Total	**208,417**

All investments on socio-environmental programs were coordinated by a multidisciplinary staff, seeking to reach the balance between the results searched by the entrepreneurship and the social and environmental aspects. BAESA's social and environmental actions trespass the compliance of compensatory measures determined by the authorities involved. The successes of social and environmental projects that have been developed in BAESA Project are proved through polls and prizes.

Among the prizes received by the company for its outstanding socio-environmental action, it can be mentioned: Mário Henrique Simonsen Award – Excellence in Social Balance (promoted by the National Foundation of Management Support); Fitz Muller Award – category of environmental education (promoted by the Environmental Foundation of Santa Catarina); and Empresa Cidadã (Citizen Company) – category of environmental preservation (promoted by Association of Sales and Market Directors of Brazil – Division of Santa Catarina).

Furthermore, other indicator of the success of the Environment Programs developed by the company, it can be mentioned the poll carried out by the company Lupi & Associados with 621 inhabitants of the municipalities covered by the Power Plant, which points that 88.3% of them have favorable opinions about the entrepreneurship.

Currently, during the operation phase, according to operational license 447/2005, renewed on 2014, March, just the following programs related to impacts should be kept and carried out:

- Environmental education program;

- Water quality and hydro sedimentology management program;
- Erosive site control program;
- Monitoring program of Macrophytes;
- Seismological monitoring program;
- Climate monitoring program;
- Icthyofauna monitoring program;
- Monitoring program of *Lontra longicaudis;*
- Implement the Environmental Conservation Plan and Water Use of the Reservoir (PCAU);
- To develop, after IBAMA demand, monitoring plan of wildlife threatened;
- Evaluate with the local government and communities' associations the reservoir touristic potential.

5.2 Environmental Impact

The environmental licensing is a legal obligation prior to the installation of any entrepreneurship or activity potentially pollutant or degrading to the environment in Brazil. The Brazilian licensing process presents as an important characteristic the social participation in decision making through Public Meetings as part of the process.

The obligation of environmental licensing is shared by State Environmental Organs and by Ibama – Instituto Brasileiro do Meio Ambiente e dos Recursos Naturais Renováveis (Brazilian Institute of Environment and Renewable Natural Resources), as part of SISNAMA – Sistema Nacional de Meio Ambiente (National Environmental System). Ibama is responsible for licensing of infra-structure projects whose involves impacts to more than one state, as Barra Grande HPP.

Aiming at providing a general view on the procedure used in the environmental licensing for a hydroelectric power plant project in Brazil which includes more than one state, it is presented below a section taken from Ibama's website:

> *"The process of environmental licensing has three different phases: Prior Licensing, Installation Licensing and Operation Licensing. Prior License (PL) must be requested to IBAMA in the planning phase of the implantation, alteration or enlargement of the entrepreneurship. This license does not authorize the installation of the project, but approves the environmental viability of the project and authorizes its location and technological conception. Besides, it establishes the conditions to be considered in the development of the executive project. The Installation License (LI) authorizes the start of the entrepreneurship construction. The deadline for this license is established by the timetable of the project construction, which cannot be superior to 6 (six) years. The Operation License (LO) must be requested before the entrepreneurship begins its operation, since it is this document that authorizes its start up. Its issuance is conditioned to an inspection to*

verify whether all the demands and technical details described in the project approved were developed. It is also verified if they are according to what is expected in the LP and LI. During the licensing process, IBAMA consults Environmental Organs (EO), as Federal Entities Historic Heritage Management (Órgãos Federais de Gestão do Patrimônio Histórico – IPHAN), Indigineous National Foundation (FUNAI), Traditional Quilombolas Communities (Fundação Palmares), Health National Foundation (FUNASA), among others. To subsidize the LO phase, the entrepreneur elaborates a group of reports, describing the execution of the environmental programs and mitigating measures expected in the phases of LP and LI".[18]

The first License for Operation that authorized HPP Barra Grande start up was issued by IBAMA on July 4, 2005, reflecting the positive understanding of the Agency regarding the project's environmental viability and the accomplishment of environmental demands, proving that all mitigations programs carried out by the project are successful.

In 2008, the operation license was renewed with a deadline of 6 years and in 2014, the operation license was renewed again with a deadline of 10 years.

The project will not produce trans-frontier effects. All impacts will occur within Brazilian frontiers and were mitigated, aiming at fulfilling the environmental demands to the implementation of the project.

BAESA Project meets the several demands of the national environmental legislation, having the necessary licenses for its implantation. The current operation license of BAESA Project is presented as follows:

- Operation License (LO) - - nº 447/2005
    - Signed on: 04/07/2005 (dd/mm/yyyy).
    - Renewed on: 26/03/2014 (dd/mm/yyyy).
    - Valid until: 26/03/2024 (dd/mm/yyyy).

When renewing BAESA Project Operation License, IBAMA requested BAESA to present the programs described on item 4.1 of this VCS PD. BAESA Energética Barra Grande should provide monitoring reports annually to IBAMA. As it can be seen, the actions required by the environmental licensing agencies refer fundamentally to the continuity of the programs and methodologies of mitigation of environmental impacts, proving the quality and seriousness of the company regarding environmental issues.

5.3 Local Stakeholder Consultation

The public audience is one of the phases of the environmental impact assessment and one of the main channel of community participation at a local level before project construction. This procedure

[18] http://www.ibama.gov.br/licenciamento/index.php

consists on presenting to the interested parties the environmental assessment report, clarifying doubts and collecting criticisms and suggestions on the entrepreneurship and the areas to be affected.

The public audiences occur by the determination of IBAMA, whenever judged to be necessary, or by social entities requirements (Public Ministry or more than 50 citizens). Public audience notice is published in Diário Oficial da União (Union's Official Journal) and in a regional or local large circulation newspaper, radios and banners. Date, hour and place of the event must be presented. The place where public audiences happen must be easily accessed by the interested parties. Therefore, due to the geographic location of the communities and interested groups, there may be more than one event about the same project.

BAESA Project was submitted to public audiences during all your licensing process. Furthermore, Project Proponents sent letters to stakeholders, inviting them to make comments about the project. Following stakeholders were consulted:

- State Government of Santa Catarina
- State Government of Rio Grande do Sul;
- Legislative Council of Santa Catarina;
- Legislative Council of Rio Grande do Sul;
- IBAMA – Brazilian Institute of Environment and Renewable Natural Resources;
- Brazilian Ministry of Environment;
- Environment Foundation of State of Santa Catarina (FATMA);
- State Secretary of Sustainable Development (responsible for issues related to the Environment in the state of Santa Catarina);
- Environment Secretary of Rio Grande do Sul (SEMA);
- State Foundation of Environmental Protection Henrique Luiz Hoessler – FEPAM;
- Santa Catarina Public Prosecutors;
- Rio Grande do Sul Prosecutors;
- Federal Prosecutors;
- Brazilian Forum of NGO's and Social Movements for Environment and Development;
- FIESC – Industries Federation of Santa Catarina State;
- FIERGS – Industries Federation of Rio Grande do Sul;
- Light Brazil Institute;
- APINE –Independent Electricity Producers Association.

Stakeholders consulted were the same stakeholders required by Brazilian DNA for CDM projects. Letters have been sent to the local stakeholders on September 01, 2008, before the validation process and became open for comments and opinions about BAESA Project until September 30, 2008. The VCS-PD was available for local stakeholders for comments. No comments were received.

It is noteworthy to say that BAESA keeps a Service Center to attend local community to provide information about the project. This Center is also used to obtain communities' view about environmental education program and other mitigation actions carried out by the project.

Besides that, there is a Community Consulting Council, formed by local stakeholders, where community is engaged on environmental programs developed by BAESA.

5.4 Public Comments

No comments were received during the public comment period of VCS PD. Either any update of the project design happened.