BAESA MONITORING REPORT

Document Prepared by Ecofinance Negócios

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1 PROJECT DETAILS

1.1 Summary Description of the Implementation Status 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 $MWh_{average}$.

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.

The technology applied in the project is well established in the sector. All equipment employed have already been successfully applied to similar projects 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 Powerhouse measures total electricity generation and two (2) meters for each generation unit located at the substation are responsible for net electricity measurement.

The operation starting date of the first turbine was 11 january 2005 and the plant is operational since then. In March 2009, Verified Carbon Standard (VCS) registered BAESA Project as Project ID number 10. Since there, two monitoring reports were verified (from 2006 to 2010) and the crediting period renewal was already approved.[1]

The total GHG emission reductions generated during this monitoring period is 4,586,251 tCO2e.

[1] More information about this process can be found at https://registry.verra.org/app/projectDetail/VCS/10 .

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

Provide contact information for the project proponent(s). Copy and paste the table as needed.

Organization name	**BAESA - Energética Barra Grande S.A**
Contact person	Juliano Natal or Peter Eric Volf
Title	*Director*
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Email	juliano.natal@cscenergia.com.br or pvolf@baesa.com.br

Organization name	**Ecofinance Negócios Eireli[2] (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
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[2] Ecofinance Negócios Eireli is the new name for Enerbio Consultoria Ltda. The name of the company was changed in 2012 as it can be proved by the estatutes of the company.

1.4 Other Entities Involved in the Project

Not applicable once there are no other Entities involved in the project.

1.5 Project Start Date

According to the VCS Standard, version 4.0, 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 VCS PD 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 January 2006 to 31 December 2015.

1.7 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:

The following map shows the localization of HPP Barra Grande:

Map 1 – Localization of HPP Barra Grande

1.8 Title and Reference of Methodology

As registered VCS PD, the methodologies used by the project are:

- Version 7 of Consolidated baseline and monitoring methodology ACM0002 - Methodology Consolidated for grid-connected electricity generation from renewable sources.
- Tool for Demonstration and Assessment of Additionality, Version 05.2.
- Version 07.0 of “Tool to calculate the emission factor for an electricity system”.

1.9 Participation under other GHG Programs

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

1.10 Other Forms of Credit

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

1.11 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"[3].

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[4].
- 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.

[3] 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.

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

- Despite the project presents low environmental impacts, with small reservoir formation and elevated power density, BAESA makes considerable investments in environmental programs and actions[5]. 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 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.

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

2 SAFEGUARDS

2.1 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 01 – 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

PROGRAMS OF ENVIRONMENTAL BASIC PROJECT	**R$ (thousand)**
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
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.

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.

2.2 Local Stakeholder Consultation

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

2.3 AFOLU-Specific Safeguards

Not applicable once for non-AFOLU projects, this section is not required.

3 IMPLEMENTATION STATUS

3.1 Implementation Status of the Project Activity

The Project activity is in commercial operation since 11/01/2005. The total electricity produced by the project activity, including the electricity supplied to the grid and the electricity supplied to internal loads (TEG,y) per year and the electricity supplied by the project activity to the grid (EG,y) per year during the monitoring period are presented in the following table:

Table 02 – TEG,y and EG,y per year for the monitoring period

Parameter	2011	2012	2013	2014	2015
TEG,y (MWh)	4,041,741	1,829,864	3,021,101	4,284,859	3,703,241
EG,y (MWh)	4,005,411	1,776,857	3,002,169	4,257,859	3,680,805

Hydrological conditions and rainfall in the region can affect electricity generation and, consequently, it can also affect emission reductions. The emission reductions can also be affected by the variability of the Brazilian Grid emission factor.

In the 1st Monitoring Period (MP) the net electricity generated was 22% less than assured energy. In 2006 and 2008, the plant generated below the estimated assured energy (59.3% and 14.3%, respectively).

In the 2nd MP the net electricity generation was 7.2 % above the assured energy. One factor very important that contributed to achieve higher emission reductions during the 2nd MP (comparing to the 1st MP) is that during 2010 the net electricity generation was 24.9% above the assured energy and the grid emission factor of this year was 0.3095 (approximately 39% above the medium emission factor of the 1st MP). Therefore, the emission reductions achieved during this specific year was significantly higher that what was observed in the first monitoring period due to two reasons (i) higher emission factor and (ii) more electricity generation.

In the 3rd MP, considering the whole MP, electricity supplied by the project activity to the grid (EG,y) was 0.32% higher than estimation based on assured energy for the period (16,723,101 MWh x 16,670,280 MWh).

In 2011, 2014 and 2015, EG,y was higher than estimation (20.1%; 27.7% and 10.4%, respectively) and in 2012 and 2013 was minor than the projected assured energy (46.7% and 9.9%).

It is important to highlight that this electricity generation variability is expected once it is highly associated to rainfall regime. Therefore, emissions reductions are directly connected to the hydraulic generation of energy, which depends significantly on the volume of water in the basin of the rivers in which the plant is located. Scarce rains, floods, or any other natural factor may cause an impact on the generation capacity of the project and, consequently, may affect the emission reductions provided by it.

The rainfall regime also impacts the results of combined margin CO_2 emission factor ($EF_{grid,CM,y}$) for plants connected to Brazilian Interconnected System. Scarce rains in the country requires more thermal generation increasing the $EF_{grid,CM,y}$.

Compared to combined margin CO_2 emission factor estimated at VCS PD registered (0.1842 tCO2/MWh) which was calculated based on 2007 data, $EF_{grid,CM,y}$ was higher in all years of this MP as presented in the table below. Note that in some years $EF_{grid,CM,y}$ is more than 120% higher than estimated at VCS PD (2013, 2014 and 2015)

Table 03 – $EF_{grid,CM,y}$ per year for the monitoring period

Parameter	2011	2012	2013	2014	2015
$EF_{grid,CM,y}$ (tCO2/MWh)	0.1988	0.3593	0.4322	0.4400	0.4075

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Emission reductions achieved during the 3rd MP are 192% higher than estimated in VCS PD for the period due to this higher increase of $EF_{grid,CM,y}$. However, it once more important to highlight that variation on electricity supplied by the project activity to the grid (0.32%) is not significant and would not change results of additionality analysis once this scenario is covered in the sensitivity analysis.

3.2 Deviations

2.3.1 Methodology Deviations

Not applicable once there is no methodology deviation.

2.3.2 Project Description Deviations

The Project Description (PD) validated and registered predicts that HPP Barra Grande follows the ONS Grid Procedures to make the calibration of its electricity meters. ONS Grid Procedures (Sub-module 12.3) defines the calibration frequency and other maintenance procedures. According to this procedure, meters should be calibrated each two years.

Table 04 presents calibration dates of the meters during this monitoring period:

Table 04 – Calibration date and Company Responsible for

Calibration Date (dd/mm/yyyy)	Company Responsible for Calibration Procedure
From 16/09/2008 to 18/09/2008	METROWATT COMÉRCIO E MANUTENÇÃO LTDA
11/01/2011[6]	METROWATT COMÉRCIO E MANUTENÇÃO LTDA
From 05/03/2012 to 08/13/2012	Laboratório de Calibração CAM
26/02/2014 and 27/02/2014	METROWATT COMÉRCIO E MANUTENÇÃO LTDA
22/02/2016 and 23/02/2016	Metrum

During the second monitoring period, the calibration frequency of two years was not followed. It should have happened at 16/09/2010 and it just occurred at 11/01/2011. For this third monitoring period, there are 11 days of the first month (January/2011) were meters were not calibrated. There was a delay in hiring the calibration service provider by the company.

Conservatively, for January/2011, it was applied the error identified in the delayed calibration test, once the error is beyond the maximum permissible error of the measuring equipment. The maximum error identified at calibration certificates issued at 2011 were applied to Total Electricity Generated (TEGy) and Electricity Supplied to the Grid – Net Electricity (EGy). For TEGy, the maximum error identified was 0.319%. For EGy, 0.565%.

Conservatively, these errors were applied to the whole amount of electricity measured in January/2011. Despite, meters had not been calibrated during just eleven days of the month.

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3.3 Grouped Projects

Not applicable once this is not a grouped project.

[6] In 2012, meters were replaced. New meters were installed as evidences supplied to DOE during verification process.

4 DATA AND PARAMETERS

4.1 Data and Parameters Available at Validation

Data / Parameter	EF_{Res}
Data unit	$kgCO_2e/MWh$
Description	Default emission factor for emissions from reservoirs.
Source of data	This value is supplied by ACM0002 - Consolidated baseline methodology for grid-connected electricity generation from renewable sources and it was defined by EB (CDM Executive Board) 23 Decision.
Value applied	The default value as per EB23 is 90 $kgCO_2e/MWh$.
Justification of choice of data or description of measurement methods and procedures applied	This value is indicated by ACM0002 - Consolidated baseline methodology for grid-connected electricity generation from renewable sources.
Purpose of Data	This value was utilized to calculate project emission (PEy)
Comments	

Data / Parameter	GWP_{CH4}
Data unit	tCO2e/t CH4
Description	Global warming potential of methane valid for the relevant commitment period
Source of data	IPCC Fourth Assessment Report
Value applied	25 tCO2e/t CH4
Justification of choice of data or description of measurement methods and procedures applied	This value is indicated by ACM0002 - Consolidated baseline methodology for grid-connected electricity generation from renewable sources.
Purpose of Data	Calculation of baseline emissions (emission factors)
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 as indicated by ACM0002 - Consolidated baseline methodology for grid-connected electricity generation from renewable sources, this value is zero
Purpose of Data	Calculation of baseline emissions and project emissions
Comments	

Data / Parameter	CapBL
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 as indicated by ACM0002 - Consolidated baseline methodology for grid-connected electricity generation from renewable sources, this value is zero
Purpose of Data	Calculation of baseline emissions and project emissions
Comments	

Data / Parameter	ABL
Data unit	m^2
Description	Area of the reservoir measured in the surface of the water, before the implementation of the project activity, when the reservoir is full (m2). For new reservoirs, this value is zero
Source of data	Project site
Value applied	0
Justification of choice of data or description of	For new hydro power plants as indicated by ACM0002 - Consolidated baseline methodology for grid-connected electricity generation from renewable sources, this value is zero

measurement methods and procedures applied	
Purpose of Data	Calculation of project emissions
Comments	

4.2 Data and Parameters Monitored

Data / Parameter	Electricity Supplied to the Grid – Net Electricity (EGy)
Data unit	MWh
Description	Electricity supplied by the project activity to the grid.
Source of data	Project activity site (Meters at substation)
Description of measurement methods and procedures to be applied	Each Generation Unit has two specific meters (One principal and one rear) located in the substation that registers the net electricity supplied to the Grid by the Unit. Spreadsheets were used, obtained directly from the meters with information generated hourly, or according to what was programmed by CCEE (Câmara de Comercialização de Energia Elétrica/ Electric Power Commercialization Chamber). Monthly, the information was checked with information of net electricity supplied by CCEE. There is a minor difference between information obtained directly from meters and information supplied by CCEE. As CCEE is a third party responsible for electricity contracts settlements in Brazilian Market, information supplied by CCEE was used. Considering the whole monitoring period (the five years), differences between information obtained from meters and information supplied by CCEE is 0.35%. CCEE information is minor. Therefore calculation is conservative. Two reports supplied by CCEE were used> • ME002 report for period from January/2011 to august/2012[7]; • MED003 report for period from september/2012 to December/2015.

[7] From September/2012, CCEE replaced ME002 reports to use MED003 report to provide information of electricity measurement.

Frequency of monitoring/recording	Hourly measurement and monthly recording
Value monitored	The values monitored for each year of this MP is presented below: • 2011 – 4,005,411 MWh • 2012 – 1,776,857 MWh • 2013 – 3,002,169 MWh • 2014 – 4,257,859 MWh • 2015 – 3,680,805 MWh
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 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. The meter's information is checked with the generation spreadsheets available at the CCEE's Website (Electric Power Commercialization Chamber). Meter are calibrated at least each 2 years, according to National Operator of the System (ONS) Procedures.
Purpose of the 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	

Data / Parameter	Total Electricity Generated (TEG_y)
Data unit	MWh
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 powerhouse)
Description of measurement methods and procedures to be applied	Each Generation Unit has one specific meter located in the plant (powerhouse) that registers the total electricity produced by the project activity. Spreadsheets obtained directly from the meters with information generated hourly or according to what was programmed by CCEE, were used to measure TEG_y.
Frequency of monitoring/recording	Continuous measurement and at least monthly recording
Value monitored	The values monitored for each year of this MP is presented below:

	• 2011 – 4,041,741 MWh • 2012 –1,829,864 MWh • 2013 – 3,021,101 MWh • 2014 – 4,284,859 MWh • 2015 – 3,703,241 MWh
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. Information from meters is checked with CCEE reports. Meter are calibrated each 2 years, according to National Operator of the System (ONS) Procedures
Purpose of the 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	Yearly
Value monitored	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 the data	Calculation of Baseline Emissions
Calculation method	Not applicable.
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.
Description of measurement methods and procedures to be applied	Measured from topographical surveys, maps, satellite pictures, etc.
Frequency of monitoring/recording	Yearly
Value monitored	94,000,000
Monitoring equipment	Not applicable.
QA/QC procedures to be applied	Data can be checked with the project environmental licenses

Purpose of the data	Calculation of project emissions.
Calculation method	Not applicable.
Comments	

Data / Parameter	$EF_{Grid,CM,y}$
Data unit	tCO2/MWh
Description	Combined margin CO2 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 combined margin emission factor will be calculated using the procedures of the "Tool to calculate the emission factor for an electricity system", version 07.0. EFgrid,OM,y and EFgrid,BM,y data will be supplied by Brazilian Designated National Authority (DNA) which is the Ministry of Science, Technology, Innovation and Communications. 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 and BM Emission Factor. Data supplied by Brazilian CDM DNA will be used.
Frequency of monitoring/recording	Annually
Value monitored	The values monitored for each year of this MP is presented below: • 2011 –0.1988 tCO2/MWh • 2012 – 0.3593 tCO2/MWh • 2013 – 0.4322 tCO2/MWh • 2014 – 0.4400 tCO2/MWh • 2015 – 0.4075 tCO2/MWh
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 the data	Calculation of Baseline Emissions

Calculation method	As per the “tool to calculate the emission factor for an electricity system”. Dispatch Data Analysis OM is the Operation Margin Emission Factor method used and the build margin emission factor is updated annually. Both Operating Margin Emission Factor and Build Margin Emission factor are supplied by MCTI. The combined margin emission factor considers the default value of 0.5 for each emission factor as recommended by the methodology.
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 7.0. 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:

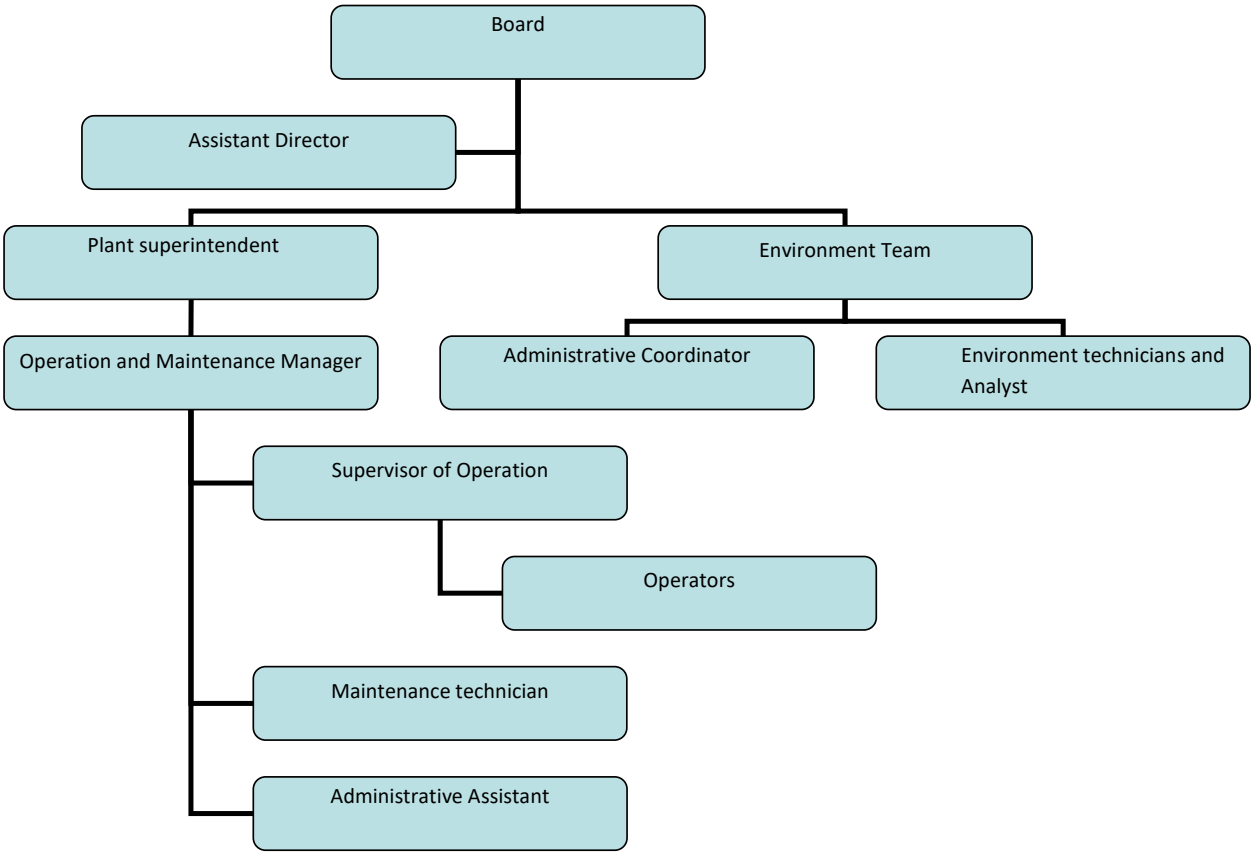
The main parameters that were controlled were:

- 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:

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, operators of BAESA operation team collects electricity generation data from each meter. Information of net electricity supplied by the three principal meters is 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 supplied by CCEE.

During the 3rd MP, all nine meters were calibrated four time as follows, as presented at table 4.

It is important to say that electricity generation information directly impacts 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 07.0. Data supplied by Brazilian CDM DNA was 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 does not change. It can be checked with Operation Licenses of the project.

Monitoring of PEy

Project emissions are calculated according ACM0002 - Consolidated baseline methodology for grid-connected electricity generation from renewable sources, version 07, and it is consolidated annually by project participants. The emission of the project is calculated by consulting company Ecofinance Negócios and it is accounted in tCO2e.

Monitoring of ERy

Emission reductions achieved by the project are calculated by consulting company Ecofinance Negócios following ACM0002 - Consolidated baseline methodology for grid-connected electricity generation from renewable sources, version 07.

5 QUANTIFICATION OF GHG EMISSION REDUCTIONS AND REMOVALS

5.1 Baseline Emissions

Baseline emissions are calculated as indicated by the baseline methodology ACM0002, version 7 that establishes that baseline emissions include only CO_2 emissions from electricity generation in fossil fuel fired power plants that are displaced due to the project activity. The baseline emission is calculated as follows:

$BEy = (EGy – EGbaseline) * EF_{grid,CM,y}$ **Equation 1**

Where:

BEy = Baseline Emission in year y (t CO_2e/year)

EGy = Electricity supplied by the project activity to the grid (MWh)

EGbaseline = Baseline electricity supplied to the grid in case of modified or retrofit facilities (MWh). For new power plants this value is taken as zero.

$EF_{grid,CM,y}$ = 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".

EGy and $EF_{grid,CM,y}$ are monitored as it was described previously and EGbaseline is 0 (zero) because HPP Barra Grande is a new power plant to be connected to the interconnected grid.

Table below provides an overview of the data used to calculate Baseline Emissions of BAESA Project for this monitoring period. Information per month is presented at Appendix 1.

Table 05 – Baseline Emissions Parameters and Results

Year	EFgrid,OM* (tCO2/MWh)	EFgrid,BM* (tCO2/MWh)	W_{OM}	W_{BM}	EFgrid,CM* (tCO2/MWh)	Net Electricity - EGy (MWh/yr)	BEy (Baseline Emissions) (tCO2e/yr)
2011	0.2920	0.1056	0.5	0.5	0.1988	4,005,411	796,192
2012	0.5176	0.201	0.5	0.5	0.3593	1,776,857	638,439
2013	0.5932	0.2713	0.5	0.5	0.4322	3,002,169	1,297,675
2014	0.5837	0.2963	0.5	0.5	0.4400	4,257,859	1,873,369
2015	0.5597	0.2553	0.5	0.5	0.4075	3,680,805	1,499,851
Total						**16,723,101**	**6,105,526**

5.2 Project Emissions

There is no leakage for the project activity; however, power density of Barra Grande Power Plant is 7.3 W/m^2, therefore emissions from its reservoir must be considered. To calculate project emission, it was used equation below:

$$PEy = \frac{EFRes * TEGy}{1000}$$ **Equation 2**

Where:

PEy = Emission from reservoir expressed as tCO_2e/year;

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

TEGy = 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).

Table 06 – Project Emissions Parameters and Results

Year	Total Electricity - TEGy (MWh/yr)	Project Emissions (PEy) (tCO2e/yr)
2011	4,041,741	363,757
2012	1,829,864	164,688
2013	3,021,101	271,900
2014	4,284,859	385,638
2015	3,703,241	333,292
Total	**16,880,808**	**1,519,275**

5.3 Leakage

According to ACM0002 - Consolidated baseline methodology for grid-connected electricity generation from renewable sources, version 07, there is no leakage for the project activity.

5.4 Net GHG Emission Reductions and Removals

Net GHG emission reductions of the project for this 3rd MP is presented at the table below.

Table 07 – Net GHG Emission Reductions

Year	Baseline emissions or removals (tCO_2e)	Project emissions or removals (tCO_2e)	Leakage emissions (tCO_2e)	Net GHG emission reductions or removals (tCO_2e)
2011	796,192	363,757	*0*	432,435
2012	638,439	164,688	*0*	473,751
2013	1,297,675	271,900	*0*	1,025,775
2014	1,873,369	385,638	*0*	1,487,731
2015	1,499,851	333,292	*0*	1,166,559
Total	**6,105,526**	**1,519,275**	**0**	**4,586,251**

APPENDIX I: COMPLEMENTARY TABLE

In Appendix I, it is presented information of Electricity supplied by the project activity to the grid (MWh) per month.

Appendix Table I - Net Electricity Supplied by the project activity to the grid (EGy) per month

Net Electricity Generation (Measured on the Subestation) - MWh/Month					
BAESA	**2011**	**2012**	**2013**	**2014**	**2015**
January	141,915	221,746	148,620	323,332	436,192
February	194,824	279,990	184,427	320,244	321,299
March	353,023	167,655	260,945	259,108	268,572
April	329,441	68,907	168,188	308,040	221,122
May	359,082	61,791	176,963	238,334	140,447
June	380,583	33,685	19,381	341,642	116,563
July	383,573	108,118	53,138	420,183	291,740
August	445,047	117,307	422,640	394,365	421,017
September	402,719	307,850	425,962	434,290	417,363
October	412,313	302,456	340,153	371,347	456,087
November	373,225	75,208	437,909	430,668	249,269
December	230,466	32,144	363,843	416,308	341,133
Total	4,006,213	1,776,857	3,002,169	4,257,859	3,680,805