Project design document form
(Version 11.0)

BASIC INFORMATION	
Title of the project activity	Complexo Carreiro II CDM Project
Scale of the project activity	☒ Large-scale ☐ Small-scale
Version number of the PDD	2
Completion date of the PDD	21/09/2020
Project participants	Boa Fé Energética S.A São Paulo Energética S.A Autódromo Energética S.A Enerbio Consultoria Ltda-ME
Host Party	Brazil
Applied methodologies and standardized baselines	Large-Scale Consolidated Methodology ACM0002 - Grid-connected electricity generation from renewable sources, version 20.0.
Sectoral scopes	01
Estimated amount of annual average GHG emission reductions	59,754 tCO_2e

SECTION A. Description of project activity

A.1. Purpose and general description of project activity

Complexo Carreiro II CDM Project (Project 6041) was registered by CDM Executive Board on 22 October 2012[1]. This PDD is being submitted to request the renewal of the crediting period for its second crediting period.

Complexo Carreiro II CDM Project (Project 6041) consists on the supply of clean hydroelectric energy to the Brazilian National Interconnected System (SIN) through the implantation and operation of three Small Hydro Power Plants (SHPs) Boa Fé, São Paulo and Autódromo with small reservoir area and installed capacity of 24,000,300 W, 16,048,800 W and 24,005,700 W, respectively. SHPs are located on the margins of Carreiro River, state of Rio Grande do Sul, Southern Region of Brazil.

According to the large-scale consolidated methodology ACM0002, the baseline scenario is that electricity delivered to the grid by the project activity would have otherwise been generated by the operation of grid-connected power plants and by the addition of new generation sources, as reflected in the Combined Margin (CM) emission factor calculations described in "TOOL07: Tool to calculate the emission factor for an electricity system". The baseline scenario is the same scenario that existed before the beginning of the project activity implementation and the CO_2 emission factor for the displacement of electricity generated by power plants in an electricity system, by calculating the "combined margin" emission factor (CM) of the electricity system, is the greenhouse gas to be considered in the project activity.

During the second crediting period, the project activity is expected to reduce 59,754 tCO2e annually and 418,281 tCO2e during the whole new crediting period of 7 years. Table below show main milestones of project implementation.

Table 01 – Main Milestones of Project Implementation

Date (dd/mm/yyyy)	Milestone	Evidence/Reference
01/11/2009	Signing of contract for SHPs Boa Fé and Autódromo	Contract for construction beginning of SHPs Boa Fé and Autódromo Projects.
19/10/2011	Operation starting date of Boa Fé SHP	Operational starting date as authorized by ANEEL through ANEEL Dispatch 4,115, issued on 19/10/2011
17/11/2011	Operation starting date of Autódromo SHP	Operational starting date as authorized by ANEEL through ANEEL Dispatch 4,450, issued on 17/11/2011
27/04/2012	Operation starting date of São Paulo SHP	Operational starting date as authorized by ANEEL through ANEEL Dispatch 1,410, issued on 27/04/2012
22/10/2012	CDM Registration date	Registration on CDM EB as CDM Project Activity.

Complexo Carreiro II Project contributes for sustainable development by the following actions:

- Through the operation of SHPs Boa Fé, São Paulo and Autódromo, clean and renewable energy is dispatched to the Brazilian National Interconnected System, displacing enterprises that would generate electricity through fossil fuel burning, preventing, thus, the emission of pollutant gases to the atmosphere.
- During the implementation, it was generated 800 direct jobs and 400 indirect jobs and stimulation for economic activities. The project promotes the region's economic development, which occurs through the generation of income to the community of municipalities involved and their collaborators. In addition, through taxes generated by their activities to the cities involved

[1] https://cdm.unfccc.int/Projects/DB/BVQI1334243115.72/view

and the Union, among them the ISSQN exceeding R$ 3,500,000.00, the project provides funds which can be reverted to the population of the region and the country as a whole.

- SHPs presents low environmental impact, with a small reservoir formation, in addition, project participants realized considerable investments in environmental programs and actions. It was developed 29 environmental programs of mitigation actions in the physical, biotic, anthropic environment to reduce and monitor the possible impacts of the project. It can be highlighted the reforestation program, which planted the small branches of native species along the river margins and the specific programs of environmental education that contributes to the awareness of the population of the municipalities involved about environmental and ecological issues.

- The implementation of this kind of enterprise in the region demanded training for collaborators hired or sub-hired in the region and for the population in the municipalities involved. Through an environmental education program, it was developed activities along with the scholar community of the municipalities within the project's direct influence, besides activities to capacitate sub-hired companies, and educational activities with residents of the reservoir's surroundings. In addition, entrepreneurs have a human resources politics that aims at the qualification of all the collaborators of the group's companies, applying also to the collaborators of the sub-contracted companies. Through this action, Hidrotérmica SA seeks to capacitate its collaborators to the market, and it contributes to the growth of knowledge and to the level of education of the municipalities where it acts.

- Investments in culture and in social and environmental responsibility programs are part of the group's corporate culture and it also occurs in the enterprises through local projects support.

A.2. Location of project activity

The implementation of SHPs Boa Fé, São Paulo and Autódromo will be held in Carreiro River, a tributary on the right margin of the Antas River, sub-basin 86, in the Atlantic Southeast basin, state of Rio Grande do Sul, South region of Brazil.

The locations of the power houses of SHPs Boa Fé, São Paulo and Autódromo are here described. The geographic coordinates are according the latest Operation License issued by the State Foundation of Environmental Protection of the State of Rio Grande do Sul (FEPAM).

SHP Boa Fé will be implemented between the municipalities of Serafina Corrêa and Nova Bassano. The coordinates of the entrepreneurship's powerhouse are Latitude - 28,75615791 and Longitude -51,840398351 (Datum: SIRGAS 2000).

SHP São Paulo will be located between the municipalities of Guaporé and Nova Bassano. The coordinates of the entrepreneurship's powerhouse are Latitude -28,77986389 and Longitude -51,846508331 (Datum: SIRGAS 2000).

SHP Autódromo will be implemented between the municipalities of Guaporé and Vista Alegre do Prata. The coordinates of the entrepreneurship's powerhouse are Latitude -28,83500000 and Longitude -51,83818000 (Datum: SIRGAS 2000).

A.3. Technologies/measures

SHPs Boa Fé, São Paulo and Autódromo uses the Carreiro River's hydraulic potential to generate electricity with an installed capacity of 24,000,300 W, 16,048,800 W and 24,005,700 W, respectively. The table below represents the main technical parameters of the plants

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Table 02 - Technical characteristics of Boa Fé, São Paulo and Autódromo SHPs

Technical characteristics / SHPs	Boa Fé	São Paulo	Autódromo
1. ELECTRICITY DATA			
Installed Capacity (W)	24,000,300W	16,048,800 W	24,005,700 W
Assured Energy (MW)	12.23 MW	8.63 MW	12.25 MW
2. RESERVOIR			
Reservoir Area (m^2)	561,500 m^2	368,700 m^2	444,100 m^2
3. DAM			
Type	Gravity CCR	Gravity CCR	Gravity CCR
Maximum Height (meters)	26 m	11 m	18 m
4. SPILLWAY			
Type	Threshold slope	Threshold slope	Threshold slope
Total Length (meters)	166 m	170 m	130 m
5. POWER HOUSE			
Type	Sheltered	Semi-Sheltered	Sheltered
Number of Generators	3	2	3
6. TURBINES			
Type	Francis, horizontal axis	Kaplan vertical axis	Francis simple, horizontal axis
Number of units	3	2	3
Nominal Unitary Flow	25.05 m^3/s	34.08 m^3/s	29.00 m^3/s
Nominal Unit Power	8,272 kW	8,273 kW	8,272 kW
7. GENERATORS			
Number of units	3	2	3
Nominal Power	8,889 kVA	8,916 kVA	8,891 kVA
Rated speed synchronous	360 rpm	360 rpm	300 rpm
Nominal voltage between phases	13.8 kV	6.9 kV	13.8 kV
8. EFFICIENCY			
Turbine	92 %	92%	92%
Generator	96.71%	96.70%	96.74%

SHPs Boa Fé, São Paulo and Autódromo are run-of-river hydroelectric power plant and that have installed capacity 24,000,300 W, 16,048,800 W and 24,005,700 W, respectively. The commercial product of a hydroelectric plant in Brazil is assured energy. The assured energy is formally calculated for commercial purposes by the regulatory agencies (ANEEL and the Ministry of Mines and Energy). As described by the Ministry of Mines and Energy[2] of Brazil, the assured energy of SHPs Boa Fé, São Paulo and Autódromo is 12.23 MW(107,134 MWh/year), 8.63 MW(75,598 MWh/year) and 12.25 MW(107,310 MWh/year), respectively. Therefore, the load factor (assured energy/installed capacity) of the SHP's Boa Fé, São Paulo and Autódromo is 50.96%, 53.94% and 51.04% respectively is determined by Brazilian official agents (MME).

[2] Ministry of Mines and Energy Ordinance, number 100, May, 31th 2007. Page. 4. Annex III.

Equipment and technologies used in the project were developed in Brazil and was successfully applied in similar projects in the country and around the world. The implementation of the project was responsibility of a national company, thereby providing development and employment of national workforce. The Turbine/Generator average lifetime is about 30 years, according to manufacturer's specification

The baseline scenario, according to ACM0002, version 20.0, is the following: "Electricity delivered to the grid by the project activity would have otherwise been generated by the operation of grid-connected power plants and by the addition of new generation sources, as reflected in the combined margin (CM) calculations described in TOOL07: Tool to calculate the emission factor for an electricity system".

The baseline scenario is the same scenario that existed before the beginning of the project activity implementation and the CO_2 is the greenhouse gas involved in the project activity.

A.4. Parties and project participants

Parties involved	Project participants	Indicate if the Party involved wishes to be considered as project participant (Yes/No)
Brazil (Host Party)	Private Entity: Boa Fé Energética S.A Private Entity: São Paulo Energética S.A Private Entity: Autódromo Energética S.A Private Entity: Enerbio Consultoria Ltda-ME	No

A.5. Public funding of project activity

This project was financed with equity and loan from Brazilian National Bank of Economic and Social Development. No public funding for the CDM's project activities was solicited from parties involved in Annex I.

A.6. History of project activity

Complexo Carreiro II CDM Project (Project 6041) was registered by CDM Executive Board on 22 October 2012. This PDD is being submitted to request the renewal of its crediting period for the second crediting period.

The Project Participants confirm that:

1. The proposed CDM project activity is not included as a Component Project Activity (CPA) in a registered CDM Programme of Activities (PoA);
2. The proposed CDM project activity is not a project activity that has been deregistered;
3. The proposed CDM project activity is not a CPA that has been excluded from a registered CDM PoA;
4. The proposed CDM project activity is not a registered CDM project activity or a CPA under a registered CDM PoA whose crediting period has or has not expired (hereinafter referred to as former project) exists in the same geographical location as the proposed CDM project activity.

A.7. Debundling

Not applicable. The project is a large-scale project activity.

SECTION B. Application of methodologies and standardized baselines

B.1. References to methodologies and standardized baselines

The CDM Project Standard for Project Activities, version 02.0, item "a" says that the "*project participants shall use the valid version of the methodologies and methodological tools applied in the registered PDD, that is, the latest version at the time of the submission of the request for renewal of crediting period or the previous version if the submission of the request for renewal of the crediting period is still within the grace period of the previous version for use*".

Therefore, the following methodology was applied:

- ACM0002 Large Scale Consolidated Methodology - Grid-connected electricity generation from renewable sources (Version 20.0) (hereafter referred as ACM0002 Methodology).[3]"

This methodology also refers to the latest approved versions of the following tools[4]:

- "TOOL01: Tool for the Demonstration and Assessment of Additionality (Version 7.0)";
- "TOOL02: Combined tool to identify the baseline scenario and demonstrate additionality" (Version 7.0);
- "TOOL03: Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion" (Version 3);
- "TOOL05: Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation" (Version 3.0);
- "TOOL07: Tool to calculate the emission factor for an electricity system" (Version 7.0);
- "TOOL10: Tool to determine the remaining lifetime of equipment" (Version 1);
- "TOOL11: Assessment of the validity of the original/current baseline and update of the baseline at the renewal of the crediting period" (Version 03.0.1);
- "TOOL32: Positive lists of technologies" (Version 2.0).

According to the CDM Project Standard for Project Activities (version 02.0) "*for renewal of crediting period of a registered CDM project activity, the project participants are not required to reassess the additionality of the project activity nor update the section of the PDD relating to additionality*".

As this PDD refers to the second crediting period of the project, the "Tool for the demonstration and assessment of additionality" (TOOL01) and the "Combined tool to identify the baseline scenario and demonstrate additionality" (TOOL02) will not be applied.

[3] Available at: https://cdm.unfccc.int/methodologies/DB/XP2LKUSA61DKUQC0PIWPGWDN8ED5PG

[4] Available at: https://cdm.unfccc.int/Reference/tools/index.html

The "Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion" (TOOL03) is also not applied to the project, since there are no GHG emissions from fossil fuel combustion in the project boundary. The "TOOL32: Positive lists of technologies" is either not applied because hydro power plants are not included in the positive list of technologies.

B.2. Applicability of methodologies and standardized baselines

The ACM0002 Large Scale Consolidated Methodology, version 20.0, is applicable to grid-connected renewable energy power generation project activities that:

(a) Install a Greenfield power plant;

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

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

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

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

The methodology is applicable under the following conditions:

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

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

Complexo Carreiro II CDM Project is formed by three grid-connected renewable hydro power plants that installed Greenfield power plants.

According to the methodology, in case of hydro power plants, one of the following conditions shall apply:[5]

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

(b) The project activity is implemented in existing single or multiple reservoirs, where the volume of the reservoir(s) is increased and the power density, calculated using equation 01 below, as follows, is greater than 4 W/m^2; or

(c) The project activity results in new single or multiple reservoirs and the power density, calculated equation 01 below, is greater than 4 W/m^2; or

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

(d) The project activity is an integrated hydro power project involving multiple reservoirs, where the power density for any of the reservoirs, calculated equation 01 below, is lower than or equal to 4 W/m^2, all of the following conditions shall apply:

(i) The power density calculated using the total installed capacity of the integrated project, as per equation provided by ACM0002 methodology, is greater than 4 W/m^2;

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

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

a. Lower than or equal to 15 MW; and

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

Complexo Carreiro II CDM Project is a project activity that in result in three new single reservoirs and the power density of each plant are greater than 4 W/m^2 as provided equation 1 and table 03 below

The project activity`s power density, according ACM0002 methodology, is calculated as demonstrated below:

$$PD = \frac{Cap_{PJ} - Cap_{BL}}{A_{PJ} - A_{BL}}$$ **Equation 1**

Where:
PD = Power Density of the project activity (W/m)
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.

The table below evidences that SHPs Boa Fé, São Paulo and Autódromo have a power density greater than 4 W/m^2.

Table 03: Power density of each plant

Item	SHP Boa Fé	SHP São Paulo	SHP Autódromo
Cap_{PJ} (W)	24,000,300	16,048,800	24,005,700
Cap_{BL}	0	0	0
A_{PJ} (m^2)	561,500	368,700	440,100
A_{BL}	0	0	0
PD (W/m^2)	42.74	43.52	54.54

The project is formed by three hydro power plants and it does not involve switching from fossil fuels to renewable energy at the site of the project activity. The project does not involve capacity additions, retrofits, rehabilitations, or replacements.

Thus, the ACM0002 methodology, version 20.0 is applicable to the Complexo Carreiro II CDM Project.

B.3. Project boundary, sources and greenhouse gases (GHGs)

The National Interconnected System is considered as the project boundary. The National Interconnected System (in Portuguese "*Sistema Interligado Nacional - SIN*") is managed by the National Interconnected Power System Operator (in Portuguese "*Operador Nacional do Sistema - ONS*"), which is responsible for all activities related to the planning and management of grid operation. The ONS traditionally subdivides the National Interconnected System into four interconnected Subsystems: South; Southeast/Midwest; North; and Northeast. These Subsystems are related to the respective Brazilian geographic regions.

Based on the effective power generation availability and consumption behavior and demand in each region, the ONS defines the dispatch of each individual power plant, as well as the inter-regional energy exchange and mid and long term operational policies to warrant reservoir management and energy security, i.e. the dispatch of thermal power units once reservoir levels fall below a certain security level. These operational conditions of the system are permanently monitored and data is available to the electricity industry agents.

According to ACM0002, version 20.0, the spatial extension of the project boundary includes the project power plant and all power plants physically connected to the electricity system that the CDM project power plant is connected to. SHPs Boa Fé, São Paulo and Autódromo SHPs are connected to National Interconnected System.

The diagram of the project boundary is presented in the figure below:

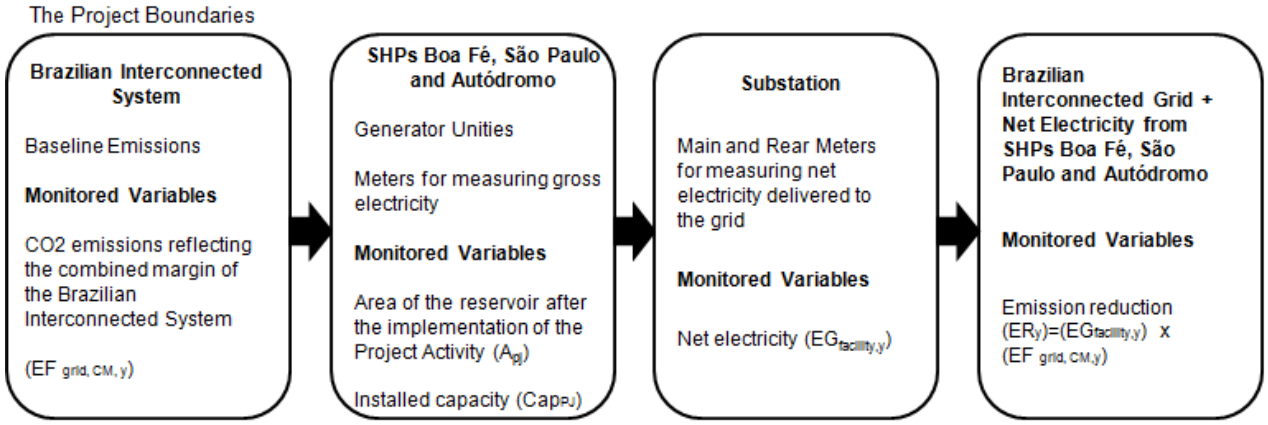


Figure 02: Project Boundary

The greenhouse gases and emission sources included in or excluded from the project boundary are presented in the table below:

	Source	GHG	Included?	Justification/Explanation
Baseline	CO_2 emissions from electricity generation in fossil fuel fired power plants that are displaced due to the project activity.	CO_2	Yes	Main emission source
		CH_4	No	Minor emission source
		N_2O	No	Minor emission source
Project activity	For dry or flash steam geothermal power plants, emissions of CH_4 and CO_2 from non-condensable gases contained in geothermal steam	CO_2	No	Not applicable to this project activity
		CH_4	No	Not applicable to this project activity
		N_2O	No	Not applicable to this project activity
	For binary geothermal power plants, fugitive emissions of CH_4 and CO_2 from non-condensable gases contained in geothermal steam	CO_2	No	Not applicable to this project activity
		CH_4	No	Not applicable to this project activity
		N_2O	No	Not applicable to this project activity
	For binary geothermal power plants, fugitive emissions of hydrocarbons such as n-butane and isopentane (working fluid) contained in the heat exchangers	Low GWP hydrocarbon/ refrigerant	No	Not applicable to this project activity
	CO_2 emissions from combustion of fossil fuels for electricity generation in solar thermal power plants and geothermal power plants	CO_2	No	Not applicable to this project activity
		CH_4	No	Not applicable to this project activity
		N_2O	No	Not applicable to this project activity
	For hydro power plants, emissions of CH_4 from the reservoir	CO_2	No	Not applicable to this project activity
		CH_4	No	Not applicable to this project activity
		N_2O	No	Not applicable to this project activity

B.4. Establishment and description of baseline scenario

According to ACM0002 methodology, version 20.0, if the project activity consists of the installation of a greenfield power plant, the baseline scenario is the following:

"*If the project activity is the installation of a Greenfield power plant, the baseline scenario is electricity delivered to the grid by the project activity would have otherwise been generated by the operation of grid-connected power plants and by the addition of new generation sources, as reflected in the combined margin (CM) calculations described in "TOOL07: Tool to calculate the emission factor for an electricity system*".

As Complexo Carreiro II is the installation of three greenfield hydro power plants with power density greater than 4 W/m^2, the baseline scenario is applicable to the project activity, as mentioned before.

According to items 283 and 286 of the CDM Project Standard (Version 2.0):

"*To demonstrate the validity of the original baseline or its update, project participants are not required to re-assess the baseline scenario. Instead, project participants shall assess the GHG emission reductions that would have resulted from that scenario (…)*

(…)If data and parameters used for determining the original baseline, that were determined ex ante and not monitored during the crediting period, are no longer valid, the project participants shall update such data and parameters in accordance with the "Methodological tool: Assessment of the validity of the original/current baseline and update of the baseline at the renewal of the crediting period".

The methodological tool TOOL11: Assessment of the validity of the original/current baseline and update of the baseline at the renewal of the crediting period" (Version 03.0.1) provides a stepwise

procedure to assess the continued validity of the baseline and to update the baseline at the renewal of a crediting period, as required by paragraph 49 (a) of the modalities and procedures of the clean development mechanism.

The first step provides an approach to evaluate whether the current baseline is still valid for the next crediting period. The second step provides an approach to update the baseline in case that the current baseline is not valid anymore for the next crediting period.

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

The "Procedures for the renewal of the crediting period of a registered CDM project activity" approved by the CDM Executive Board require assessing the impact of new relevant national and/or sectoral policies and circumstances on the baseline. The validity of the current baseline is assessed using the following Sub-steps:

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

As mentioned before, the baseline is "If the project activity is the installation of a Greenfield power plant, the baseline scenario is electricity delivered to the grid by the project activity would have otherwise been generated by the operation of grid-connected power plants and by the addition of new generation sources, as reflected in the combined margin (CM) calculations described in "TOOL07: Tool to calculate the emission factor for an electricity system".

There are no relevant mandatory national and/or sectoral policies which have come into effect after registration of the project activity that impact the baseline scenario. The current baseline complies with relevant mandatory national and/or sectoral policies.

In the first crediting period, the project electricity system was the National Interconnected System (SIN), defined as the relevant grid to the project activity. The definition of the SIN as the relevant electricity system is also recommended by Brazilian DNA[6] through Resolution N° 08 of May/2008, which defines the National Interconnected System as a single system that shall be used for the calculation of CO_2 emission factors. This Resolution is still valid.

Brazilian DNA calculates the CO_2 emission factors and publishes it through its website[7]. In the second crediting period, the project activity will follow the same definition of the project electricity system and use emission CO_2 emission factors published by Brazilian DNA.

Step 1.2: Assess the impact of circumstances

There are no circumstances that impact the baseline scenario. During the second crediting period, the combined margin emission factor of the National Interconnected System will be calculated, according to "TOOL07: Tool to calculate the emission factor for an electricity system" and based on the Build Margin (BM) and Operating Margin (OM) values published by the Brazilian DNA.

The Combined Margin (CM) emission factor is calculated based on data of all plants connected to the National Interconnected System (SIN) and centrally dispatched by the National Interconnected Power System Operator (*Operador Nacional do Sistema - ONS*). Based on this generation data as provided by the ONS, the Brazilian Designed National Authority (DNA) calculates the BM and OM emission factors of the SIN according to the "TOOL07: Tool to calculate the emission factor for an electricity system" and makes them available to the public. In case in the future these data are no longer calculated and published by the DNA, the Project Participants may choose between: a) to

[6] Source: http://antigo.mctic.gov.br/mctic/opencms/ciencia/SEPED/clima/cimgc/Comissao_Interministerial_de_Mudanca_Global_do_Clima__CIMGC.html.

[7] Source: http://antigo.mctic.gov.br/mctic/opencms/ciencia/SEPED/clima/textogeral/emissao_despacho.html.

make use of the latest available official data and information as calculated and published by the Brazilian DNA; or b) to conduct the calculations based on data from ONS.

Section B.6 presents the emission factors and baseline calculations, following TOOL07: Tool to calculate the emission factor for an electricity system.

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

This step does not apply, since in the absence of the project, the electricity would be generated by grid connected power plants. Power plants connected to the system would continue to supply energy independently of the technical lifetime of the equipment applied to the project.

Regarding the project lifetime, the project has 30 years of expected operational lifetime, as indicated by registered PDD. The operational starting date of the first plant was 19 October 2011. Therefore, the remaining lifetime exceeds the end of second crediting period.

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

Detailed description of data, parameters and emission factors used to baseline calculations are presented at section B6.

Step 2: Update the current baseline and the data and parameters

The application of Steps 1.1, 1.2, 1.3 and 1.4 confirmed that the current baseline is still valid for the subsequent crediting period. The baseline scenario does not need to be reassessed. considering the updates regarding parameters and their applied values.

However, data and parameters used to estimate baseline emissions had to be updated once Brazilian DNA publishes Build Margin (BM) and Operating Margin (OM) yearly.

Detailed description of data and parameters applied to baseline scenario are presented at section B6.

Step 2.1: Update the current baseline

The application of Steps 1.1, 1.2, 1.3 and 1.4 confirmed that the baseline scenario is still valid. There is no need to be updated. Ex ante emission reduction estimation were updated according to “Tool to calculate the emission factor for an electricity system” Version 07.0.

Step 2.2: Update the data and parameters

Brazilian DNA provides yearly updated data about emissions from National Interconnected System power generation. The latest available data are from 2019 and were used to undertake the emission factors updates.

According to the methodological tool “Tool to calculate the emission factor for an electricity system” Version 07.0, for hydropower generation project activities the Weighting of operating margin emissions factor and the Weighting of build margin emissions factor are, respectively, 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. Therefore, for the second crediting period, it will be used W_{OM} = 0.25 and W_{BM} = 0.75

At PDD registered for the first crediting period, 2009 data of $EF_{grid,OM}$ and $EF_{grid,BM}$ were used to calculate ex ante emission reduction estimation. For the second crediting period, 2019 values will be used. Section B.6 presents these values.

B.5. Demonstration of additionality

According to the CDM Project Standard for Project Activities (version 02.0) "*for renewal of crediting period of a registered CDM project activity, the project participants are not required to reassess the additionality of the project activity nor update the section of the PDD relating to additionality*". Therefore, this section is not applicable for the renewal of the crediting period.

B.6. Estimation of emission reductions

B.6.1. Explanation of methodological choices

According to ACM0002 methodology (version 20.0), the emission reduction (ER_y) are calculated as follows:

$$ER_y = BE_y - PE_y \quad \textbf{Equation 02}$$

Where:
ER_y = Emission reductions in year *y* (tCO_2e/yr);
BE_y = Baseline emissions in year *y* (tCO_2/yr);
PE_y = Project emissions in year *y* (tCO_2e/yr).

BE_y Calculation (Baseline emissions in year y (tCO_2/yr))

ACM0002 methodology, version 20.0, 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 methodology assumes that all project electricity generation above baseline levels would have been generated by existing grid-connected power plants and the addition of new grid-connected power plants. The baseline emissions are to be calculated as follows:

$$BE_y = EG_{PJ,y} * EF_{grid,CM,y} \quad \textbf{Equation 03}$$

Where:
BE_y = Baseline emissions in year *y* (tCO_2/yr);
$EG_{PJ,y}$ = Quantity of net electricity generation that is produced and fed into the grid as a result of the implementation of the CDM project activity in year *y* (MWh/yr);
$EF_{grid,CM,y}$ = Combined margin CO_2 emission factor for grid connected power generation in year *y* calculated using the latest version of "TOOL07: Tool to calculate the emission factor for an electricity system" (tCO_2/MWh).

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

$$EG_{PJ,y} = EG_{facility,y} \quad \textbf{Equation 04}$$

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

Assured Energy of Boa Fé, São Paulo and Autódromo SHPs were considered to determine the ***ex-ante*** calculation of $EG_{facility,y}$.

To calculate $EF_{grid, CM, y}$ it will be used the data provided by the Brazilian DNA, which provides data of the operating margin emission and the build margin emission factors by dispatch analysis using "TOOL07: Tool to calculate the emission factor for an electricity system". In case the Brazilian DNA discontinues the publication of these data during the monitoring period, the Project Participants may choose between: a) to make use of the latest available official data and information as calculated and published by the Brazilian DNA; or b) to conduct the calculations based on data from ONS.

The steps recommended by "TOOL07: Tool to calculate the emission factor for an electricity system", version 07.0, are discussed below.

Step 1: Identify the relevant electricity systems

According to the "TOOL07: Tool to calculate the emission factor for an electricity system", version 07.0, project participants may delineate the project electricity system using any of the following options:

(a) Option 1. A delineation of the project electricity system and connected electricity systems published by the DNA or the group of the DNAs of the host country(ies), In case a delineation is provided by a group of DNAs, the same delineation should be used by all the project participants applying the tool in these countries;

(b) Option 2. A delineation of the project electricity system defined by the dispatch area of the dispatch centre responsible for scheduling and dispatching electricity generated by the project activity. Where the dispatch area is controlled by more than one dispatch centre, i.e. layered dispatch area, the higher level area shall be used as a delineation of the project electricity system (e.g. where regional dispatch centres are required to comply with dispatch orders of the national dispatch centre then area controlled by the national dispatch centre shall be used);

(c) Option 3. A delineation of the project electricity system defined by more than one independent dispatch areas, e.g. multi-national power pools.

Option 1 is chosen. The National Interconnected System (SIN) is defined as the relevant grid to the project activity. The definition of the SIN as the relevant electricity system is also recommended by the DNA through Resolution N° 08 of May/2008, which defines the National Interconnected System as a single system that shall be used for the calculation of CO_2 emission factors.

Step 2: Choose whether to include off-grid power plants in the project electricity systems

Project participants may choose between the following two options to calculate the operating margin and build margin emission factor:

Option I: Only grid power plants are included in the calculation.
Option II: Both grid power plants and off-grid power plants are included in the calculation.

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

The Brazilian DNA publishes[8] the emission factor calculation based on Option (i) above.

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

[8] Source: http://antigo.mctic.gov.br/mctic/opencms/ciencia/SEPED/clima/textogeral/emissao_despacho.html

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

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

The method chosen to calculate Operation Margin emission factor is the dispatch data analysis operation margin method.

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

The method chosen for operation margin emission factor calculation is the dispatch data analysis calculated on an ***ex-post*** basis.

As previously stated, the Operating Margin (OM) emission factor ($EF_{grid,OM-DD,y}$) calculation based on the dispatch data analysis method is currently conducted by the Brazilian DNA, in accordance with the dispatch data provided by the National Interconnected Power System Operator (ONS).

According to the "*Tool to calculate the emission factor for an electricity system*", version 07.0, the dispatch data analysis OM emission factor ($EF_{grid,OM-DD,y}$) is determined based on the grid power units that are actually dispatched at the margin during each hour *h* where the project is displacing grid electricity. This approach is not applicable to historical data and, thus, requires annual monitoring of $EF_{grid,OM-DD,y}$.

Dispatch data OM emission factors for 2019 will be used for an ***ex-ante*** estimation of CERs for the second crediting period.

Step 5: Calculate the build margin emission factor

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

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

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

Option 2 was chosen by project participants.

The build margin emission factor is calculated by the Brazilian DNA[9]. Data from 2019 will be used for the Build Margin emission factor, which is calculated and published by the Brazilian DNA. The 2019 data vintage was adopted for the build margin calculation as these are the latest data made publicly available by the Brazilian DNA.

Step 6: Calculate the combined margin emission factor

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

(a) Weighted average Combined Margin; or
(b) Simplified Combined Margin.

Complexo Carreiro II CDM Project used option (a) to calculate the combined margin emission factor.

The combined margin emission factor is calculated according to the following equation:

$$EF_{grid,CM,y} = EF_{grid,OM,y} * w_{OM} + EF_{grid,BM,y} * w_{BM}$$ **Equation 05**

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

According to *Tool to calculate the emission factor for an electricity system*", version 07.0, the following default values should be used for W_{OM} and W_{BM}: (a) Wind and solar power generation project activities: W_{OM} = 0.75 and W_{BM} = 0.25 (owing to their intermittent and non-dispatchable nature) for the first crediting period and for subsequent crediting periods; (b) 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.

Therefore, the following values will be used during the second crediting period: **W_{OM} = 0.25 and W_{BM} = 0.75.**

PE_y Calculation (project emissions in year y (tCO_2e/yr))

According to ACM0002 methodology, version 20.0, for most renewable power generation project activities, PE_y = 0. However, some project activities may involve project emissions that can be significant. These emissions shall be accounted as project emissions by using the following equation:

$$PE_y = PE_{FF,y} + PE_{GP,y} + PE_{HP,y}$$ **Equation 06**

Where:
PE_y = Project emissions in year *y* (tCO_2e/yr)
$PE_{FF,y}$ = Project emissions from fossil fuel consumption in year *y* (tCO_2/yr)

[9] For more information: http://antigo.mctic.gov.br/mctic/opencms/ciencia/SEPED/clima/textogeral/emissao_despacho.html

$PE_{GP,y}$ = Project emissions from the operation of geothermal power plants due to the release of non-condensable gases in year *y* (tCO_2e/yr)
$PE_{HP,y}$ = Project emissions from water reservoirs of hydro power plants in year *y* (tCO_2e/yr).

For Complexo Carreiro II Project $PE_{FF,y}$ and $PE_{GP,y}$ are zero.

For hydro power project activities that result in new reservoirs and hydro power project activities that result in the increase of existing reservoirs, project proponents shall account for CH_4 and CO_2 emissions from the reservoir. The methodology establishes that if the power density of the project activity is greater than 10 W/m^2, $PE_{HP,y} = 0$. As demonstrated at section B.2, the power density of the plants that composes project activity are greater than 10 W/m2.

Therefore $PE_{HP,y} = 0$ and the project does not generate any associated project emissions.

Leakage

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

Project Emissions Reductions

According to ACM0002 methodology (version 20.0), the emission reductions (ER_y) are calculated as follows:

$$ER_y = BE_y – PE_y \qquad \textbf{Equation 02}$$

Where:
ER_y = Emission reductions in year *y* (tCO_2e/yr);
BE_y = Baseline emissions in year *y* (tCO_2/yr);
PE_y = Project emissions in year *y* (tCO_2e/yr).

As there is no project emissions ($PE_y = 0$), emission reductions achieved by the project can be calculated according to equation 03 of this PDD as follows: $ER_y = BE_y = EG_{PJ,y} * EF_{grid,CM,y}$..

Where:

BE_y = Baseline emissions in year *y* (tCO_2/yr);
$EG_{PJ,y}$ = Quantity of net electricity generation that is produced and fed into the grid as a result of the implementation of the CDM project activity in year *y* (MWh/yr);
$EF_{grid,CM,y}$ = Combined margin CO_2 emission factor for grid connected power generation in year *y* calculated using the latest version of "TOOL07: Tool to calculate the emission factor for an electricity system" (tCO_2/MWh).

Consequently, the emission reductions generated by the project activity are calculated as the simple product between the quantity of net electricity supplied by Complexo Carreiro II CDM project to the grid and the Combined Margin (CM) emission factor, where the Operating Margin (OM) emission factor will be calculated according to the Dispatch Data Analysis annually updated and the Build Margin (BM) emission factor defined ex-ante (Option 2) considering the data vintage of the year 2019, which was the latest BM available information provided by the Brazilian DNA at the time of the conclusion of this PDD.

For the second crediting period, weights considered for Combined Margin Emission Factor are: 25% for the Operating Margin and 75% for Build Margin.

B.6.2. Data and parameters fixed ex ante

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(s) applied	0
Choice of data or measurement methods and procedures	As SHPs Boa Fé, São Paulo and Autódromo are greenfield power plants, this value is 0 (zero).
Purpose of data	To calculate project emissions.
Additional comment	-

Data/Parameter	A_{BL}
Data unit	m^2
Description	Area of the single or multiple reservoirs measured in the surface of the water, before the implementation of the project activity, when the reservoir is full (m^2). For new reservoirs, this value is zero
Source of data	Project site
Value(s) applied	0
Choice of data or measurement methods and procedures	As SHPs Boa Fé, São Paulo and Autódromo are a new power plant, this value is 0 (zero).
Purpose of data	To calculate project emissions.
Additional comment	-

Data/Parameter	$EF_{grid,BM,y}$
Data unit	tCO_2/ MWh
Description	Build margin CO_2 emission factor in year *y*
Source of data	Brazilian DNA, BM emission factor for the year 2019.
Value(s) applied	0.1020
Choice of data or measurement methods and procedures	Build margin CO_2 emission factor is calculated and published by the Brazilian DNA. 2019 data vintage was adopted for build margin calculation as this is the latest data available.
Purpose of data	Calculation of baseline emissions.
Additional comment	For methodological choices details, please refer to sections B.6.1 and B.6.3

B.6.3. Ex ante calculation of emission reductions

As previously stated, project activity emissions reductions will be calculated based on equation 02, where both PE_y and the Leakage are 0 (zero). Therefore, the emission reductions will be calculated directly through equation 3, as follows:

$$ER_y = BE_y = EG_{PJ,y} * EF_{grid,CM,y} \quad \textbf{Equation 3}$$

Where:
ER_y = Emission Reductions in year *y* (tCO_2e/yr)
BE_y = Baseline emissions in year *y* (tCO_2/yr);
$EG_{PJ,y}$ = Quantity of net electricity generation that is produced and fed into the grid as a result of the implementation of the CDM project activity in year *y* (MWh/yr);
$EF_{grid,CM,y}$ = Combined margin CO_2 emission factor for grid connected power generation in year *y* calculated using the latest version of "TOOL07: Tool to calculate the emission factor for an electricity system" (tCO_2/MWh).

The ER_y calculation is presented as follows.

$EG_{PJ,y}$ Calculation

Table 05 - $EG_{PJ,y}$ Calculation

Year	SHP BOA FÉ ($EG_{PJ,y}$)	SHP SÃO PAULO ($EG_{PJ,y}$)	SHP AUTÓDROMO ($EG_{PJ,y}$)	Total ($EG_{PJ,y}$) (MWh)
2019	868	612	869	2,349
2020	107,134	75,598	107,310	290,042
2021	107,134	75,598	107,310	290,042
2022	107,134	75,598	107,310	290,042
2023	107,134	75,598	107,310	290,042
2024	107,134	75,598	107,310	290,042
2025	107,134	75,598	107,310	290,042
2026	106,266	74,986	106,440	287,692
Total	**749,938**	**529,186**	**751,169**	**2,030,293**

Assumptions:

- $EG_{PJ,y}$ projection was performed assuming the operation of the Hydro Power Plants during 8,760 hours per year;
- Electricity generation is projected according to Assured Energy of the hydro power plant.
- The second crediting period will be from 22 October 2019 to 21 October 2026. Therefore, the ex-ante projection was proportionally calculated.

Emission Factor Calculation

The emission factor that will be used for ***ex-ante*** estimation of Complexo Carreiro II CDM Project emission reductions is **0.20602**. Table below shows a summary of the main parameters involved on the emission factor calculation:

Table 05 – $EF_{grid,CM\ 2019}$ Calculation

Emission Factor	2019
$EF_{grid,OM}$ (tCO_2/MWh)	0.51809
$EF_{grid,BM}$ (tCO_2/MWh)	0.1020
W_{OM}	0.25
W_{BM}	0.75
$EF_{grid,CM}$ (tCO_2/MWh)	**0.20602**

Notes:

- The daily and monthly data for operation margin emission factor is available at: http://antigo.mctic.gov.br/mctic/opencms/ciencia/SEPED/clima/textogeral/emissao_despacho.html
- Annual $EF_{grid,OM,y}$ used for emission reductions projections was calculated through the simple arithmetic average of the monthly $EF_{grid,OM,y}$ published by Brazilian DNA

The ***ex-ante*** Emission Reductions estimation is presented in the table below:

Table 06 - *Ex-ante* Emission Reductions Estimation for Complexo Carreiro II CDM Project (tCO_2e)

Years	Total Emission Reductions (tCO_2e)
2019	484
2020	59,754
2021	59,754
2022	59,754
2023	59,754
2024	59,754
2025	59,754
2026	59,270
Total	**418,281**

B.6.4. Summary of ex ante estimates of emission reductions

Year	Baseline emissions (t CO_2e)	Project emissions (t CO_2e)	Leakage (t CO_2e)	Emission reductions (t CO_2e)
2019	484	0	0	484
2020	59,754	0	0	59,754
2021	59,754	0	0	59,754
2022	59,754	0	0	59,754
2023	59,754	0	0	59,754
2024	59,754	0	0	59,754
2025	59,754	0	0	59,754
2026	59,270	0	0	59,270
Total	**418,281**	0	0	**418,281**
Total number of crediting years	7 years			
Annual average over the crediting period	**59,754**	0	0	**59,754**

B.7. Monitoring plan

B.7.1. Data and parameters to be monitored

The monitoring of ACM0002 methodology, version 20.0 must be applied. Project does not present leakages, nor project emissions to be monitored. The energy measurement is essential to verify and monitor the GHGs emission reduction. It is necessary, therefore, to use metering equipment to register and check the electricity generated by the units. The Monitoring Plan (item B.7.2) allows the calculation of GHG emissions generated by the project activity in a direct manner, by applying the combined margin emission factor.

All data collected as part of monitoring will be electronically archived and be kept at least for 2 years after the end of the last crediting period. All measurements will be conducted with calibrated measurement equipment according to Brazilian industry standards.

The following data and parameters will be monitored:

Data/Parameter	$EG_{facility,y}$
Data unit	MWh/yr
Description	Quantity of net electricity generation supplied by the project plant/unit to the grid in year *y*
Source of data	Electricity meters
Value(s) applied	The value used was 290,042 MWh/year This value was obtained by the sum of the assured energies of the plants multiplied by the number of hours in year *y*
Measurement methods and procedures	Two meters located at Substation Guaporé measure net electricity generation supplied by the project plants. This parameter will be monitored using bi-directional energy meter. Spreadsheets will be used, obtained directly from the electricity meters with information generated hourly. Meters calibration will follow what was described on the document elaborated by ONS – Sub module 12.3 - Maintenance of the measurement system for billing. The meters must comply with the accuracy classes 0.2% by ABNT (Brazilian Association of Technical Standards). The measurements is made by a holding Hidrotérmica or by an Outsourced Measurement Agent. Meters data collection and storage at Substation Guaporé is carried out by the holding Hidrotérmica through the software ZFA. This collection is made by the O&M team. This software has a database, which archives all information's. A backup of this file is generated every month. This collection is automatic, and the data´s sent through System of Energy Data Collection (*Sistema de Coleta de Dados de Energia – SCDE*) to CCEE. Monthly, the information can be confronted with information provided by CCEE, Electric Energy Commercialization Chamber, which supplies records of net electricity supplied to the grid. Continuous measurement and at least monthly recording will be the monitoring frequency
Monitoring frequency	Continuous measurement and at least monthly recording.
QA/QC procedures	Measurements of the electricity generated crosschecked with reports of net

	electricity generation supplied by CCEE.
Purpose of data	Baseline emissions calculation
Additional comment	CCEE – It is the entity responsible for electricity contracts settlement in Brazilian Electricity Market.

Data/Parameter	**$EF_{OM,DD,y}$**
Data unit	tCO_2/ MWh
Description	Operating margin CO_2 emission factor in year *y*
Source of data	Calculated by Brazilian DNA, Project Participants or third Parties.
Value(s) applied	0.51809
Measurement methods and procedures	***Ex-post*** operating margin emission factor will be calculated by the Brazilian DNA, by Project Participants or third parties, through ONS data. It will be calculated through the Dispatch Data of the National Interconnected System as per the "Tool to calculate the emission factor for an electricity system".
Monitoring frequency	Annual
QA/QC procedures	As per the "Tool to calculate the emission factor for an electricity system"
Purpose of data	Baseline emissions calculation
Additional comment	Value applied was calculated based on data provided by the Brazilian DNA for the Operating Margin and Build Margin values of year 2019 (the most recent value of a complete year available at the time of the re-validation start). In case the Brazilian DNA discontinues the publication of the EFgrid,OM,y during the crediting periods, the Project Participants may choose between: a) to make use of the latest available official data and information as calculated and published by the Brazilian DNA; or b) to conduct the calculations based on data from ONS.

Data/Parameter	**$EF_{grid,CM,y}$**
Data unit	tCO_2/MWh
Description	Combined margin CO_2 emission factor in year *y*
Source of data	Calculated by Brazilian DNA, Project Participants or third Parties.
Value(s) applied	0.20602
Measurement methods and procedures	***Ex-post*** emission factor will be calculated by the Brazilian DNA, by Project Participants or third parties, through ONS data. The variable $EF_{grid,OM,y}$ necessary for $EF_{grid,CM,y}$ calculation will also be monitored and calculated through the Dispatch Data of the National Interconnected System. To be calculated as per the "Tool to calculate the emission factor for an electricity system".
Monitoring frequency	Annual
QA/QC procedures	As per the "Tool to calculate the emission factor for an electricity system"
Purpose of data	Baseline emissions calculation

Additional comment	Value applied was calculated based on data provided by the Brazilian DNA for the Operating Margin and Build Margin values of year 2019 (the most recent value of a complete year available at the time of the re-validation start). The BM value will be fixed for the entire second crediting period, while the OM values shall be updated annually and the resulting CM values accordingly during the crediting period. In case the Brazilian DNA discontinues the publication of the EFgrid,OM,y during the crediting periods, the Project Participants may choose between: a) to make use of the latest available official data and information as calculated and published by the Brazilian DNA; or b) to conduct the calculations based on data from ONS.

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
Value(s) applied	Boa Fé SHP – 24,000,300 W São Paulo SHP – 16,048,800 W Autódromo SHP – 24,005,700 W
Measurement methods and procedures	The installed capacity is monitored according to nameplate capacity. All official documentation of the plants (Environmental Licenses, ANEEL Ordinances) refer to the Cap_{PJ} rounded values in MW (24 MW; 16 MW and 24 MW). The monitoring frequency is yearly.
Monitoring frequency	Once at the beginning of each crediting period
QA/QC procedures	The uncertainty level for these data is low. The installed capacity is monitored according to nameplate capacity. All official documentation of the plants (Environmental Licenses, ANEEL Ordinances) refer to the Cap_{PJ} rounded values in MW (24 MW; 16 MW and 24 MW), This can be used for cross-checking.
Purpose of data	Project emission calculation
Additional comment	

Data/Parameter	A_{PJ}
Data unit	m^2
Description	Area of the single or multiple reservoirs measured in the surface of the water, after the implementation of the project activity, when the reservoir is full
Source of data	Project Site
Value(s) applied	Boa Fé SHP – 561,500 m^2 São Paulo SHP – 368,700 m^2 Autódromo SHP – 444,100 m^2
Measurement methods and procedures	Measured from topographical surveys, maps, satellite pictures, etc. Value will be evidenced by Operation License of each plant.
Monitoring frequency	Once at the beginning of each crediting period
QA/QC procedures	The uncertainty level for these data is low. Data is regulated and supervised by Environmental Agency and it is expressed at operation licenses of each project.
Purpose of data	Project emission calculations

Additional comment	

B.7.2. Sampling plan

Not applicable.

B.7.3. Other elements of monitoring plan

The Monitoring Plan follows what was established in the PDD registered for the first crediting period. It is elaborated following Monitoring Methodology presented in the ACM0002 methodology, version 20.0.

The responsibilities described below are common to all three plants.

Responsibilities

- Operation and Maintenance Board: responsible for activities related to the plant's operation and maintenance.

- Measurement Area, linked to the Operation and Maintenance Board: responsible for collecting information directly in meters.

- Outsourced Agent Measurement: part of the Measurement Area allocation can be outsourced by hiring an measurement agent. In this case, the measurement area is responsible for monitoring the work carried out by Measurement Agent outsourced.

- Electric Power Commercialization Chamber (CCEE): it is responsible for implantation, operation and maintenance of SCDE[10], to enable the collection of electric energy's data for the use of Accounting and Settlement System (SCL), aiming at assuring the accuracy of the amounts measured, as well as the meeting of the required deadlines

- Enerbio Consultoria: responsible for calculating the greenhouse gases emission reductions of the project.

Before describing the monitoring process for each small hydro power plant, it is necessary to present a peculiarity of the Complex. The plants are located in the following sequence in the river: SHP Boa Fé, São Paulo and Autódromo.

SHP Boa Fé does not have internal meters. In SHP São Paulo, there are two meters (one main and one rear) that measure total electricity produced by SHP Boa Fé and two meters (one main and one rear) that measure total electricity produced by SHP São Paulo. In SHP Autódromo, there are two groups of two meters (main and rear). One group measures the gross electricity generated by SHP Autódromo and another group measures the total electricity generated by SHPs Boa Fé and São Paulo.

These meters located at the plants measure total electricity generated by each plant, which it is not a monitored parameter for this project.

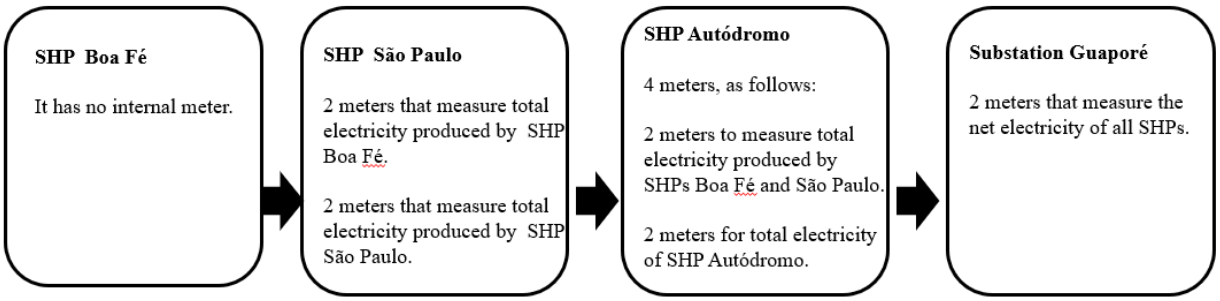
[10] The SCDE is a system responsible for the daily collection and treatment of measurement. Data acquisition is made automatically, directly from the meters or through the database of the agent.

Source: http://www.ccee.org.br/cceeinterdsm/v/index.jsp?vgnextoid=101da5c1de88a010VgnVCM100000aa01a8c0RCRD

Two meters (one main and one rear) located at Substation Guaporé measure net electricity generation supplied by all project plants (Boa Fé, São Paulo and Autódromo SHPs). Net electricity of the 3 SHPs are accounted jointly by the two meters located at this substation.

Collection and storage of the data produced by the meters located in the Substation Guaporé is actually made by the holding Hidrotérmica through the software ZFA. This collection is made by the O&M team. This software has a database, which archives all information's. A backup of this file is generated every month. This collection is automatic, and the data is sent through SDCE to CCEE.

The diagram below shows the number and location of the SHPs meters.



ONS – Sub module 12.3 - Maintenance of the measurement system for billing (called ONS Sub Module 12.3) establishes that The preventive maintenance of each SMF must be carried out each 2 (two) years and **meters calibration should happen each 5 (five) years**.

If during any monitoring period, ONS – Sub module 12.3 changes the periodicity of preventive maintenance and/or meters calibration, the project shall follow this rule because this is the official requirement of Brazilian National System.

The monitoring process for each small hydro power plant is described below:

Process Description – SHP Boa Fé

I – Procedure of Generation Data Collection

Monthly, Measurement Area is responsible for generating from meters database spreadsheets with the generation data, consolidated hourly, regarding the previous month.

SHP Boa Fé has two meters of gross electricity located at SHP São Paulo and net electricity meters are located in the substation Guaporé.

The procedure quoted above might be outsourced through a Measurement Agent's hiring. In this case, Measurement Area is responsible for supervising the work performed by the Measurement Outsourced Agent

II – Data Storage

The information of generation is electronically stored by the Operation and Maintenance Board.

Periodically, the Information Technology Area accomplishes a insurance backup for all company`s data through a Data Server *backup.*

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

III – Confronting of the internal generation data with the third party reports

Monthly, information will be confronted with information provided by CCEE.

Process Description – SHP São Paulo

I – Procedure of Generation Data Collection

Monthly, Measurement Area is responsible for generating from meters database spreadsheets with the generation data, consolidated hourly, regarding the previous month.

Gross electricity measurement of SHP São Paulo happens through two meters located in SHP Autódromo and net electricity is accounted through meters located at the substation Guaporé.

This procedure can be outsourced through a Measurement Agent's hiring. In this case, Measurement Area is responsible for supervising the work performed by the Measurement Outsourced Agent

II – Data Storage

The information of generation is electronically stored by the Operation and Maintenance Board. Periodically, the Information Technology Area accomplishes a insurance backup for all company`s data through a Data Server *backup.*

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

III – Confronting of the internal generation data with the third part reports

Monthly, information will be confronted with information provided by CCEE.

Process Description – SHP Autódromo

I – Procedure of Generation Data Collection

Monthly, Measurement Area is responsible for generating from meters database spreadsheets with the generation data, consolidated hourly, regarding the previous month.

Gross electricity measurement occurs through two meters located inside the SHP and net electricity is accounted through meters located in the substation Guaporé.

The procedure quoted above might be outsourced through a Measurement Agent's hiring. In this case, the Special Measurement Area is responsible for supervising the work performed by the Measurement Outsourced Agent.

II – Data Storage

The information of generation is electronically stored by the Operation and Maintenance Board.

Periodically, the Information Technology Area accomplishes a insurance backup for all company`s data through a Data Server *backup.*

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

III – Confronting of the internal generation data with the third part reports

Monthly, information will be confronted with information provided by CCEE.

Emission Reductions Calculation:

Project Participants team or third party will be responsible for GHGs emission reductions calculation during the monitoring period of the project, as described in the item B.6.1. For the emission factors calculation, it will be used data provided by the Brazilian DNA. In case the Brazilian DNA discontinues the publication of these data during the monitoring period, the Project Participants may choose between: a) to make use of the latest available official data and information as calculated and published by the Brazilian DNA; or b) to conduct the calculations based on data from ONS.

SECTION C. Start date, crediting period type and duration

C.1. Start date of project activity

01/11/2009 is the starting date of the project activity. This is the date when the company responsible for SHPs Boa Fé and Autódromo construction was hired (Contracts: CT BF 047/2009 and CT AUT 046/2009 are evidence for these dates).

The item B.5 of the registered PDD[11] presents a table with a detailed timeline that shows all actions taken by the Project Participants concerning the definition of the project starting date as per the CDM rules.

C.2. Expected operational lifetime of project activity

30 years and 0 months.

C.3. Crediting period of project activity

C.3.1. Type of crediting period

The project uses renewable crediting period, and this is the second crediting period.

C.3.2. Start date of crediting period

22/10/2019

C.3.3. Duration of crediting period

7 years and 0 months.

[11] Available at: https://cdm.unfccc.int/Projects/DB/BVQI1334243115.72/view

SECTION D. Environmental impacts

D.1. Analysis of environmental impacts

The growing global concern about sustainable use of the resources is leading to a requirement for more sensitive environmental management practices. This is increasingly reflected in legislation and policies around the world. In Brazil, the situation is not different. The licensing policies and environmental rules are very demanding, just as the best international practices.

Brazilian law requires a licensing process for new enterprises that involve polluting or potentially pollutant activity. In the State of Rio Grande do Sul, the State Foundation of Environmental Protection Henrique Luiz Roessler (FEPAM) is the legal responsible of the licensing process, which begins with the environmental impact study conducted by the entrepreneur and follows with the previous analysis (preliminary studies) undertaken by the local environmental agency.

In Taquari-Antas Basin, where SHPs are located, FEPAM developed an integrated study of hydroelectric projects planned in the inventory conducted by the Electric Energy Company of Rio Grande do Sul, CEEE, and it determined which of them were environmentally feasible through detailed environmental studies. In this study, it was defined that SHPs of Complexo Carreiro II, among others, should be licensed through the Environmental Impact Assessment (EIA).

Checked their environmental feasibility, the project must go through three phases to obtain all necessary licenses for its operation. In the first stage, federal and state environmental legislation is consulted in order to verify venture feasibility and enforce the legal conditions. If FEPAM has a positive understanding about environmental design concepts, Previous Environmental License (LP) is issued.

After obtaining LP, it must be presented physical and operational project for the enterprise and construction activities, if necessary, demonstrating how they will be observing the conditions and restrictions imposed by LP. To obtain the installation environmental license (LI) is required (a) additional information about previous environmental assessment, (b) a new simplified assessment (RDPA – Detailed Report of Environmental Programs), or (c) the Environmental Basic Project (PBA), as resolution of the environmental agency informed in the LP.

If the project fully attends the requirements expressed in LP, the enterprise gets approval to begin the project implementation through the issuance of Environmental Installation License (LI).
The third and last stage provides the authorization for starting the enterprise operational with the issuance of Environmental Operating License (LO).

LO issuance is the confirmation that the enterprise construction was carried out accordingly to the submitted project and it is licensed in compliance with conditions and environmental restrictions.

Below, it follows SHPs Boa Fé, São Paulo and Autódromo current Operation Licenses of each plant.

Operation License (LO)	**SHP Boa Fé**	**SHP São Paulo**	**SHP Autódromo**
Number	02534 / 2017-DL	02535 / 2017-DL	02034 / 2017-DL
Date	04/05/2017	04/05/2017	10/04/2017
Valid	09/05/2022	09/05/2022	18/04/2022

D.2. Environmental impact assessment

All SHPs of the project have a restricted flooding area, not significantly altering the environment. Thus, the environmental impact of the activity is considered small and Complexo Carreiro II project meets the various requirements of state environmental laws and the Brazilian electric sector, having the necessary licenses for their development.

To identify possible environmental impacts caused by SHPs, it was performed a study, called Environmental Impact Assessment (EIA). In this document, it is described and explained all environmental impacts produced in physical, biotic, and anthropic environment during construction and operation phase. It is also indicated some environmental and social projects to be developed with the objective of mitigating the impact generated by the venture.

29 programs and actions to minimize the impact of the entrepreneurship were conducted. All programs that comprise the basic environmental project (PBA) were prepared according to the latest natural and social resources management techniques.

Environmental impact study and basic environmental project (PBA) of the enterprises were supplied to entities involved in the CDM and present a detailed environmental impact assessments and mitigation measures adopted.

It follows a brief description of some programs to be developed in the Complexo Carreiro II Project implementation:

Cleaning of Accumulation Basin Program

The area flooded by the enterprises is reduced. However, the existing vegetation flooding and the water contact with possible sources of pollution can deteriorate the reservoir water quality, so there was a necessity to define a deforestation scenario with less environmental impact.

The Cleaning Basin Accumulation Program presented guidelines for the implementation of activities of deforestation and cleaning, in-depth way, and ensure protection of aquatic communities, providing maintenance of water quality of future reservoirs and mitigating the environmental impacts caused by removal of existing vegetation in the area to be flooded by the enterprises.

Hydro sediment Monitoring Program

Sediment flow to the river channel is basically dependent of natural processes that are often associated with human actions, and contribute for rocks dissociate, sediments formation and its consequent carry.

For that, this program aimed to (i) broad and deep the knowledge of hydro sediment processes in direct and indirect influence area of the enterprise; (ii) know the dynamics of sediments inflow and their deposition; (iii) determine the sediments distribution; (iv) identify and monitor margins erosion; (v) evaluate changes both upstream and downstream; (vi) monitor the sediment volume; (vii) propose corrective and preventive actions.

Climate Monitoring Program

This program aimed to monitor the microclimate in direct and indirect influence area of the dams, with the installation of an automatic weather station in direct influence area, integrating information from other meteorological stations in the region. One of his goals is to systematize, facilitate and disseminate weather information for environmental planning and management of the reservoir, forming a database with relevant meteorological parameters and time series to quantify accurately the climatic effect resulting from the venture.

Fauna Rescue and Monitoring Program

The surveys of terrestrial vertebrates' populations monitoring were frequently carried out quarterly, with campaigns distributed seasonally. It was done fauna rescues during the deforestation for construction sites and reservoirs. Rescues with boats will be made just during SHPs reservoirs filling.

According to IBAMA's recommendations, it was necessary the construction of the Screening and Rehabilitation Temporary Center (CPTR) for rescued animals. The objective of this measure was to ensure the integrity of the animal that may be rescued for later release.

Flora Rescue Program

Flora rescue program met the environmental mitigation and compensation requirements to mitigate the impacts resulting from the projects implementation, including the epiphytes rescue, seeds and seedlings collecting, and the transplanting of trees species immune to cut, as well as scientific and commercial interest species. For this, the program efforts should address the selection of a group of species capable to allow the maintenance of local genetic diversity and the work of rescue, transplantation, collection, relocation, and monitoring.

Revegetation of Surrounding Areas of the Reservoir Program

The reforestation of areas devoid of trees along the permanent preservation area (APP) is environmentally friendly for the restoration of pre-existing ecological processes, as well as being required by law as a condition for implementation of hydropower projects.

This program aims to recover and preserve the main areas acquired by the entrepreneur, which will restructure APP surrounding the reservoir. Through planting native tree species in the region, it will ensure the fulfillment of obligatory forest replacement established by FEPAM, the recovery of local floristic diversity, restoring their interrelationship with wildlife.

Ichthyofauna Rescue and Monitoring Program

Changes from plants operation involves interactions of the fish fauna with the water quality of reservoirs, the presence of physical barriers for movements and new environments created by dams.

Due to ichthyofauna and enterprises characteristics, Ichthyofauna Monitoring Program includes activities for evaluating the effectiveness of measures to mitigate the impacts of the operation of hydroelectric plants to the elements of this fauna.

Social Communication Program

Landscape transformations, such as the implantation of a SHP and all alterations provoked by it generate impacts, curiosities, and doubts in the population of the region, both in direct and indirect entrepreneurship's areas of influence.

In this context, the social communication performs a key role, once it attempts to minimize these feelings and involve the population with the project through the information exchange, making use of the Social Communication. This program has as target people affected by construction, city's authorities, NGOs, syndicates, associations, communitarian leaderships, the press and others that manifest interest.

Infrastructure and Territory Restructuring Program

The infrastructure and territory restructuring program was justified by the necessity to meet a new reality resulting from plants implementation. For this, it was necessary to reorganize the affected territory and restore infrastructure and services affected, protecting the relations between the communities existing before the project, seeking to maintain already established living conditions, reconstructing the current infrastructure dynamics. In addition, the program is also justified by the need to implement improvements in local roads to meet the construction demands, not only in the current road system, but also in new segments.

Historical, Cultural and Landscape Rescue Program

The landscape heritage of a region refers both to the natural land forms, inherited from the landscape and which served as a substrate for fixing the inhabitants, and the landscape created by man constructing their houses, planting for subsistence, in the expression of their religiosity and their culture. The landscape rescue assumes to preserve relevant scenarios and property of historical and cultural value, defining the best way to save them for future generations.

Archaeological Rescue Program

The places where are found traces of material culture, results of human actions, are called archaeological sites. Database of Archaeological sites of the Institute of Historical and Artistic Heritage (IPHAN) showed that there is record of archaeological sites in the region. More specifically in the records of the Centre for Archaeological Research and Education (CEPA) at the University of Santa Cruz do Sul (UNISC), it is found the registration of two archaeological sites for the town of Serafina Corrêa; one for Nova Bassano and two for the municipality of Vista Alegre do Prata.

For the municipality of Guaporé, there are eight archaeological sites occurrences, according to the records of the Centre for Archaeological Research and Education (CEPA) at the Catholic University of Rio Grande do Sul (PUCRS). Even though preliminary studies during the EIA have identified that in the SHPs area there were no indications of archaeological sites, due to the high inclination of the slopes and difficult access, but as it is an area with archaeological potential justified the development of Archaeological Rescue Program for the area, as determined by IPHAN.

Migrant Population Support Program

During the construction of SHPs Autódromo, Boa Fé and São Paulo, there were a influx of people into the region. The induced population may be grouped as migrants linked to the installation of new enterprises and migrants attracted to the region by the expectation of obtaining jobs, open your own business or to enjoy other opportunities in the municipalities affected.

The assistance to migrant population related to the construction is regulated by applicable employment laws or clauses included in contracts between the entrepreneur and companies hired. Regarding the population indirectly attracted by construction activities, actions were guided by negotiations and agreements with local government.

Environmental Education Program

It was performed activities along the school communities in the entrepreneurship's influence area, with focus on (i) capacitating teachers of municipal education which act in the municipalities covered by the entrepreneurship, besides (ii) capacitating activities with the workers of hired companies and (iii) educational activities with residents surrounding the reservoir. This program had intense integration with the programs of Social Communication, Prevention of Accidents and Public Health and Conservation and Use of the Reservoir Waters and its Surroundings.

Municipalities Support Program

The main objective of this program was to support the socioeconomic development of municipalities in influence area of the venture, aiming to assist the development and implantation of sustainable farming technologies and its tourism potential.

The Complexo Carreiro II CDM Project Environmental Impact Assessment and Environmental Licenses were provided to the DOE during the validation phase, prior to the project's registration.

SECTION E. Local stakeholder consultation

E.1. Modalities for local stakeholder consultation

This section was copied from registered PDD used for the first crediting period.

According to the resolution nº 7, from March 5th, 2008[12] published by Brazilian Designated National Authority and consolidated in the Handbook for Project Activities Submission under the CDM, developed by the Brazilian Designated National Authority, local stakeholders should be invited to perform comments about CDM project activities.

Thus, the following local stakeholders were invited, through letters:

City of Guaporé:

- Guaporé City Hall
- Guaporé Municipal Assembly
- Municipal Secretariat of Planning and Coordination, Department of Environment
- Rural Workers Union of Guaporé

City of Nova Bassano:

- Nova Bassano City Hall
- Nova Bassano Municipal Assembly
- Municipal Secretariat of Agriculture and Environment
- Rural Workers Union of Nova Bassano

City of Serafina Corrêa:

- Serafina Corrêa City Hall
- Serafina Corrêa Municipal Assembly
- Municipal Secretariat of Agriculture and Environment
- Rural Workers Union of Serafina Corrêa

City of Vista Alegre do Prata:

- Vista Alegre do Prata City Hall
- Vista Alegre do Prata Municipal Assembly
- Municipal Secretariat of Agriculture and Environment
- Vista Alegre do Prata Rural Workers Union

Other Stakeholders:

- State Environmental Agency (FEPAM)

[12] http://www.mct.gov.br/upd_blob/0023/23744.pdf

- Brazilian NGO Forum (FBOMS)
- State Department of Environment (SEMA)
- State Federal Attorney of Public Interest
- Federal Attorney of Public Interest

E.2. Summary of comments received

The project did not receive any comment from local stakeholders.

E.3. Consideration of comments received

It is not applicable because the project did not receive any comment.

SECTION F. Approval and authorization

Party involved in the project activity is Brazil. Letter of approval is available at: https://cdm.unfccc.int/Projects/DB/BVQI1334243115.72/view

Appendix 1. Contact information of project participants

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Appendix 2. Affirmation regarding public funding

No public funding for this project has been obtained

Appendix 3. Applicability of methodologies and standardized baselines

Not applicable. This section is intentionally left blank.

Appendix 4. Further background information on ex ante calculation of emission reductions

The monthly values[13] of the Operating Margin Grid Emission Factor ($EF_{grid,OM,y}$) and the Build Margin Grid Emission Factor ($EF_{grid,BM,y}$), which were used for emission reductions ex-***ante*** estimation of Complexo Carreiro II CDM Project are available below. All data is provided by the Brazilian DNA. In case the Brazilian DNA stops to publish these data during the monitoring period, they will be calculated by the project participants.

Annex Table 01 – Build Margin and Monthly Operating Margin Emission Factors of 2019 - Brazilian Interconnected Grid System

BUILD MARGIN

Average emission factor (tCO2/MWh) - ANNUAL	
2019	0,1020

OPERATING MARGIN

Average emission factor (tCO2/MWh) - MONTHLY												
2019	Month											
	January	February	March	April	May	June	July	August	September	October	November	December
	0,3540	0,5573	0,5075	0,5095	0,4794	0,4175	0,5914	0,5312	0,5606	0,5370	0,5720	0,5997

Appendix 5. Further background information on monitoring plan

Not applicable. This section is intentionally left blank.

Appendix 6. Summary report of comments received from local stakeholders

Not applicable. This section is intentionally left blank.

[13] Available at: http://antigo.mctic.gov.br/mctic/opencms/ciencia/SEPED/clima/textogeral/emissao_despacho.html.

Appendix 7. Summary of post-registration changes

In September/2020, project participants (PPs) required a post-registration changes (PRC) on registered PDD[14]. This PRC is pending to approval. All changes proposed are presented below:

To register the post-registration changes, Project Participants (PPs) had to use the current template of CDM-PDD-FORM. This form has some sections and requirements that were not present the CDM-PDD-FORM used at the registered PDD. Also, the order of the sections is not the same. Therefore, some updates were necessary to attend it.

The post registration changes proposed at PRC were:

Permanent Changes to the Registered Monitoring Plan

1. At the Monitoring Plan, PPs added the information that in SHP São Paulo, besides the two meters (one main and one rear) that measure the gross electricity generated by SHP Boa Fé, there are two other meters (one main and one rear) that measure total electricity produced by SHP São Paulo. This information was added as a clarification. This does not not impact the $EG_{facility,y}$ monitoring. Meters used for $EG_{facility,y}$ monitoring are located at Guaporé Substation. This is a permanent change to the registered monitoring plan.
2. Another change at the Monitoring Plan was to present meters calibration requirements according to the updated ONS requirements. ONS Sub Module 12.3 was updated. From 01/01/2017, it establishes that meters calibration should happen each 5 (five) years. Therefore, from the starting date of the first crediting period until 31/12/2016, meters calibration should happen each 2 (two) years and from 01/01/2017, each 5 (five years). This is a permanent change to the registered monitoring plan.

Changes to the Project Design

1. Changes in the installed capacity of the project activity (Cap_{PJ}): Turbine and Generator implemented in Boa Fé SHP, São Paulo SHP and Autódromo SHP produces a nominal installed capacity of 24,000,300 W; 16,048,800 W and 24,005,700 W, respectively. All official documentation of the plants (Environmental Licenses, ANEEL Ordinances) refer to the Cap_{PJ} values expressed at PDD registered. Brazilian Regulators do not consider this immaterial variation (0.001%; 0.31% and 0.02%) a change in the installed capacity. No additional investment was performed, and these changes do not affect revenues generation of the plants once there is no change in the assured energy approved by ANEEL. The assured energy is the amount of electricity allowed to be sold under power purchase agreements. As this technical parameter did not change, additionality analysis was not affected.
2. The area of the reservoirs measured in the surface of the water, after the implementation of the project activity, when the reservoir is full reservoir area (A_{PJ}) is a parameter to be monitored. The operation License of each plant showed that the reservoir area implemented differs from information presented at the PDD registered. A_{PJ} of Boa Fé SHP, São Paulo SHP and Autódromo SHP are 561,500 m^2; 368,700 m^2 and 444,100 m^2, respectively.
3. At São Paulo SHP, the turbine type implemented was different from PDD registered. PDD registered predicted Francis Turbines and Kaplan Turbines were implemented.
4. Changes of item 1 and 2 impacted power density result which was also updated.

It is important to highlight that both changes are in parameter that are monitored during the monitoring period, according to ACM0002, version 12.1. From PPs understanding, these changes

[14] Available at: https://cdm.unfccc.int/Projects/DB/BVQI1334243115.72/view

should not be considered as a post registration change. But, considering the understanding of the CDM Secretariat about other projects, Project participants decided to update the PDD.

Additionally, to comply paragraph 242 of the CDM Accreditation Standard, the PP shall report in the revised PDD the impacts of the proposed or actual changes to the registered CDM project activity on the following:

- **The applicability and application of the applied methodologies, the applied standardized baselines and the other applied methodological regulatory documents with which the project activity has been registered;**

There was no impact in the applicability and application of the applied methodologies and the other applied methodological regulatory documents with which the project has been registered.

- **The compliance of the monitoring plan with the applied methodologies, the applied standardized baselines and the other applied methodological regulatory documents;**

There was no impact in the compliance of the monitoring plan with the applied methodologies and the other applied methodological regulatory documents.

- **The level of accuracy and completeness in the monitoring of the project activity compared with the requirements contained in the registered monitoring plan;**

There was no impact in the level of accuracy and completeness in the monitoring of the project activity compared with the requirements contained in the registered monitoring plan.

- **The additionality of the project activity;**

There was no impact in additionality of the project activity.

- **The scale of the project activity.**

There was no impact in the scale of the project activity which is a large scale project activity.