

**VOLUNTARY CARBON STANDARD
MONITORING REPORT – Version 05**

Date: 18th March 2009

BAESA PROJECT

Monitored Period: 01th January 2006 to 31th December 2008

Crediting Period: 01th January 2006 to 31th December 2015

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1. General Description of Project Activity

1.1 Project title

BAESA Project

1.2 Type/Category of the project

BAESA Project fits in the category of scope 1 – Energy Industries (Renewable Source)

1.3 A brief description of the project:

The project activity consists on the supply of clean hydroelectric energy to the Brazilian National Interconnected System (SIN) through the implantation and operation of Hydro Power Plant (HPP) Barra Grande, 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, with an installed capacity of 708 MW, using a small reservoir, with low environmental impact related to its installed capacity.

Barra Grande Hydro Power 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 economical and population growth, contributing, thus, to the environmental, social and economical sustainability, by increasing the participation of clean and renewable energy in relation to the country's total consumption of electricity. The installation of HPP Barra Grande provides the generation of enough electricity to the supply of 30% of the energetic demand of the state of Santa Catarina or 20% of the total energy consumed in the state of Rio Grande do Sul.

The scenario prior to the implantation of the project points to an important presence of thermoelectric power plants in the national energetic matrix (second greatest source of energy in the country), with total concentration of coal thermoelectric power plants (greatest contributors for the emission of CO₂ in the national energetic matrix) being in the Southern Region of the country, where BAESA Project is located. Moreover, the projection of the Ministry of Mines and Energy (MME) points to a total growth in the offer of thermoelectric energy in the country of 10,486 MW in the period of 2006-2015, based mainly on natural gas, oil and mineral coal, sources with more potential to contribute to global warming than the generation provided by the technology implanted by BAESA Project. It is important to highlight that all coal thermoelectric power plants projected by MME to start their operation in the period of 2006-2015 are located in the Southern region of the country, where BAESA Project is located.

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

The alternative scenarios to the project activity are two situations which reflects the calculation of the combined margin of baseline scenario: (i) the continuity of the present scenario, with electricity generation happening according to the current generation composition of the National Interconnected System, more specifically of the South Subsystem and (ii) the construction of a new mineral coal thermoelectric power plant.

BAESA Project makes use of three generator units with three specific meters (for each unit), destined to measure the Project's generation of energy. The project activity reduces the emission

of greenhouse gases (GHGs) through the use of renewable sources of energy and making use of clean technology, avoiding the generation of electricity via sources of fossil fuels with consequent emissions of CO₂, that would be generated if the project did not exist. The reservoir of HPP Barra Grande is responsible for emissions of CH₄ which will be accounted for and reduced from the total project emission reduction.

Through actions that exceed the simple compliance of compensatory measures determined by the authorities involved in the entrepreneurship implementation, the construction of BAESA project proved that it is possible unite social and economic development with environment preservation, social responsibility and historical and cultural heritage recuperation.

Therefore, BAESA Project contributes to the sustainable development of the cities involved and of the country 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, which 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”¹.

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 possible entrepreneurships that would generate energy through the burning of fossil fuels, avoiding, thus, the emission of pollutants gases to the atmosphere and preserving the environment to future generations.
- Through the generation of more than 5,000 direct and indirect jobs during the phases of construction and operation and through the improvement of the economic activities aggregated to the implantation of the entrepreneurship, BAESA Project promotes region economical development, which occurs through the generation of revenue to the communities of the municipalities involved and their collaborators. Moreover, through taxes and tributes generated by its activities to the municipalities involved and to the Union, BAESA Project provides financial resources that will be reverted to the population of the region and of the country at large. It is estimated that during the period of construction of the entrepreneurship, (1) R\$ 240 millions were brought to the local, regional and state economy through the purchase of materials, payment of salaries and hiring of services; (2) 8.5 millions were directly applied to health, education, leisure, security and social assistance infra-structure of the municipalities; (3) R\$ 7.5 millions were collected by the municipalities of Anita Garibaldi and Pinhal da Serra through Taxes over Services of any Nature (ISSQN – Imposto Sobre Serviços de Qualquer Natureza) and (4) R\$ 9.0 millions were collected to the states of Rio Grande do Sul and Santa Catarina, referring to the Tax over Circulation of Goods and Services (ICMS – Imposto Sobre Circulação de Mercadorias e Serviços). It is still estimated that with total operation of the entrepreneurship, City Halls will receive about R\$ 25.5 millions annually, referring to the Financial Compensation for the Utilization of Hydro Resources (CFURH – Compensação Financeira pela Utilização de Recursos Hídricos) which may make, if well managed by the public power, a long-term plan of socio-economical development.

¹ 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.

- Besides BAESA project presents low environmental impacts, with small reservoir formation and elevated power density, BAESA makes considerable investments in environmental programs and actions. Twenty-six programs are being developed, distributed in 6 programs, which totalize an invested amount of approximately R\$ 209 millions. Among the environmental projects, it can be highlighted the reforestation program that has the goal of planting one million seedlings until the year of 2013. In order 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 project of reforestation and environmental education. The project of rearrangement of the population affected by the entrepreneurship also deserves emphasis, once some families that lived in houses hanging from the river's side, without electricity and without the minimum conditions of sanitation were relocated to dwellings of quality, 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 to be obtained for the families involved.
- Since HPP Barra Grande is located in the rural area of Rio Grande do Sul and Santa Catarina, the implantation of this kind of project in the region will demand the capacitating of the collaborators to be hired or sub-hired in the region and of the population itself in the municipalities involved. Through environmental education program, BAESA Project has invested in formation of multipliers in the municipalities of the region of range, having as target the public and private schools teachers, members of the organized civil society and the public power to act as spreaders of the principles and techniques of environmental education, besides the activities of training with sub-hired construction workers and educational activities with inhabitants from the reservoir's surroundings. Through this action, BAESA Project seeks to capacitate its collaborators to the market and contribute to the growth of knowledge and to the level of education of the municipalities where it acts.

Through all these actions, BAESA Project proves that it is possible to promote economical growth, balancing the economical (generation of energy), social (communities and municipalities involved) and environmental components (the ecosystem), respecting, thus, the principles of sustainable development.

1.4 BAESA Monitoring Report:

The GHG emission reduction during the period from January 2006 until December 2008 was achieved through the dispatched electricity generated by HPP Barra Grande that, in the absence of the project, would have been generated through non-renewable sources from Power Plants connected to the Brazilian Interconnected System, fostering the emission of greater quantities of green house gases.

Baseline scenario is that electricity delivered to the grid by the project would have otherwise been generated by the operation of a grid-connected power plant and by the addition of new generating sources, as reflected in the combined margin calculations.

Monitoring has the objective of measuring the emission reductions achieved by the project. To elaborate the monitoring plan, it was followed the Monitoring Methodology present in consolidated baseline methodology for grid-connected electricity generation from renewable sources ACM0002, version 07 (methodology applied to the project).

The main parameters that were controlled were:

- Gross Electricity Generation (MWh);
- Plant Internal Consumption (MWh);
- Net Electricity Supplied to the Grid (MWh);
- Emission Factor for Electricity Generation Connected to the Brazilian Interconnected Grid (tCO₂e/MWh);
- Project Emissions (tCO₂e);
- Project Emissions Reductions (tCO₂e);

HPP Barra Grande Operation and Maintenance Manager is responsible for the operation and maintenance activities of the plant and for the activities of consolidation and analysis of gross and net electricity. Each generator unit has three measures instruments. One of them is located in the Powerhouse and it measures the gross electricity generated by the unit and two of them, called “Principal” and “Retaguarda” (Rear), are located in the substation with the objective of measuring net electricity.

Data of electricity generation may be confronted with the information present in the website of the CCEE (CCEE - Entity responsible for measurements, accounting and settlement on Brazilian electric energy market).

The emission factor for power generation connected to Brazilian National Interconnected System was made available by Ministry of Science and Technology (MCT) with data of National System Operator, ONS. The variables EFgrid,OM,y and EFgrid,BM,y were calculated and monitored by Enerbio Consultoria through the dispatch data of National Interconnected System.

Emissions and emissions reductions achieved by the project activity were monitored by project participants, as described on Monitoring Plan of approved VCS PD, using the equation indicated by methodology ACM0002, version 07 for emission reduction calculation.

1.5 Period of Monitoring Report, Amount of Monitored Emissions Reductions and Vintages:

- Total Crediting Period of the VCS Project: 01th January 2006 to 31th December 2015
- Period of Monitoring Report: 01th January 2006 to 31th December 2008
- Amount of Monitored Emissions Reductions: 1.028.338 tCO₂e

Project Participants wishes to display separate vintages for the amount of monitored emission reduction of this Verification Period in:

- Vintage 2006 – 153,460 tCO₂e;
- Vintage 2007 – 368,968 tCO₂e
- Vintage 2008 – 505,908 tCO₂e

1.6 Personnel responsible for the information:

- Ana Karl - Coordinator of Social Responsibility of Energética Barra Grande S.A - BAESA;
- Eduardo Baltar – Director of Enerbio Consultoria Ltda

2. Monitoring Methodology and Plan

2.1 Title and reference of the VCS methodology applied to the project activity and explanation of methodology choices:

- Version 7 of consolidated baseline and monitoring methodology ACM0002 - Methodology Consolidated for grid-connected electricity generation from renewable sources.
- Version 01.1 of “Tool to calculate the emission factor for an electricity system”.

For more information about the methodology consult the following website:
<http://cdm.unfccc.int/methodologies/PAmethodologies/approved.html>

2.2 Justification of the choice of the methodology and why it is applicable to the project activity:

The ACM0002 methodology can be applicable to BAESA Project due to the following aspects:

- HPP Barra Grande is an installation of a new hydro power plant/unit;
- The geographic and system boundaries for the relevant electricity grid can be clearly identified and information on characteristics of the grid is available due to the geographic data and the relevant electricity grid system limits are easily identified, as well as all information about the grid is available in ONS, Operador Nacional do Sistema (National System Operator), (www.ons.org.br), and in ANEEL, Agência Nacional de Energia Elétrica (National Agency of Electric Energy), (www.aneel.gov.br).
- HPP Barra Grande is a project activity which result in new reservoirs and the power density of the power plant is greater than 4 W/m²;

2.3 Monitored Data:

Main parameters to be monitored are:

- Electricity Supplied to The Grid;
- Total Electricity Generated;
- (EF_{grid}, CM, y) Combined Margin CO₂ Emission Factor;
- Project Emissions
- Emission Reductions

It is described below how each parameter is monitored.

Electricity Supplied to the Grid (EGy) and Total Electricity Generated

Each Generation Unit has three meters. One of them is located in the Powerhouse and it is responsible for registering the Gross Electricity (or Total Electricity) generated by each unit. The other two meters of each generation unit are located in the substation and they register the Electricity Supplied to the Grid (or Net Electricity). All meters are calibrated and are according to the specifications of ONS.

In HPP Barra Grande, there is a Measurement Billing System according the technical specifications defined by ONS Grid Procedures. The communication of this SMF with CCEE occurs directly through a VPN (Virtual Private Network) and, this way, SCDE has direct access to the mass memory of the electricity meters.

In the first week of each month, HPP Barra Grande operators collect, in the electricity meters mass memory, gross and net hourly generation data of generation unit referring to the previous month. This data are compiled in a unique spreadsheet which is the HPP internal control generation spreadsheet for the referred month under analysis.

Information present in internal control generation spreadsheet will be confronted with SCDE spreadsheet. SCDE spreadsheets provide electricity generation values identical to the values of the HPP internal control generation spreadsheet. However, for emission reductions calculation, it will be used electricity generation data of CCEE General Measurement Report, present in the CCEE website. This data is consisted by the net electricity generation minus the losses of National Interconnected System (approximately 2.5%), setting, therefore, a more conservative value.

Both generation information, internally generated and through CCEE website, are electronically stored by the Operation and Maintenance Manager.

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

All data collected as part of the monitoring will be archived and be kept for at least 2 years after the end of the last crediting period.

(EF_{grid,CM,y}) Combined Margin CO₂ Emission Factor;

The combined margin emission factor EF_{grid,CM,y} is calculated as follows:

$$EF_{grid,CM,y} = EF_{grid,OM,y} \times W_{OM} + EF_{grid,BM,y} \times W_{BM}$$

Equation 1

Where:

EF_{grid, BM,y} = Build margin CO₂ emission factor in year y (tCO₂e/ MWh)

EF_{grid, OM,y} = Operating Margin CO₂ emission in year y (tCO₂e/ MWh)

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

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

The CO₂ emission factors of build margin and operating margin is calculated ex-post. CO₂ emission factors from electricity generation verified on Brazilian Interconnected System (SIN) are calculated based on the generation record of plants centrally dispatched by the **National Operator of the System** (From the Portuguese Operador Nacional do Sistema - ONS).

Combined Margin CO₂ Emission Factor was calculated based on data supplied by Ministry of the Science and Technology (MCT) (www.mct.gov.br), institution which chairs the Brazilian DNA of CDM. Operating Margin Emission Factor and Build Margin Emission factor, necessary

data to calculate the Combined Margin Emission Factor were calculated by ONS (National System Operator) and made available by MCT.

The Build Margin CO₂ Emission Factor for the year of 2008 was not available at the moment of this Monitoring Report elaboration. Therefore, it was used the Build Margin Emission Factor of the year of 2007 to calculate the Combined Margin Emission Factor of 2008. Build Emission Factor of 2007 is less than Build Emission Factor of 2006, therefore more conservative.

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, it was adopted the following weights: W_{OM} = 0.50 and W_{BM} = 0.50.

Project Emissions (PEy)

There is no leakage for the project activity; however, power density of Barra Grande Power Plant is 7.3 W/ m², therefore emissions from its reservoir must be considered. To calculate project emission, it was used equation below:

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

Where:

PEy = Emission from reservoir expressed as tCO₂e/ano;

EFRes = is the default emission factor for emissions from reservoirs, and the default value as per EB23 is 90 Kg CO₂e/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)

Emission Reductions

Project emission reduction is calculated according version 07 of ACM0002 methodology. As mentioned previously, LEy is zero. Therefore, emission reduction is calculated as described below:

$$ERy = BEy - PEy \quad \text{Equation 3}$$

Where:

ERy = Emission Reduction in year y (t CO₂e/yr)

BEy = Baseline emissions in year y (t CO₂e/yr)

PEy = Project emissions in year y (t CO₂e/yr)

Baseline emissions are calculated as indicated by the baseline methodology ACM0002 that establishes that baseline emissions include only CO₂ 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:

$$BE_y = (EG_y - EG_{baseline}) * EF_{grid,CM,y} \quad \text{Equation 4}$$

Where:

BE_y = Baseline Emission in year y (t CO₂e/year)

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

$EG_{baseline}$ = 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 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”

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

2.4 Data Collected in order to monitor project emissions:

As mentioned previously, BAESA project presents emissions from its reservoir. To calculate project emission, equation 2 is applied:

As the default emission factor for emissions from reservoirs is provided by IPCC (per EB23) and its value is 90 Kg CO₂e/MWh, the unique parameter to be collected in order to monitor project emissions is the Total Electricity Produced.

As it was mentioned before, each generation unit has one meter located in the Powerhouse which is responsible for registering the Gross Electricity (or Total Electricity) generated by each unit. Spreadsheets obtained directly from the meters are used to monitor this parameter, with information generated hourly or according to what was programmed by CCEE.

Table below presents data collected in order to monitor project emissions:

Table 1 – Project Emissions

Year	Month	Gross Electricity (MW)	PEy (Project Emissions)
2006	January	151.776,27	13.660
2006	February	233.909,66	21.052
2006	March	180.203,44	16.218
2006	April	67.437,05	6.069
2006	May	19.218,08	1.730
2006	June	19.169,61	1.725
2006	July	12.579,87	1.132
2006	August	21,06	2
2006	September	194.655,79	17.519
2006	October	222.048,46	19.984
2006	November	151.060,81	13.595
2006	December	142.051,12	12.785
2007	January	172.250,00	15.503
2007	February	130.744,45	11.767
2007	March	174.728,51	15.726
2007	April	227.486,13	20.474
2007	May	316.209,60	28.459
2007	June	316.670,95	28.500
2007	July	406.804,85	36.612
2007	August	361.776,54	32.560
2007	September	356.980,54	32.128
2007	October	471.339,04	42.421
2007	November	434.261,36	39.084
2007	December	320.336,14	28.830
2008	January	269.720,49	24.275
2008	February	200.691,89	18.062
2008	March	106.905,11	9.621
2008	April	97.979,23	8.818
2008	May	190.430,35	17.139
2008	June	288.937,88	26.004
2008	July	296.278,21	26.665
2008	August	202.997,41	18.270
2008	September	280.508,32	25.246
2008	October	249.723,95	22.475
2008	November	425.962,48	38.337
2008	December	340.553,13	30.650
Total		8.034.407,78	723.096,70

2.5 Data Collected in order to monitor Baseline Emissions:

To monitor Baseline emissions was necessary to monitor also the electricity supplied to the grid (EGy) and the Combined Margin Emission Factor and its components.

Table below provides an overview of the data collected to monitor and to calculate Baseline Emissions of BAESA Project for this monitoring period.

Table 2 – Baseline Emissions

Year	Month	EFgrid,OM*	EFgrid,BM*	W _{OM}	W _{OM}	EFgrid,CM*	Net Electricity - MW (EGy)	BEy (Baseline Emissions)
2006	January	0,3218	0,0814	0,5	0,5	0,2016	143.284,73	28.884,53
2006	February	0,3462	0,0814	0,5	0,5	0,2138	233.336,82	49.893,00
2006	March	0,3373	0,0814	0,5	0,5	0,2094	174.896,89	36.617,09
2006	April	0,2752	0,0814	0,5	0,5	0,1783	65.351,75	11.652,26
2006	May	0,3173	0,0814	0,5	0,5	0,1993	18.474,37	3.682,66
2006	June	0,3058	0,0814	0,5	0,5	0,1936	18.586,29	3.598,26
2006	July	0,3507	0,0814	0,5	0,5	0,2160	12.287,76	2.654,63
2006	August	0,3360	0,0814	0,5	0,5	0,2087	19,57	4,08
2006	September	0,3834	0,0814	0,5	0,5	0,2324	188.603,19	43.830,75
2006	October	0,3598	0,0814	0,5	0,5	0,2206	216.313,81	47.722,07
2006	November	0,2651	0,0814	0,5	0,5	0,1732	146.581,87	25.393,94
2006	December	0,2802	0,0814	0,5	0,5	0,1808	138.253,82	24.999,23
2007	January	0,2292	0,0775	0,5	0,5	0,1533	167.360,51	25.660,31
2007	February	0,1954	0,0775	0,5	0,5	0,1364	126.822,46	17.302,43
2007	March	0,1948	0,0775	0,5	0,5	0,1361	169.910,55	23.126,47
2007	April	0,1965	0,0775	0,5	0,5	0,1370	220.618,19	30.225,53
2007	May	0,1606	0,0775	0,5	0,5	0,1190	306.076,19	36.428,98
2007	June	0,2559	0,0775	0,5	0,5	0,1667	308.342,16	51.400,87
2007	July	0,3096	0,0775	0,5	0,5	0,1935	395.384,82	76.509,43
2007	August	0,3240	0,0775	0,5	0,5	0,2007	352.498,59	70.763,31
2007	September	0,3550	0,0775	0,5	0,5	0,2163	347.998,35	75.256,17
2007	October	0,3774	0,0775	0,5	0,5	0,2274	458.949,80	104.380,91
2007	November	0,4059	0,0775	0,5	0,5	0,2417	421.777,51	101.931,38
2007	December	0,4865	0,0775	0,5	0,5	0,2820	312.247,65	88.045,71
2008	January	0,5727	0,0775	0,5	0,5	0,3251	262.324,17	85.276,40
2008	February	0,6253	0,0775	0,5	0,5	0,3514	195.191,81	68.590,77
2008	March	0,5794	0,0775	0,5	0,5	0,3284	101.418,24	33.307,67
2008	April	0,4529	0,0775	0,5	0,5	0,2652	91.228,11	24.191,96
2008	May	0,4579	0,0775	0,5	0,5	0,2677	183.472,32	49.112,78
2008	June	0,5180	0,0775	0,5	0,5	0,2977	282.169,66	84.012,95
2008	July	0,4369	0,0775	0,5	0,5	0,2572	286.932,35	73.786,33
2008	August	0,4258	0,0775	0,5	0,5	0,2516	196.153,81	49.361,11
2008	September	0,4102	0,0775	0,5	0,5	0,2438	271.924,34	66.301,51
2008	October	0,4369	0,0775	0,5	0,5	0,2572	241.791,59	62.182,98
2008	November	0,3343	0,0775	0,5	0,5	0,2059	413.408,99	85.121,46
2008	December	0,4686	0,0775	0,5	0,5	0,2730	330.461,57	90.224,86
Total							7.800.454,58	1.751.434,78

2.6 Environmental and Social Programs:

There are some environmental and social requirements that are condition for the maintenance and renewal of the License necessary for the project operation. BAESA Project has your License Operation emitted by IBAMA (environmental agency responsible for that) which proves that all actions required are being implemented.

In 15th January 2009, BAESA sent through the letter “BAESA – 022/2009” all reports and documents related to the actions necessary to renew the Operation License. There is a table in this letter that presents a synthesis of the follow-up of the actions from July to December 2008. Project Participants describe below some actions developed by BAESA in this period and its references in the letter “BAESA – 022/2009”.

- *Keep the Programs of Technical and Social Assistance and present annual reports on the activities, including a system to attend economic-financial issues of the properties;*

The Project of Technical and Social Assistance was presented to IBAMA in August 2005. This project is under execution for a period of 42 months. The implementation of this project is happening in an integrated way with the actions of the projects of environmental education and conservation of water and soil. For these projects, BAESA hired three institutions UNOESC, EMATER/RS and EPAGRI/SC that will work together to give the necessary support to the re-insertion and the social and economic re-organization of the families. All reports related to this program presented to IBAMA are described in the item 2.4 of the letter “BAESA – 022/2009”.

- *Present, in the Monitoring Reports, evaluation with the checking of indicators of economical and social insertion of the families served by the Program of Technical and Social Assistance;*

The Project of Technical and Social Assistance provide the definition of indicators to monitor and evaluate the social and economic insertion of the families. The evaluation with the checking of indicators of economical and social insertion of the families related to the information of 2007 was sent to IBAMA in July/2008 through the letter BAESA 375/2008. This information can be seen in the item 2.5 of the letter “BAESA – 022/2009”.

- *Present annual monitoring reports of the impact on the vitality of the surrounding communities, according to programs indicators and others that may infer the revitalization of these communities;*

BAESA sent to IBAMA through the letter “BAESA 022/2009” the report named “Evaluation and Monitoring of Surrounding Communities of Barra Grande Dam – General Report of November 2008” complying with the requirement 2.6 of the Renovation of Operation License 447/2005. This information can be seen in the item 2.6 of the letter “BAESA – 022/2009”.

- *Continue with actions developed to prevent endemic diseases in the reservoir’s area of influence, according to the local and regional health organs;*

These actions are part of the Program of Technical and Social Assistance and Environmental Education. The principal methodological tool is the education of the surrounding population about basic knowledge which provides the construction of knowledge for best life quality of the families in harmony with the environment. BAESA develops actions through partnership with official entities of the state of Rio Grande do Sul and Santa Catarina. BAESA participated in the vaccination campaign aiming at to finish with infantile paralysis and “rubeola” in the cities covered by the HPP Barra Grande. Information that shows that a report about these actions was provided to IBAMA can be found in the item 2.9 of letter “BAESA – 022/2009”.

- *Keep the Unity of Service to the Population Affected by the implantation of the entrepreneurship, in an easily accessible place, throughout the period of concession of the Plant, which should be amply divulged to the interested parties;*

The attendance of the population is done in the Permanent Centre of Attendance of BAESA, located in Anita Garibaldi. 140 attendances were done in the period from July to December 2008. This information can be seen in the item 2.10 of the letter “BAESA – 022/2009”.

- *Present a report on the programs of local development promotion aimed at the third sector in the municipalities of Anita Garibaldi/SC, Pinhal da Serra/RS and Esmeralda/RS, in which it can be inferred the effective participation of the entrepreneur and effective partnership along with public institutions and non-governmental organizations;*

The support to the local development has been implemented through the strengthening of the technical and social assistance actions, accelerating the introduction of new productive alternatives in the region of HPP Barra Grande. To contribute in a systemic way for the region development, BAESA made a partnership with SEBRAE/SC to contribute for the technical-economic viability of entrepreneurship and production units, through the boosting of productive capacity and organization of the social capital involved. Information that shows that a report about these actions was provided to IBAMA can be found in the item 2.8 of the letter “BAESA – 022/2009”.

- *Conclude, according to the physic-financial timetable and Commitment Terms with the beneficiaries, the construction for collective rural resettlement;*

The item 2.3 of the letter “BAESA – 022/2009” shows that BAESA sent to IBAMA a report through the letter 0375/2008 of 8th July 2008, describing the attendance of the requirements.

- *Continue with the Monitoring of slopes surrounding the reservoir;*

The project keeps its activities according the schedule established. The item 2.12 of the letter “BAESA – 022/2009” shows the reports delivered to IBAMA to prove the continuity of the Program.

- *Continue with the Program for Recuperation of Degraded Areas according to the guidelines obtained in the seminar of December 06, 2007 and IBAMA’s recommendations;*

BAESA continues developing action in the Program for Recuperation of Degraded Areas according to the guidelines of IBAMA. Proof of that can be found in all reports delivered to IBAMA that are presented in the items 2.14 and 2.15 of the letter “BAESA – 022/2009”.

- *Continue the monitoring of Dyckia distachya and other relocated rheophytes; work along with research institutions for the development of projects of genetic census of the relocated species, aiming at assessing the genetic variability of Dyckia distachya population; and present reports referring to Dyckia distachya and to the diagnosis and inventory of species of rheophytes;*

BAESA continues developing actions to monitor Dyckia distachya and other relocated rheophytes. All activities were described in several reports about this subject which were delivered to IBAMA in January 2008 through the letter “BAESA – 022/2009”. This information can be found in the item 2.16 of the letter “BAESA – 022/2009”.

- *Continue with the Program of Forest Reposition according to the guidelines obtained in the seminar of December 06, 2007 and IBAMA’s recommendations; and present reports every semester containing the methodology employed in each area, the seedlings quantitative, the species used, the quantitative of areas recuperated, and aims for the following months;*

BAESA continues developing actions in the Program of Forest Reposition according to the guidelines of IBAMA. Proof of that can be found in all reports delivered to IBAMA that are presented in the items 2.14 and 2.15 of the letter “BAESA – 022/2009”.

- *Guarantee the monitoring of the Ichthiofauna;*

BAESA executes the monitoring and management of Ichthiofauna since 2002. Currently, BAESA develops the Ichthiofauna Plan through a contract established with the institution FAPEU-LAPAD-UFSC. Reports that describe this monitoring were delivered to IBAMA in January 2009 through the letter “BAESA – 022/2009”. This information can be seen in the item 2.17 of the letter “BAESA – 022/2009”.

- *Continue the Fauna Monitoring using the same methodologies and areas employed in the periods before and during the fillings of the reservoir in order to compare the results obtained;*

BAESA keeps executing the Fauna Monitoring as required by IBAMA. BAESA presented several reports to IBAMA to show that this monitoring has been executed. Proof of that can be seen in the item 2.18 of the letter “BAESA – 022/2009”.

- *Present annual reports on the monitoring of the quality of water.*

BAESA presented to IBAMA in January 2009 the annual report of monitoring of the quality of water as can be seen in the item 2.11 of the letter “BAESA – 022/2009”.

3. Calculation of GHG emission by Sources

3.1 Describe the formulae used to calculate the emissions reductions

Emissions reductions (ER_y) achieved by the project activity during a given period of year y are calculated as equation 3 below:

$$ER_y = BE_y - PE_y \quad \text{Equation 3}$$

Where:

ER_y = Emission Reduction in year y (t CO₂e/yr)

BE_y = Baseline emissions in year y (t CO₂e/yr)

PE_y = Project emissions in year y (t CO₂e/yr)

To calculate the Baseline Emissions (BE_y), equation 4 is used, as described below:

$$BE_y = (EG_y - EG_{baseline}) * EF_{grid,CM,y} \quad \text{Equation 4}$$

Where:

BE_y = Baseline Emission in year y (t CO₂e/year)

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

EG_{baseline} = 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 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”

The combined margin emission factor $EF_{grid,CM,y}$ is calculated as follows:

$$EF_{grid,CM,y} = EF_{grid,OM,y} \times W_{OM} + EF_{grid,BM,y} \times W_{BM}$$

Equation 1

Where:

$EF_{grid, BM,y}$ = Build margin CO₂ emission factor in year y (tCO₂e/ MWh)

$EF_{grid, OM,y}$ = Operating Margin CO₂ emission in year y (tCO₂e/ MWh)

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

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

For BAESA Project, it was adopted the following weights: $W_{OM} = 0.50$ and $W_{BM} = 0.50$, as recommended by the latest “Tool to calculate an emission factor for an electricity system” and the Build and Operating Margin CO₂ emission factor were provided by official Brazilian sources (MCT and ONS).

Furthermore, project emissions (PE_y) are calculated as indicated by equation 2, as follows:

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

Equation 2

Where:

PE_y = Emission from reservoir expressed as tCO₂e/ano;

EF_{Res} = is the default emission factor for emissions from reservoirs, and the default value as per EB23 is 90 Kg CO₂e/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).

3.2 Tables providing values obtained when applying formulae above

Year	Month	EFgrid,OM*	EFgrid,BM*	W _{OM}	W _{CM}	EFgrid,CM*	BEy (Baseline Emissions)	LEy (Leakage)	PEy (Project Emissions)	ERy (t CO2e)
2006	January	0.3218	0.0814	0.5	0.5	0.2016	28.884.53	-	13.660	15.224,67
2006	February	0.3462	0.0814	0.5	0.5	0.2138	49.893.00	-	21.052	28.841,13
2006	March	0.3373	0.0814	0.5	0.5	0.2094	36.617.09	-	16.218	20.398,78
2006	April	0.2752	0.0814	0.5	0.5	0.1783	11.652.26	-	6.069	5.582,93
2006	May	0.3173	0.0814	0.5	0.5	0.1993	3.682.66	-	1.730	1.953,04
2006	June	0.3058	0.0814	0.5	0.5	0.1936	3.598.26	-	1.725	1.872,99
2006	July	0.3507	0.0814	0.5	0.5	0.2160	2.654.63	-	1.132	1.522,44
2006	August	0.3360	0.0814	0.5	0.5	0.2087	4.08	-	2	2,19
2006	September	0.3834	0.0814	0.5	0.5	0.2324	43.830.75	-	17.519	26.311,73
2006	October	0.3598	0.0814	0.5	0.5	0.2206	47.722.07	-	19.984	27.737,70
2006	November	0.2651	0.0814	0.5	0.5	0.1732	25.393.94	-	13.595	11.798,47
2006	December	0.2802	0.0814	0.5	0.5	0.1808	24.999.23	-	12.785	12.214,63
2007	January	0.2292	0.0775	0.5	0.5	0.1533	25.660.31	-	15.503	10.157,81
2007	February	0.1954	0.0775	0.5	0.5	0.1364	17.302.43	-	11.767	5.535,43
2007	March	0.1948	0.0775	0.5	0.5	0.1361	23.126.47	-	15.726	7.400,90
2007	April	0.1965	0.0775	0.5	0.5	0.1370	30.225.53	-	20.474	9.751,78
2007	May	0.1606	0.0775	0.5	0.5	0.1190	36.428.98	-	28.459	7.970,11
2007	June	0.2559	0.0775	0.5	0.5	0.1667	51.400.87	-	28.500	22.900
2007	July	0.3096	0.0775	0.5	0.5	0.1935	76.509.43	-	36.612	39.897
2007	August	0.3240	0.0775	0.5	0.5	0.2007	70.763.31	-	32.560	38.203
2007	September	0.3550	0.0775	0.5	0.5	0.2163	75.256.17	-	32.128	43.128
2007	October	0.3774	0.0775	0.5	0.5	0.2274	104.380.91	-	42.421	61.960
2007	November	0.4059	0.0775	0.5	0.5	0.2417	101.931.38	-	39.084	62.848
2007	December	0.4865	0.0775	0.5	0.5	0.2820	88.045.71	-	28.830	59.215
2008	January	0.5727	0.0775	0.5	0.5	0.3251	85.276.40	-	24.275	61.002
2008	February	0.6253	0.0775	0.5	0.5	0.3514	68.590.77	-	18.062	50.528
2008	March	0.5794	0.0775	0.5	0.5	0.3284	33.307.67	-	9.621	23.686
2008	April	0.4529	0.0775	0.5	0.5	0.2652	24.191.96	-	8.818	15.374
2008	May	0.4579	0.0775	0.5	0.5	0.2677	49.112.78	-	17.139	31.974
2008	June	0.5180	0.0775	0.5	0.5	0.2977	84.012.95	-	26.004	58.009
2008	July	0.4369	0.0775	0.5	0.5	0.2572	73.786.33	-	26.665	47.121
2008	August	0.4258	0.0775	0.5	0.5	0.2516	49.361.11	-	18.270	31.091
2008	September	0.4102	0.0775	0.5	0.5	0.2438	66.301.51	-	25.246	41.056
2008	October	0.4369	0.0775	0.5	0.5	0.2572	62.182.98	-	22.475	39.708
2008	November	0.3343	0.0775	0.5	0.5	0.2059	85.121.46	-	38.337	46.785
2008	December	0.4686	0.0775	0.5	0.5	0.2730	90.224.86	-	30.650	59.575
Total							1.751.434,78	-	723.096,70	1.028.338,08

Annex 1

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