2ND MONITORING REPORT

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1 PROJECT DETAILS

1.1 Summary Description of the Implementation Status of the Project

The project activity consists in electricity generation by renewable source (hydro), through the construction of two small hydropower plants (SHPs) located in the Júlio de Castilhos and Salto Jacuí municipalities, both in Rio Grande do Sul state – south region of Brazil.

According to the dispatches 1,180 and 1,805 issued by National Electric Energy Agency – *ANEEL* (from Portuguese *Agência Nacional de Energia Elétrica*) on 18th April 2007 and 18th May 2009 respectively, both the power plants of project activity are located on the Ivaí river, Atlantic Southeast Basin.

The Engenheiro Ernesto Jorge Dreher SHP has an installed power of 17.95 MW and a new reservoir which in its higher water level occupies an area of 0.83 km^2.

The Engenheiro Henrique Kotzian SHP has an installed power of 13.23 MW and a new reservoir which in its higher water level occupies an area of 0.66 km^2.

The project activity purpose is to provide electric power to the National Interconnected System - *SIN* (from Portuguese: *Sistema Interconectado Nacional*), displacing the thermal generation from fossil fuels presents in the system with the generation of renewable sources of energy. Moreover, the SHPs construction helps to meet the growing energy demand on Rio Grande do Sul state, to decrease the external energy dependency and contributes to the environmental sustainability, as it increases the share of renewable energy in relation to the total consumption of electricity of Brazil.

The table 1 shows when and which equipments the project activity operates.

Table 1: Operational timeline of Eng. Ernesto Jorge Dreher and Eng Henrique Kotzian SHPPs.

YEAR	ACTIVE
2009	01 July 2009 – Generating units number 1, 2 and 3 with total installed capacity of 17,145 MW (Eng. Ernesto Jorge Dreher SHP) start inputting energy into the grid. 01 November 2009 – Generating unit number 4 with installed capacity of 326,6 kW (Eng. Ernesto Jorge Dreher SHP) start inputting energy into the grid.

2010	01 September 2010 - Generating units number 2 and 3 with total installed capacity of 8,82 MW (Eng. Henrique Kotzian SHP) start to input energy into the grid. 01 October 2010 - Generating unit number 1 with installed capacity of 4,41 MW (Eng. Henrique Kotzian SHP) start to input energy into the grid.

The technical characteristics of equipment installed in the SHPs can be seen in tables below:

Table 2: Engenheiro Ernesto Jorge Dreher SHP technical characteristics

Generator	Characteristics	Source
Type	Synchronous	Equipment plaque data
Quantity	5	Equipment plaque data
Power (kW)	3 x 5,715 / 1 x 326.3 / 1 x 480	Equipment plaque data
Nominal Power (kVA)	3 x 6,350 / 1 x 375 / 1 x 592.6[1]	Equipment plaque data
Voltage (kV)	3 x 6.9 / 1 x 0.38 / 1 x 0.38	Equipment plaque data
Frequency (Hz)	60	Equipment plaque data
Turbines	**Characteristics**	**Source**
Type	Francis	
Quantity	5	Equipment plaque data
Power (kW)	3 x 5,912 / 1 x 315.43 / 1 x 480[2]	Equipment plaque data
Nominal Flow (m^3/s)	3 x 11.40 / 1 x 2.36 / 1 x 3.40	Equipment plaque data
Water head (m)	3 x 57.5 / 1 x 15 / 1 x 15.42	Equipment plaque data
Other Information	**Characteristics**	**Source**
Reservoir Area (Km^2)	0.83	LO_1058/2019-DL

[1] Since the unit 5 is a motor working as a generator was considered for power factor 0.81 (load 100%) as per original datasheet from the equipment.

[2] This one is Kaplan type with 480 kW (instead Francis 483 kW forecasted) since the nominal flow decreased from 3.60 m^3/s (forecasted in the Project design) to 3.40 m^3/s (as built)

Power Density (W/m²)	21.63	Based on ACM0002
Assured Energy[3] (MWaverage) (PLF =68.18%)	12.24	ANEEL database

Table 3: Engenheiro Henrique Kotzian SHP technical characteristics

Generator	Characteristics	Source
Type	Synchronous	
Quantity	3	Equipment plaque data
Power (kW)	3 x 4,410	Equipment plaque data
Nominal Power (kVA)	3 x 4,900	Equipment plaque data
Voltage (kV)	3 x 6.9	Equipment plaque data
Frequency (Hz)	60	Equipment plaque data
Turbines	**Characteristics**	**Source**
Type	Francis	
Quantity	3	Equipment plaque data
Power (kW)	3 x 4,529	Equipment plaque data
Nominal Flow (m^3/s)	3 x 16.08	Equipment plaque data
Water head (m)	31.21	Equipment plaque data
Other Information	**Characteristics**	**Source**
Reservoir Area (Km^2)	0.66	LO N° 206/2019-DL
Power Density (W/m^2)	20.05	Based on ACM0002
Assured Energy (MWaverage) (PLF = 65.53%)	8.67	ANEEL database

[3] Assured energy is considered a long term average generation discounting programmed and unprogrammed stops for maintenance and other related parameters.

1.2 Sectoral Scope and Project Type

Engenheiro Ernesto Jorge Dreher and Engenheiro Henrique Kotzian SHPs VCS Project (JUN1120) fits in the category of sectoral scope 1 – Energy (renewable/non-renewable) and it is not a grouped project.

1.3 Project Proponent

Organization name	BME Rincão do Ivaí Energia S.A.
Contact person	Mateus Stefanello
Title	Director
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Organization name	BME Capão da Convenção Energia S.A.
Contact person	Mateus Stefanello
Title	Director
Address	Avenida Brasil, 2530, Sala H, Hermani, Ibirubá, Rio Grande do Sul State
Telephone	ZIP 98200-000
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1.4 Other Entities Involved in the Project

Organization name	Carbotrader Assessoria e Consultoria em Energia EIRELI
Role in the Project	PD and MR Consultant
Contact person	Arthur Moraes
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1.5 Project Start Date

01/07/2009

1.6 Project Crediting Period

Crediting period - 01/07/2009 to 30/06/2019

Total number of crediting years - 10 years (renewable).

1.7 Project Location

At the pictures below is it possible to verify the regional position of both municipalities where the hydro plants are located in Rio Grande do Sul state, region South of Brazil. The municipalities are Júlio de Castilhos (figure 1) and Salto Jacuí (figure 2). The stretch of Ivaí river, where the power plants of the project activity are located on, flows between these two municipalities, being one of their geographical limits. The Engenheiro Ernesto Jorge Dreher SHP is located at 29º07'13"S and 53º22'04"W, and the Engenheiro Henrique Kotzian SHP is located at 29°07'34"S and 53°19'06"W.

Figure 1: Localization of Júlio de Castilhos city.

Figure 2: Localization of Salto do Jacuí city.

1.8 Title and Reference of Methodology

Version 12.1.0 of consolidated baseline and monitoring methodology ACM0002 - Methodology Consolidated for grid-connected electricity generation from renewable sources.

Link:

https://cdm.unfccc.int/methodologies/DB/XP2LKUSA61DKUQC0PIWPGWDN8ED5PG

TOOL 07: Version 2 of “Tool to calculate the emission factor for an electricity system”.

link: https://cdm.unfccc.int/Reference/tools/index.html

1.9 Participation under other GHG Programs

Project activity registered on CDM (from UNFCCC) under the number 8018, link:

https://cdm.unfccc.int/Projects/DB/RWTUV1351891991.08/view

This project activity has achieved carbon credits over CDM schemes for the period: 01/01/2013 to 31/12/2015. No other.

1.10 Other Forms of Credit

If the GHG emissions reductions are issued on CDM program, the monitoring report with the credit period involved became public available in the link of the project activity, below:

Link: https://cdm.unfccc.int/Projects/DB/RWTUV1351891991.08/view

So, the credit period reported in this program cannot be the same for the VCS program.

1.11 Sustainable Development

The project activity consists of two new renewable energy generators, SHP Engenheiro Ernesto Jorge Dreher (17.95 MW of installed power) and Engenheiro Henrique Kotzian (13.23 MW of installed power) with the purpose of supplying electricity generated by a renewable source for the National Interconnected System (SIN), offsetting the thermal generation by fossil fuels with the generation of renewable electricity, in order to supply part of the growing demand for electricity in Brazil.

A very advantageous attraction of SHPs is the fact that their installation and operation do not cause impacts as a large hydroelectric plant. Being considered **run-of-river** power plants, they preserve the flow upstream that is the same downstream, as happens in the river flow regime of historical flows. As the water used accumulates in an embedded place, having the shape of a full river, they do not need large reservoirs, which avoids damage to the soil, fauna, flora and water resources present there.

The whole project was conceived in terms of the Brazilian regulation for licensing hydroelectric projects, based on the National Environment Policy (PNMA), established by Federal Law 6,938 /81 and the Resolutions of the National Environment Council CONAMA #06 and #237, issued on September 16th, 1987 and December 22nd, 1997 respectively, which establish procedures for the environmental licensing of electrical projects in Brazil.

Throughout the process of implementing the project activity, it was necessary for the project proponents to prepare environmental studies and for some compensation measures to be adopted, so that all required environmental licenses were issued by FEPAM (competent state environmental agency).

To minimize the effects of the project activity on the local environment, the following programs were installed (among others): program to maintain the sanitary flow (ecological flow) of the river, to clean the reservoir (before filling it to prevent the proliferation of vectors), rescue of ichthyofauna and terrestrial fauna, program to recover degraded areas, riparian forests and legal reserve areas (including slope stabilization and erosion control), conservation and use of the reservoir surroundings and environmental education program .

Programs for monitoring water quality and monitoring the area (to avoid hunting and predatory fishing) also need to be maintained by project participants as part of the requirements for renewing the operating license.

An important part of the project, environmental education aims to pass on to the local communities the knowledge about the environment of the region, gathered during the performance of environmental studies, to inform the new relationships introduced in the daily lives of the populations with the implementation of the SHPs, encouraging positive changes in the way of relating to the region's environment and raising awareness among the internal public about the values of the environment and the local cultural tradition.

The elaboration of studies of this magnitude and compensatory measures are beneficial to the region affected by the project, as they enable projects of economic and social interest to be in line with the protection of natural resources and their efficient use.

Continuous reports (environmental assessment) are delivered to the Environmental agency responsible (shall be done during the project activity lifetime).

2 SAFEGUARDS

2.1 No Net Harm

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. The programs focusing the impacts mitigation are being developed and is valid during all the project lifetime and are frequently reported (1 or 2 times per year) to environmental agency (FEPAM).

2.2 Local Stakeholder Consultation

Social programs involving the SHP´s employees, their families and local community are being developed during the project lifetime. A permanent channel to any stakeholder is available on: https://www.coprel.com.br/contato or through the phone number # 116.

No comments from stakeholder were received during the period of this monitoring report.

2.3 AFOLU-Specific Safeguards

Not applicable, no AFOLU project.

3 IMPLEMENTATION STATUS

3.1 Implementation Status of the Project Activity

Within the period covered by this report, the project activity has installed all the forecasted power capacity to its both plants. The generating unit 5 of SHPP Jorge Dreher is already working. Since its starting date was forecasted to September 2011, the target was accomplished. So, the SHP Ernesto Jorge Dreher is generating with all it generating unit since then. The reductions forecasted by the time of validation process were overcome by the performed due the increase of the CO_2 emission factor of the Brazilian grid correspondent to the year of 2010. This increase promoted the increase of emission reductions performed to the period. No significant events that could impact the GHG emission reductions of project activity were registered.

3.2 Deviations

3.2.1 Methodology Deviations

There are no deviations from the monitoring plan.

3.2.2 Project Description Deviations

There are no deviations from the monitoring plan.

3.3 Grouped Projects

Not applicable. Not grouped project.

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 emission from reservoirs
Source of data	Decision at EB 23
Value applied	90
Justification of choice of data or description of measurement methods	Standard Value

and procedures applied	
Purpose of Data	Calculation of project emissions.
Comments	Applicable if the power densities of project activity become greater than 4 W/m² and less than or equal to 10 W/m².

4.2 Data and Parameters Monitored

The parameters "$TEG_{Engenheiro\ Ernesto\ Jorge\ Dreher,y}$" and "$TEG_{Engenheiro\ Henrique\ Kotzian,y}$" aren´t applicable since the power density (PD) are above 10 W/m². More details in the section 5.2.

Data / Parameter	$EG_{Engenheiro\ Ernesto\ Jorge\ Dreher,y}$
Data unit	MWh/year
Description	Quantity of electricity generation supplied by the SHPP Engenheiro Ernesto Jorge Dreher to the grid in year y.
Source of data	Project activity site (Metering Panel inside the SHP Power House)
Description of measurement methods and procedures to be applied	Meters shall be calibrated in accordance with standards for electricity generation.
Frequency of monitoring/recording	Continuous measurement and at least monthly recording.
Value monitored	2011= 70,513.08 2012= 47,643.60
Monitoring equipment	Meters 90011045 (main) and 90011046 (backup). Calibrations on 30/03/2009 and 17/05/2011.
QA/QC procedures to be applied	These data was used to calculate the emission reductions. The data was archived monthly (electronic) and also kept archived during the credit period (shall be kept archived for two years after). The data from the energy meters was checked in the CCEE databank and also cross checked against annual reports from CCEE´s Infomercado website (public available for consultation). By this way the process becomes more accurate and effective.
Purpose of the data	Calculation of baseline emissions.
Calculation method	-
Comments	-

Data / Parameter	$EG_{Engenheiro\ Henrique\ Kotzian,y}$
Data unit	MWh/year
Description	Quantity of electricity generation supplied by the SHPP Engenheiro Henrique Kotzian to the grid in year y.
Source of data	Project activity site (Metering Panel inside the SHP Power House)
Description of measurement methods and procedures to be applied	Meters shall be calibrated in accordance with standards for electricity generation.
Frequency of monitoring/recording	Continuous measurement and at least monthly recording.
Value monitored	2011= 59,842.32 2012= 36,662.35
Monitoring equipment	Meters 90011049 (main) and 90011050 (backup). Calibrations on 02/06/2009 and 17/05/2011.
QA/QC procedures to be applied	These data was used to calculate the emission reductions. The data was archived monthly (electronic) and also kept archived during the credit period (shall be kept archived for two years after). The data from the energy meters was checked in the CCEE databank and also cross checked against annual reports from CCEE´s Infomercado website (public available for consultation). By this way the process becomes more accurate and effective.
Purpose of the data	Calculation of baseline emissions.
Calculation method	-
Comments	-

Data / Parameter	$EF_{grid,CM,y}$
Data unit	tCO_2e/MWh
Description	Combined Margin CO_2 emission factor for grid connected power generation in year y calculated using the latest version of the "Tool to calculate the emission factor for an electricity system".
Source of data	Based on data provided by DNA (Designated National Authority).
Description of measurement methods and procedures to be	The Combined Margin is calculated through a weighted-average formula, considering the $EF_{grid,OM-DD,y}$ and the $EF_{grid,BM,y}$ and the default weights are w_{OM} = 0.5 and w_{BM} = 0.5. As per the "Tool to

applied	calculate the emission factor for an electricity system".
Frequency of monitoring/recording	Annually.
Value monitored	2011= 0.1988 2012= 0.3593
Monitoring equipment	-
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	-
Comments	-

Data / Parameter	$EF_{grid,BM,y}$
Data unit	tCO_2/MWh
Description	CO_2 Build Margin emission factor of the grid, in a year *y*
Source of data	Based on data provided by DNA (Designated National Authority).
Description of measurement methods and procedures to be applied	According procedures established by the most recent version of "Tool to calculate the emission factor for an electricity system".
Frequency of monitoring/recording	Annual
Value monitored	2011= 0.1056 2012= 0.2010
Monitoring equipment	-
QA/QC procedures to be applied	-
Purpose of the data	Calculation of baseline emissions.
Calculation method	-
Comments	-

Data / Parameter	$EF_{grid,OM-DD,y}$

Data unit	tCO_2/MWh
Description	CO_2 Operating Margin emission factor of the grid, in a year *y*
Source of data	Data provided by DNA (Designated National Authority) to the year *y*.
Description of measurement methods and procedures to be applied	According procedures established by the most recent version of "Tool to calculate the emission factor for an electricity system".
Frequency of monitoring/recording	Annually.
Value monitored	2011= 0.2920 2012= 0.5176
Monitoring equipment	
QA/QC procedures to be applied	This data will be annually updated to be applied in ex-post calculation of the Emission Factor of Combined Margin
Purpose of the data	Calculation of baseline emissions.
Calculation method	-
Comments	-

Data / Parameter	Cap_{PJ} *– Ernesto Jorge Dreher SHP*
Data unit	W
Description	Installed capacity of the SHHP Ernesto Jorge Dreher after the implementation of the project activity.
Source of data	Plaques of equipments installed at project site.
Description of measurement methods and procedures to be applied	Check on equipments plaques or datasheets.
Frequency of monitoring/recording	annually
Value monitored	17,950,000
Monitoring equipment	-
QA/QC procedures to be applied	-

Purpose of the data	Calculation of project emissions
Calculation method	-
Comments	-

Data / Parameter	*Cap_{PJ} – Henrique Kotzian SHP*
Data unit	W
Description	Installed capacity of the SHPP Henrique Kotzian after the implementation of the project activity.
Source of data	Plaques of equipments installed at project site.
Description of measurement methods and procedures to be applied	Check on equipments plaques or datasheets.
Frequency of monitoring/recording	annually
Value monitored	13,230,000
Monitoring equipment	-
QA/QC procedures to be applied	-
Purpose of the data	Calculation of project emissions
Calculation method	-
Comments	-

Data / Parameter	*A_{PJ} – Ernesto Jorge Dreher SHP*
Data unit	m^2
Description	Area of the SHHP Ernesto Jorge Dreher single or multiple reservoirs measured in the water surface, after the implementation of the project activity, when the reservoir is full.
Source of data	Operation Licence issued by FEPAM: LO N° 1058/2019-DL.
Description of measurement methods and procedures to be applied	Check on environmental license or new documents issued by ANEEL authorizing changes over reservoir area.

Frequency of monitoring/recording	annually
Value monitored	830,000
Monitoring equipment	Topographical measurement to measure the area of the reservoir.
QA/QC procedures to be applied	The uncertainty level for these data is low. The reservoir area is monitored by environment regulators.
Purpose of the data	Calculation of the project emissions
Calculation method	-
Comments	-

Data / Parameter	A_{PJ} – *Henrique Kotzian SHP*
Data unit	m^2
Description	Area of the SHPP Henrique Kotzian single or multiple reservoirs measured in the water surface, after the implementation of the project activity, when the reservoir is full.
Source of data	Operation License issued by FEPAM: LO N° 206/2019-DL.
Description of measurement methods and procedures to be applied	Check on environmental license or new documents issued by ANEEL authorizing changes over reservoir area.
Frequency of monitoring/recording	annually
Value monitored	660,000
Monitoring equipment	Topographical measurement to measure the area of the reservoir.
QA/QC procedures to be applied	The uncertainty level for these data is low. The reservoir area is monitored by environment regulators.
Purpose of the data	Calculation of the project emissions
Calculation method	-
Comments	-

4.3 Monitoring Plan

The monitoring plan for the project activity is based on the methodology ACM0002 and consist of the monitoring of the electricity generation from the proposed project activity, the surface area of reservoir at the full reservoir level, the installed capacity of the plant after project implementation and emission factors.

1) Power generation and measurement system:

General Characteristics of the Measurement System

The procedures designed for monitoring electricity generation by the project activity follows the parameters and regulations of the Brazilian energy sector. The National Grid Operator (ONS) and the Electric Power Commercialization Chamber (*CCEE* from portuguese *Câmara de Comercialização de Energia Elétrica*) are the organs responsible for specification of technical requirements of energy measurement system for billing, i.e, those bodies monitor and approve projects for accurate accounting of energy.

The agent responsible for the measurement system for billing (*SMF* from the Portuguese *Sistema de Medição para Faturamento*) develops the project in accordance with the technical specifications of the measurements for billing, which should include the location of measurement points, panels of measurement, meters and systems for local and remote measurement.

As stated by the sub-module 2.14 of Grid Procedures[4], the SMF is a system composed of main and back-up meters, instrument transformers, communication channels between the agents and CCEE; and data collecting systems to billing measures.

The measurement system measures and records the energy. There are six meters to register the energy generation of project activity (three main meters and three back up). There are one main and one back up meter installed in panels located at the power houses of each plant of project activity. Those meters send generation information to project owners (BMEs), to the operational team (COPREL) and to SINERCOM/CCEE (generation monitoring system of Electric Power Commercialization Chamber). Those information are used by CCEE to establish how much each plant generate (before transmission losses). The measures of energy effectively inputted into the grid are done by the third pair of meters (main and back up) installed at the substation of Salto do Jacuí Hydropower, point where the energy generated by project activity is inputted into the grid. This third pair of meters will record the energy generated by both plants of project activity since the transmission lines which come from the plants are joined at some point before reach this meters. Using the data of meters installed at the power houses of the two plants, the regulatory agency can establish the volume of energy generated by each plant.

[4] http://www.ons.org.br/paginas/sobre-o-ons/procedimentos-de-rede/vigentes

Despite being located inside the substation of Salto do Jacuí Hydropower, the pair of meters above referred is independent from the energy generated by the plant. It measures exclusively the energy generated by project activity plants.

For this system is guaranteed the data inviolability. After the calibration, it is sealed for safety.

To an easier understanding, see the figure 4.

The data stored in the meters are collected by the Energy Data Collecting System – SCDE (from Portuguese *Sistema de Coleta de Dados de Energia Elétrica*) of the CCEE, remotely and automatically, through direct access to the agent meters or intermediated for the agent through its Meter Collecting Unit – UCM.

Using the information collected with the three pairs of meters, CCEE provides the generation reports correspondent to each plant, used to energy trading.

Therefore, CCEE is responsible for the monthly readings and keeping the records of the energy dispatched. If any problem happens at the local meter level, the reading lecture corresponding to the amount of energy during the time of the problem will not be lost because of the online reading performed by CCEE.

All information related to the project monitoring will be made available by project proponents at the time of the carbon credits verification and will be archived at least for 2 years after the end of the last crediting period.

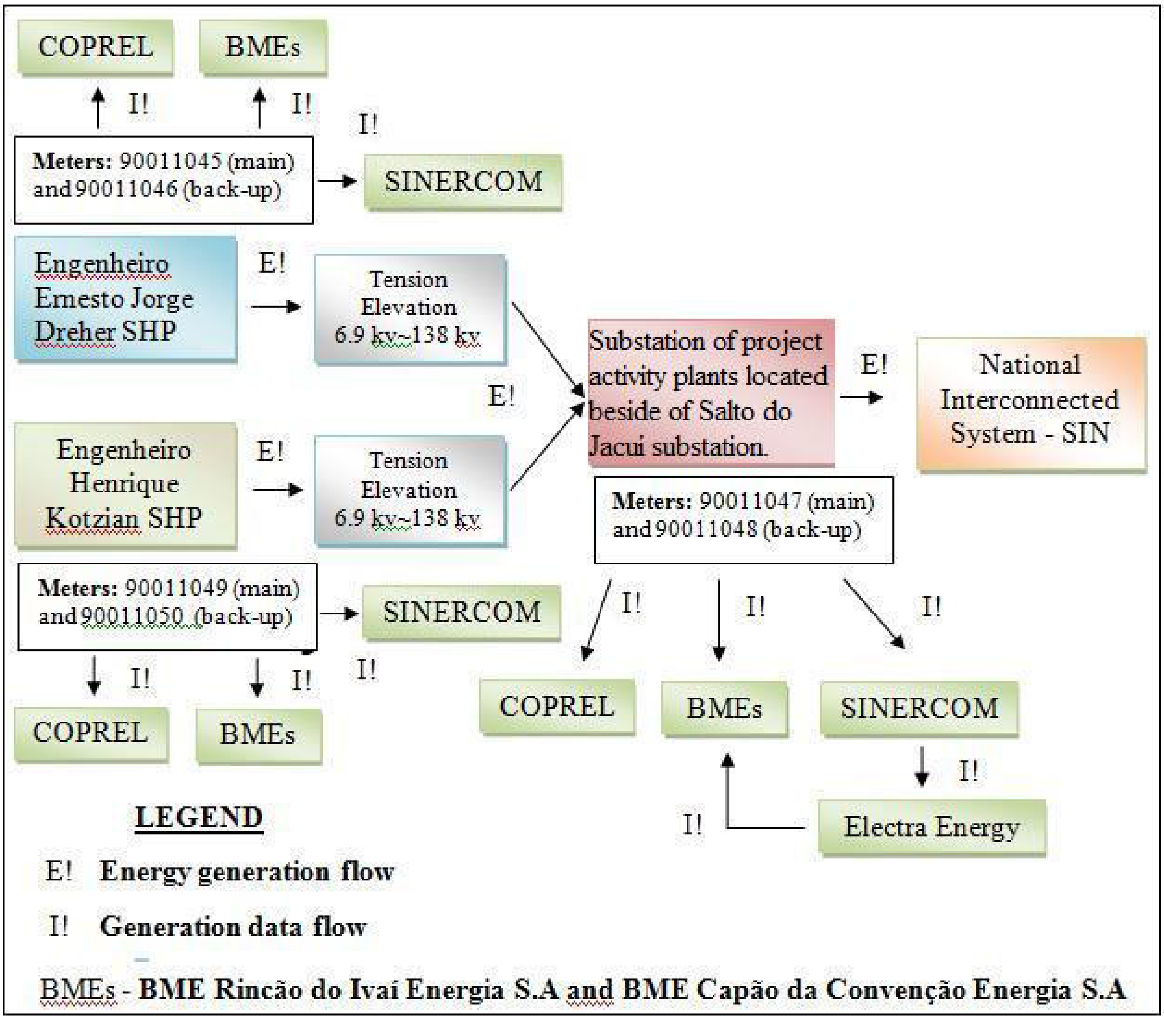

Figure 4: Flow chart of energy and generation data (**meters installed can be changed during the project lifetime, so the serial number can be changed also**).

Data monitoring:

The readings of meters are used to calculate emission reductions. The monitoring steps are as follow:

(1) The data will be measured continuously and recorded monthly;

(2) Spreadsheets containing the electricity dispatched to the grid will be generated; CCEE data measured (from CCEE databank – SINERCOM - third part) will be used to cross check the monitored data;

(3) The project participants will provide the generation measurement data and the SINERCOM (restricted access website) generation spreadsheets to the DOE, so it can check the authenticity of declared information.

(4) The emission reductions, and any project emissions (if applicable), should be managed by the project manager responsible at Carbotrader.

Quality control:

(1) Calibration of meters:

The calibration of meters shall be conducted at least every two years by a qualified organization that must comply with national standards and industrial regulations to ensure the system accuracy. After calibration, the meters are sealed for safety and the calibration certificates are archived with other monitoring records. The class of accuracy of the equipment that will be used in the project activity is under the national standards (class 0.2) stated in "*Grid Procedures*" from the National Grid Operator: Module 12, submodule 12.2.

(2) Emergency treatment

In case of unavailability of measures from any point of measurement, due to maintenance, commissioning or for any other reason, will be used the methodology to estimate data as the ONS submodule 2[5].

Data Management:

All the project activity issues regarding the SHPs construction will be treated by the responsible Managers / Directors from BME Rincão do Ivaí and BME Capão da Convenção.

The monitoring data will be stored during the project's duration. In this case this means 10 years (one period duration) plus 2 years after it ends according to the methodology. If the project is renewed for another two periods, the data will be stored for 30 years plus 2 years, making up a total of 32 monitoring years.

All data gathered in the monitoring range will be electronically filed and kept for the period above mentioned.

The emission reductions to be generated will be calculated regularly by the project proponents and kept for the verification phase.

Training Procedures:

All training necessary for the plants operational team were provided by equipment suppliers during the installation and pre operational phases. After the engagement of COPREL Cooperativa de Energia as the third party which assumed the operations and maintenance activities of the plants, all the training activities are being undertaken by the engaged company to itself team.

[5] http://www.ons.org.br/paginas/sobre-o-ons/procedimentos-de-rede/vigentes

The emergency procedures related to the project activity operation (for instance: workers' safety and health, dam safety related emergency drills/exercises, etc, according to the Brazilian legislation), are included in the training courses that the third party company is supposed to offer.

Furthermore, operation, maintenance and calibration procedures will follow the national guidelines set by the National Grid Operator.

1) **Emission Factors:**

The Emission Factor related to this project activity ($EF_{grid,CM,y}$, $EF_{grid,OM\text{-}DD,y}$ e $EF_{grid,BM,y}$) as mentioned previously, are available by the brazilian DNA and it can be viewed at its website (http://antigo.mctic.gov.br/mctic/opencms/ciencia/SEPED/clima/index.html). Thus, the monitoring of this data will be ex-post through periodic access to data provided by DNA.

2) **Installed capacity – Cap_{PJ}:**

The installed capacity of the hydro power plant after the implementation of the project activity will be monitored yearly through one of the following options:

- Technical specifications on the installed equipments;

- Installed plaques in the equipments;

- Factsheets.

In Brazil, the installed capacity of hydropower plants is determined and authorized by the competent regulatory agency. Furthermore, any modification must also be authorized and made available to the public. Thus, any new authorization to increase the installed capacity of the plants will be monitored. It will be used to installed capacity, which is also a recognized standard, to assure the project technical characteristics.

It is also important to highlight that according the ANEEL resolution number 407, issued on 19th October 2000, if the present/real installed capacity is greater than +/- 5 % of the authorized (granted) installed capacity, a revision of the authorized installed capacity should be requested. This revision must not be requested by the responsible for both Engenheiro Ernesto Jorge Dreher SHP and Engenheiro Henrique Kotzian SHPs because the increment in their capacities overwhelm the ANEEL granted values in only 0.44% and 1,76% respectively, so no revision or comunication action should be done accord to the mentioned ANEEL resolution.

3) **Area of the reservoir – A_{PJ}:**

The area of the reservoir will be checked annually during the first credit period taking in consideration the surface of the water, after the implementation of the project activity, when the reservoir is full. To this purpose will be used topographic surveys, satellite pictures or environmental licenses.

Authority and Responsibility:

The BME Rincão do Ivaí Energia S.A. and BME Capão da Convenção Energia S.A. are responsible for the maintenance and calibration of the monitoring equipments, compliance to operational requirements and corrective actions related to the functionality of Engenheiro Ernesto Jorge Dreher SHP and Engenheiro Henrique Kotzian SHP respectively. Moreover, the companies have authority and responsibility for registration, monitoring, and measurements as well as managing all the issues related to the project activity and to organize staff training to use appropriated techniques in those procedures.

The baseline project emissions and Emissions Reductions calculations will be performed by Carbotrader which should report the results in a proper way to the entities related with the VCS process.

5 QUANTIFICATION OF GHG EMISSION REDUCTIONS AND REMOVALS

5.1 Baseline Emissions

Baseline emissions (BEy in tCO_2) are the product of the baseline emissions factor ($EF_{grid,CM,y}$ in tCO_2/MWh) multiplied by the electricity supplied by the project activity to the grid (EGPJ,y in MWh), as follows:

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

Where:

BE_y Baseline emissions in year y (tCO_2e/yr);

$EG_{PJ,y}$ Quantity of net electricity generation that is produced and fed into the grid as a result of the implementation of the CDM project activity in year y (MWh/yr);

$EF_{grid,CM,y}$ Combined margin CO_2 emission factor for grid connected power generation in year y, calculated using the latest version of the “Tool to calculate the emission factor for an electricity system” (tCO_2/MWh).

Energy Generated ($EG_{PJ,y}$)

The project activity is the installation of two new grid-connected renewable power plants/units at sites where no renewable power plants were operated prior to the implementation of the project activity, thus classified as a Greenfield renewable energy power plants.

The $EG_{PJ,y}$ is based on the estimative of energy to be inputted annually into the grid by the Project activity, which considers the net Power of the plants, information provided by ANEEL and the Brazilian Mines and Energy Ministry. Then:

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

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

$$EG_{facilities,y} = EG_{PJ,y} = EG_{Engenheiro\ Ernesto\ Jorge\ Dreher,y} + EG_{Engenheiro\ Henrique\ Kotzian,y}$$

$$EG_{PJ,2011} = 70{,}513.08 + 59{,}842.32 = 130{,}355.40 \text{ MWh/year}$$

$$EG_{PJ,2012} = 47{,}643.60 + 36{,}662.35 = 84{,}305.95 \text{ MWh/year}$$

Emission Factor calculation *($EF_{grid,CM,y}$)*

For baseline emission factor calculation, the six steps below should be followed:

STEP 1. Identify the relevant electricity systems;

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

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

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

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

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

Step 1: Identify the relevant electricity systems

Considering the stated in the “Tool to calculate the emission factor for an electricity system[6]” and the fact that Brazilian DNA has published the Resolution nº 8 issued on May 26th, 2008,

[6] "*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*"

which defines the **Brazilian Interconnected Grid** as a single system that covers all the five macro-geographical regions of the country (North, Northeast, South, Southeast and Midwest), the boundaries of Brazilian electricity system are clearly defined.

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

Since the Brazilian DNA has made available the emission factor calculation based on information of the grid power plants only, the off-grid power plants are not considered (Option I).

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

The method adopted to calculate the operating margin is "Dispatch data analysis OM" (Option c). The calculation is performed by the Brazilian DNA and made publicly available.

Step 4: Calculate the operating margin emission factor according to the selected method

The selected method is the "*Dispatch data analysis OM*".

The Dispatch Data emission factor (OM), is calculated as follows:

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

Where:

$EF_{grid,OM-DD,y}$ = Dispatch data analysis operating margin CO_2 emission factor in year y (tCO_2/MWh);

$EG_{PJ,h}$ = Electricity displaced by the project activity in hour h of year y (MWh);

$EF_{EL,DD,h}$ = CO_2 emission factor for grid power units in the top of the dispatch order in hour h in year y (tCO_2/MWh);

$EG_{PJ,y}$ = Total electricity displaced by the project activity in year y (MWh).

h = Hours in year y in which the project activity is displacing grid electricity

y = Year in which the project activity is displacing grid electricity

$EF_{EL,DD,h}$ approach is defined by the Brazilian DNA who is the responsible for the calculation.

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

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.

According to the tool, the build margin emission factor (BM) is calculated as follows:

$$EF_{grid,BM,y} = \frac{\sum_m EG_{m,y} . EF_{EL,m,y}}{\sum_m EG_{m,y}}$$

Where:

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

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

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

m = Power units included in the build margin

y = Most recent historical year for which electricity generation data is available

The CO_2 emission factor of each power unit *m* ($EF_{EL,m,y}$) should be determined as per the tool in Step 4 (a) for the simple OM, using options A1, A2 or A3, using for *y* the most recent historical year for which electricity generation data is available, and using for *m* the power units included in the build margin.

The power units included in the build margin are defined by the Brazilian DNA who is responsible for the operating margin and build margin calculations. The results of these are made publicly available in its web site for consultation. For the second crediting period, the build margin emissions factor shall be calculated ex ante.

Step 6 : Calculate the combined margin emissions factor (CM)

For calculation of combined margin emission factor the weighted average CM method (Option a) should be used as the preferred option.

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

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 (per cent)

w_{BM} = Weighting of build margin emissions factor (per cent)

Considering that the project activity is SHP based, the calculation of the combined margin emissions factor shall use the following default values for w_{OM} and w_{BM}:

w_{OM} = 0.50 and w_{BM} = 0.50 for the first crediting period.

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

Table 4 – Baseline emissions

Years	EFgrid,OM* (tCO_2/MWh)	EFgrid,BM* (tCO_2/MWh)	W_{OM}	W_{BM}	EFgrid,CM* (tCO_2/MWh)	Net Electricity - EGy (MWh/yr)	BEy (Baseline Emissions) (tCO_2e/yr)
2011	0.2920	0.1056	0.5	0.5	0.1988	130,355.40	25,911
2012	0.5176	0.2010	0.5	0.5	0.3593	84,305.95	30,291
TOTAL						**214,661.35**	**56,202**

5.2 Project Emissions

According to the methodology ACM0002, for hydro power project activities that result in new reservoirs, project proponents shall account for CH_4 and CO_2 emissions from the reservoir, estimated as follows:

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

$$PE_{HP,y} = \frac{EF_{Res} \cdot TEG_y}{1000}$$

Where:

$PE_{HP,y}$ Emission from water reservoirs (tCO_2e/yr);

EF_{Res} Default emission factor for emissions from reservoirs of hydro power plants in year y (kgCO2e/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).

a. If power density of project is greater than 10 W/m^2:

$PE_{HP,y}$ = 0

The power densities of the project activity are calculated as follows:

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

Where:

PD Power density of the project activity, in W/m^2.

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

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

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

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

For Engenheiro Ernesto Jorge Dreher SHP, the PD value is:

$$PD = \frac{17{,}950{,}000 - 0}{830{,}000 - 0} = 21.63 \text{ W/m}^2$$

For Engenheiro Henrique Kotzian SHP, the PD value is:

$$PD = \frac{13{,}230{,}000 - 0}{660{,}000 - 0} = 20.05 \text{ W/m}^2$$

Therefore, the reservoir project emissions ($PE_{HP,y}$) are zero to both hydropower plants of project activity because their Power Densities are higher than 10 W/m^2.

5.3 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.

5.4 Net GHG Emission Reductions and Removals

Since:

$$ER_y = BE_y - PE_{HP,y}$$

Where:

ER = Emission reductions in year y (tCO_{2e}/yr)

BE = Baseline emissions in year y (tCO_2/yr)

PE = Project emissions in year y (tCO_{2e}/yr)

Considerening the emissions related to the SHP reservoirs are zero ($PE_{HP,y}$ = 0), the Project activity emissions reductions are calculated as below:

$$ER_y = BE_y \ (tCO_2/yr)$$

The baseline emission (BE_y) are better described on Section 5.1 with the steps descriptions and parameters used.

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	*25,911*	*0*	*0*	*25,911*
2012	*30,291*	*0*	*0*	*30,291*
Total	***56,202***	***0***	***0***	***56,202***