



Monitoring Report

CARBON OFFSET UNIT (CoU) PROJECT



Title:

Version 2.1

Date 24/10/2022

First CoU Issuance Period: 4 years, 7 months

Monitoring Period: 01/11/2017 to 31/05/2022



Monitoring Report (MR) CARBON OFFSET UNIT (CoU) PROJECT

Monitoring Report	
Title of the project activity	Santana I SHP CDM Project (JUN 1118)
UCR Project Registration Number	128
Version	2
Completion date of the MR	24/08/2022
Monitoring period number and duration of this monitoring period	Monitoring Period Number: 1 Duration of this monitoring Period: (first and last days included (01/11/2017 to 31/05/2022)
Project participants	PCH Santana Ltda (private entity) Carbotrader Assessoria e Consultoria em Energia Ltda. (private entity)
Host Party	Brazil (Host Country)
Applied methodologies and standardized baselines	AMS-I.D. - Grid connected renewable electricity generation (version 13)
Sectoral scopes	Sectoral Scope 1 – Energy Industries (Renewable / Non-renewable Sources)
Estimated amount of GHG emission reductions for this monitoring period in the registered PCN	2017: _____ CoUs (2,135 tCO ₂ eq)
	2018: _____ CoUs (22,044 tCO ₂ eq)
	2019: _____ CoUs (22,010 tCO ₂ eq)
	2020: _____ CoUs (12,024 tCO ₂ eq)
	2021: _____ CoUs (15,167 tCO ₂ eq)
	2022: _____ CoUs (7,958 tCO ₂ eq)
Total:	_____ CoUs (81,338 tCO ₂ eq)

SECTION A. Description of project activity

A.1. Purpose and general description of project activity >>

a) Purpose of the project activity and the measures taken for GHG emission reductions >>

The project activity consist in the generation of electricity by a renewable source (hydroelectric source), through the construction of a Small Hydro Power (SHP) plant called Santana I.

This project was developed by PCH Santana Ltda (former Firenze Energética S/A), a private entity which is an arm of the Interalli Group. Interalli Group is based on Curitiba city, Paraná State in Brazil. This company has a diversified actuation, enterprises that deals with technological development of seeds and planting; port terminal facilities, logistic system, commodities export and import, and hydroelectric energy generation plant.

The SHP power installed capacity is 14.758 MW and its location is given in the Santana river in the city of Nortelândia, state of Mato Grosso in west-central region of Brazil.

This Small Hydro Power plant has a reservoir of 1.17 km² characterized as a small reservoir, which does not present a significant impact compared to the large hydroelectric facilities.

Moreover, help with regard to improvement in the supply of electricity contributing to environmental sustainability by increasing the share of renewable energy in relation to total consumption of electricity in Brazil. Thus, the project activity was the construction of renewable energy project as environmentally sustainable alternative to electricity energy generate.

Considering that the project activity consists in SHP with a small reservoir, it represents a virtually zero environmental impact when compared to large hydroelectric facilities. This fact is important because the construction of Small Hydro Power plants really contributes to the efficient use of natural resources and environment, thus avoiding the growth of environmental and social liabilities caused by new large hydroelectric plants.

Concerning to the project contribution for Greenhouse Gas emissions (GHG) mitigation, the project activity reduces emissions of these gases avoiding thermoelectric plants operation that use fossil fuels as energy source. In the absence of the project activity, fossil fuels would be burned in thermoelectric plants grid interconnected. The project activity initiative helps Brazil to meet its goals of promoting sustainable development.

The project activity is aligned with the specific requirements of the CDM (Clean Development Mechanism) of the host country, because:

- It contributes to environmental sustainability as reduce the use of fossil energy (non-renewable sources). Thus the project contributes to the best use of natural resources and makes use of clean and efficient technologies;
- It contributes to better working conditions and increases the opportunity for employment in the area where the project is located;
- It contributes to local economy better conditions, since the use of renewable energy reduces the fossil fuel dependence; reduce the amount of pollution and the associated social costs related to it.

Moreover, the project diversify the sources of generation of electricity and decentralized energy

generation from bringing specific benefits such as:

- Increased reliability, with shorter and less extensive interruptions;
- Fewer demands related to reserve margin;
- Energy of better quality for the region;
- Minor losses in transmission and distribution lines;
- Control energy reactive;
- Mitigation of congestion in transmission and distribution.

The datas of turbines and generators that were installed in SHP Santana I are summarized below. Some of these values are described on the equipments' plaques.

- Turbines: 2 (two) Francis, horizontal axis of 7.656 MW each¹;
- Generators: 2 (two) Synchronous, horizontal axis of 7.380 MW each.
- Installed Capacity: 14.758 MW
- Assured Energy: 8.89 MW²
- The reservoir area is 1.17 km²

The SHP Santana I is connected with the national grid by a single circuit transmission line with 4.1 km length at 34.5 kV through the substation Nortelândia, owned by CEMAT – Centrais Elétricas Matogrossenses S.A.

b) Brief description of the installed technology and equipment>>

The project activity *Santana I SHP CDM Project (JUN 1118)* (hereinafter referred to as “SHP Santana I” or “the Project”) was implemented by PCH Santana Ltda. The Project involved the installation of two units of 7.656 MW turbines matched with two generators units of 7.380 MW each. The total installed capacity of the Project is 14.758 MW, and the assured energy 8.89 MWavg. The estimated annual system-connected electricity (EG_y) is 77,876 MWh.

The Project provides renewable energy to the Brazilian Interconnected System. The emission reductions are reached by displacing part of the fossil-fuelled electricity from the Brazilian Interconnected System.

The Project is **a run of river small hydroelectric plant** that uses the hydro potential of Santana river (which is part of the Paraná River basin), and has a small reservoir with 1,170,000 m² of area.

The Project facility contains a small dam, which stores water in order to generate electricity for short periods of time. It was designed to function as a run of river scheme. A typical run of river scheme involves a low-level diversion dam. A low-level diversion dam raises the river water level sufficiently to enable an intake structure to be located on the river side. The intake consists of a trash screen and a submerged opening with an intake gate. Water from the intake is normally taken through a pipe (called a penstock) downhill to a power station constructed downstream of the intake and as low level as possible to gain the maximum head on the turbine.

¹ Slightly different from registered PDD (during the project design phase forecasted 7,653 MW each)

² Value changed through the Mines and Energy Ministry Ordinance #21 of 27/06/2011 prior on PDD registered in the CDM = 8.72 MWavg

Figure 1 below shows the scheme of a run of the river power plant:

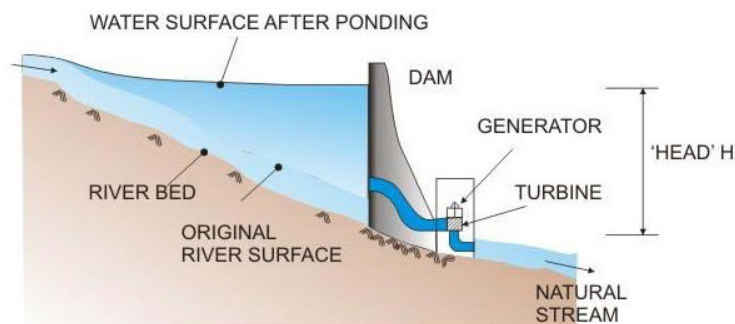


Figure 1 - Schematic view of a run of river power plant

The equipment and technology used in the Project have been successfully applied to similar projects in Brazil and around the world.

There were stops mainly due to operational convenience (hydrology), but these did not cause alterations in the calculations of the project emission reductions. The occurrences are not considered significant by the project participants.

Follow below the Table 1 with the calibration data:

Table 1: Calibration data

Nº	METERS IDENTIFICATION		DATE OF ISSUE	VALIDITY ³
1	Number: MW-1612A263-02 ⁴ Manufacturer: Schneider/ION8650C	Main meter	09/03/2017 08/05/2018	5 years
2	Number: MW-1706B363-02 ⁵ Manufacturer: Schneider/ION8650	Backup meter	08/05/2018	5 years

c) Relevant dates for the project activity (e.g. construction, commissioning, continued operation periods, etc.)>>

UCR Project ID or Date of Authorization: 128

Start Date of Crediting Period: 01/11/2017

Project Commissioned: 26/04/2012

³ From 01/01/2017 the calibration frequency changed from 2 to 5 years (as per ONS procedures)

⁴ Main meter "MW-1612A263-02" replaces "PT-1003A493-01" on 09/03/2017

⁵ Backup meter "MW-1706B363-02" replaces "PT-1003A532-01" on 06/03/2017

CDM Crediting Period (7 years): from 01/11/2010 to 31/10/2017
Continued operation since commissioning on 26/04/2012.

d) Total GHG emission reductions achieved or net anthropogenic GHG removals by sinks achieved in this monitoring period>>

The total GHG emission reductions achieved in this monitoring period is as follows:

Summary of the Project Activity and ERs Generated for the Monitoring Period	
Start date of this Monitoring Period	01/11/2017
Carbon credits claimed up to	31/05/2022
Total ERs generated (tCO _{2eq})	81,338 tCO _{2eq}
Leakage	0

e) Baseline Scenario>>

According to AMS I. D.:

The baseline scenario is that the 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 into the grid.

The project activity is the construction of a new grid-connected renewable power plant/unit.

The baseline emissions are the product of electrical energy baseline $EG_{BL,y}$ expressed in MWh of electricity produced by the renewable generating unit multiplied by the grid emission factor (in tCO_{2e}/MWh) calculated in a transparent and conservative manner

In the project activity absence (baseline scenario), the electricity would be being generated for other grid-connected power plants, included fossil fuel based power plants (more details about the baseline scenario and National Interconnected Grid - SIN in Section B.6).

The project activity uses as source for SIN emission factor calculation the operating and build margin coefficients provided by host country Designated National Authority (DNA) - publicly available.

The CO₂ Emission Factor resulting from the electric energy generation verified in SIN is calculated based on generating records from plants centrally operated by the National Electric System Operator (from Portuguese *Operador Nacional do Sistema Elétrico* - ONS).

The method used to make this calculation is the dispatch analysis method. These information are necessary for renewable energy projects connected to electric grid and implanted in Brazil under the CDM.

The data resultant from ONS, Mines and Energy Ministry and Science, Technology and Innovation Ministry work are available to CDM project proponents. Thus, they can be applied in calculating *ex-ante* emissions avoided by the project activity, and the emission reduction will be *ex-post* calculated.

Further details of project baseline development can be viewed through the link:
<https://www.gov.br/mcti/pt-br/acompanhe-o-mcti/sirene/dados-e-ferramentas/fatores-de-emissao>

A.2. Location of project activity>>

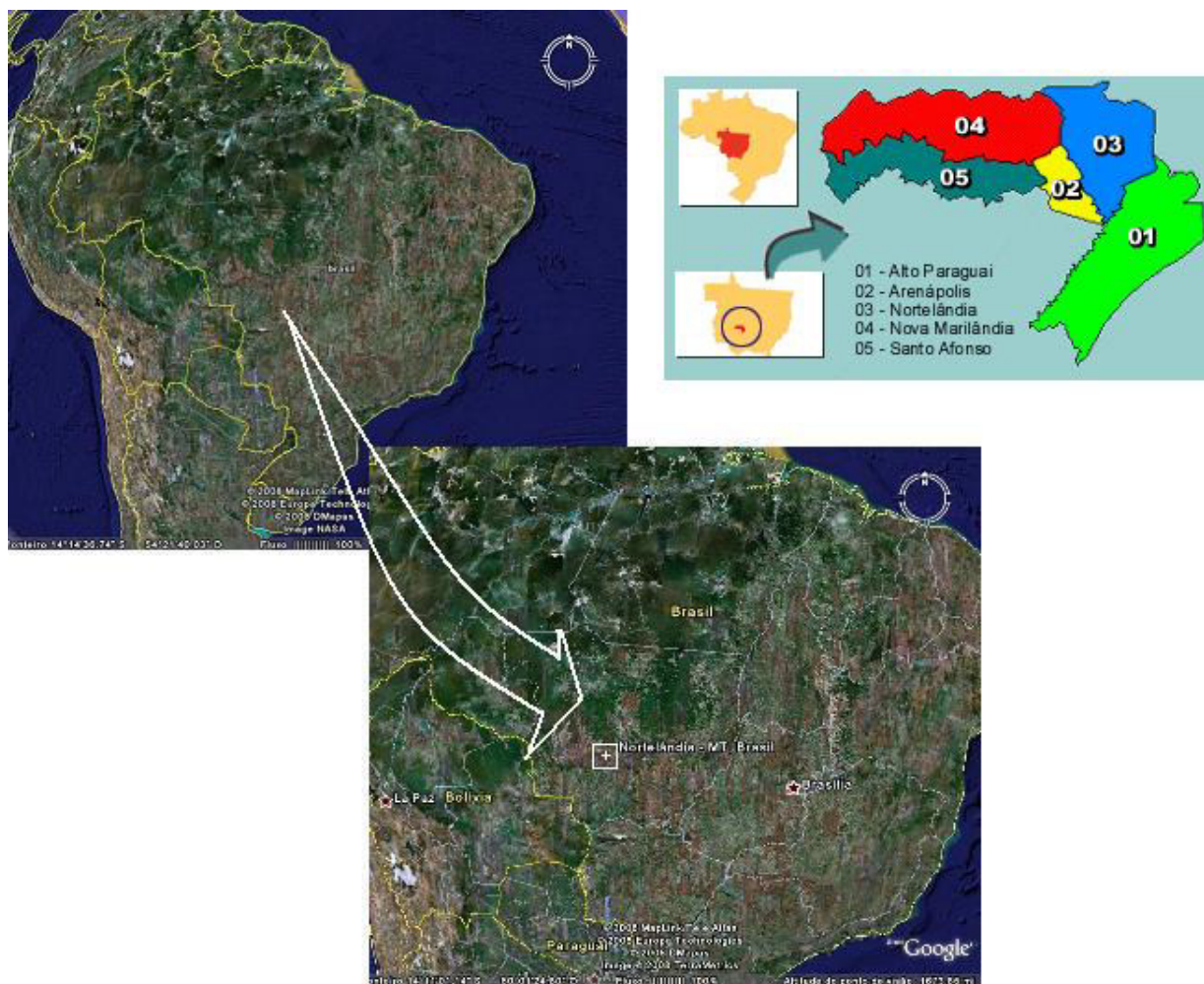
Country: Brazil

District/City: Nortelândia

State: Mato Grosso

The geographical coordinates of the location of the dam are: 56° 49' 44" West and 14° 23' 28" South (-14.391111, -56.828888)

Figure 2: Geographical location of Nortelândia city.



Source: Google Earth (www.google.com) and City Brazil (www.citybrazil.com.br).

A.3. Parties and project participants >>

Party (Host)	Participants
Brazil	PCH Santana Ltda (private entity) Carbotrader Assessoria e Consultoria em Energia Ltda. (private entity)

A.4. References to methodologies and standardized baselines >>

SECTORAL SCOPE - 1

TYPE – Energy Industries (Renewable / Non-renewable Sources)

CATEGORY- The methodology used is the AMS-I.D (version 13.0)⁶: “Grid connected renewable electricity generation” (EB 36). This one already contains the standardized baseline.

And:

- Tool to calculate the emission factor for an electricity system (version 01.0, EB 35)⁷

Applicability of methodologies and standardized baselines >>

This is a small scale project and since the SHP installed capacity remains the same during all project lifetime, 14.758 MW - with no provision to scale increment - the project activity remains under the same project type: I renewable energy project activity, not greater than 15.0 MW. Hence this project activity is a small scale project.

A.5. Crediting period of project activity >>

Provide the duration of the crediting period corresponding to the monitoring period covered in this monitoring report.

Length of the crediting period corresponding to this monitoring period: 14 years – 01/11/2017 - 31/10/2031

A.6. Contact information of responsible persons/entities >>

Arthur Moraes

E-mail: moraes.arthur@carbotrader.com

Phone: +55 11 4522-7180

⁶ <https://cdm.unfccc.int/methodologies/DB/W3TINZ7KKWCK7L8WTXFQQOFQQH4SBK>

⁷ https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-07-v1.1.pdf/history_view

SECTION B. Implementation of project activity

B.1. Description of implemented registered project activity >>

a) Provide information on the implementation status of the project activity during this monitoring period in accordance with UCR PCN>>

- a) The project activity ***Santana I SHP CDM Project (JUN 1118)*** (hereinafter referred to as “SHP Santana I” or “the Project”) was implemented by PCH Santana Ltda. The Project involved the installation of two units of 7.656 MW turbines matched with two generators units of 7.380 MW each. The total installed capacity of the Project is 14.758 MW, and the assured energy 8.89 MWavg. The estimated annual system-connected electricity (EG_y) is 77,876 MWh.

The Project provides renewable energy to the Brazilian Interconnected System. The emission reductions are reached by displacing part of the fossil-fuelled electricity from the Brazilian Interconnected System.

The Project is **a run of river small hydroelectric plant** that uses the hydro potential of Santana river (which is part of the Paraná River basin), and has a small reservoir with 1,170,000 m² of area.

The Project facility contains a small dam, which stores water in order to generate electricity for short periods of time. It was designed to function as a run of river scheme. A typical run of river scheme involves a low-level diversion dam. A low-level diversion dam raises the river water level sufficiently to enable an intake structure to be located on the river side. The intake consists of a trash screen and a submerged opening with an intake gate. Water from the intake is normally taken through a pipe (called a penstock) downhill to a power station constructed downstream of the intake and as low level as possible to gain the maximum head on the turbine.

- b) About SHP implementation:

With respect to regulatory permits, Santana I SHP has authorizations emitted by ANEEL:

- Dispatch #3301 of 04/09/2008 issued on 05/09/2008 by ANEEL. Approving the basic project of Santana I SHP. Current dispatch.
- Ordinance ANEEL #126 of 28/03/2008 issued on 31/03/2008 by MME. Approving Santana I SHP at the Infra-structure Special Regime Incentives – REIDI.
- Resolution #542 of 14/10/2003 issued on 15/10/2003 by ANEEL. Authorizing Firenze Energética (currently PCH Santana Ltda) to establish as a Independent Energy Producer.
- Dispatch #407 of 09/07/2003 issued on 10/07/2003 by SPH/ANEEL. Approving the Simple Inventory Studies of the Santana river in the Mato Grosso State.
- Dispatch #1,362 of 25/04/2012, SHP Santana I commercial operation start occurred in 26/04/2012

With respect to environmental permits legislation requires issuing of following licenses:

- **Preliminary License (LP):** preliminary phase of planning activity in which concept and location of enterprise are evaluated. In this phase Environmental Impact Study (EIA) and Environmental Impact Report (RIMA) are analysed, or, depending on the case, the Environmental Control Report (RCA).

- **Installation License (LI):** authorizes implementation of enterprise. In this phase, the Environmental Control Plan (PCA) is analysed, it contains projects for systems of treatment and/or disposing of liquid and atmospheric effluents and solid residue etc.
- **Operation License (LO):** authorizes operation of enterprise after verification of compliance with measures determined in phases of LP and LI.

The project activity comprises one SHP, therefore, it is necessary environmental permits for its development.

The Santana I SHP has the following licences to be implemented:

- **LAI 55954/2008** – Environmental Installation License from Environment Secretary of Mato Grosso State – SEMA (Secretaria de Estado do Meio Ambiente – SEMA). Issued on 16 October 2008. Construction Start.
- **LAI 299/2008** – Environmental Installation License from SEMA. Issued on 02 April 2008.
- **LAI 962/2007** – Environmental Installation License from SEMA, issued on 17 January 2007.
- **LAO 316226/2017** – Currently valid Environmental Operation License from SEMA, issued on 15/12/2017.

b) For the description of the installed technology(ies), technical process and equipment, include diagrams, where appropriate>>

Small-scale project activity

Type 1: Renewable energy project

Category: Electricity generation for a system

The project activity consists in the use of water, come directly from the river to generate electricity. The gravitational energy of water is used to move the turbines and by doing this, trigger generators that enable the generation of electricity. This is a source of clean energy and renewable that presents minimal impact on the environment.

The Santana I SHP use the potential of renewable water of Santana river, where will be constructed a little reservoir of 1.17 km² which allows the storage of water to generate energy efficiently, since this is considered a small reservoir.

The Santana I SHP is a venture classified as Small Hydro Power plant. According to Resolution 652, of 9/12/2003, the National Electric Energy Agency (ANEEL) to be considered a small hydroelectric, the area of the reservoir must be less than 3 km² (300 ha) and generation capacity must be between 1 MW and 30 MW. This type of enterprise is also called “run of river” plant which does not include significant water stocks.

Thus, this type of plant has almost no environmental impacts due to installed capacity remains relatively low, between 1 and 30 MW of power, and their areas of flooding are relatively small.

The Santana I SHP will be interconnected to the national electric grid (National Interconnected System - SIN) and shall supply electricity to the Brazilian electrical system which is unique and interconnected. Its installed capacity is 14.758 MW with two generators groups, where these groups are composed of two generating turbines of the type Simple Spiral Francis and two generators, each one coupled to its turbine.

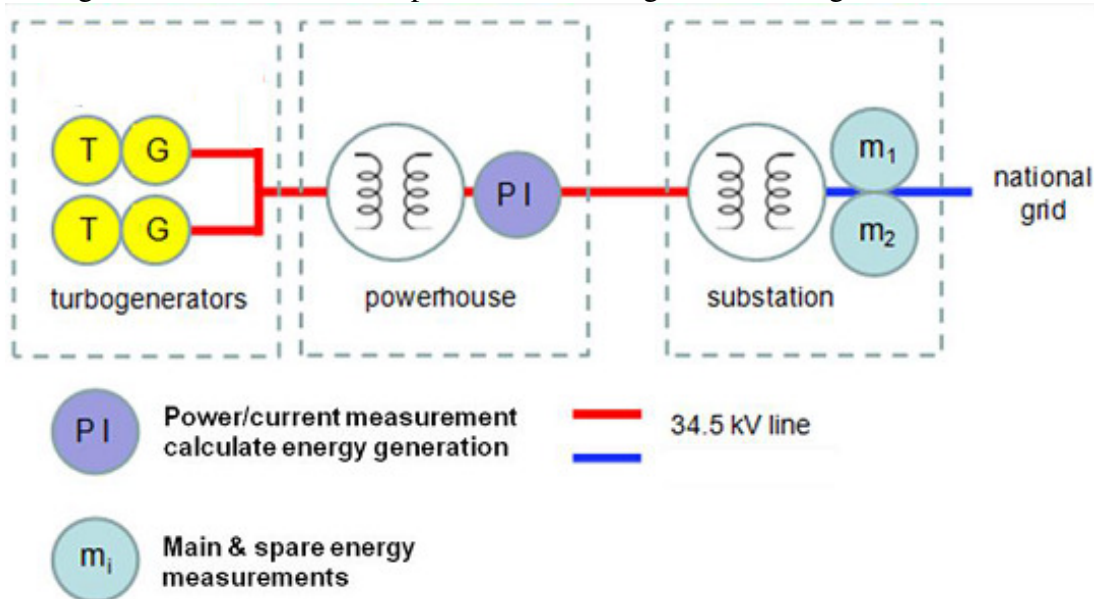
As we can see, the installed capacity of the plant is below the limit of 15 MW established for small-scale CDM projects.

The technology and equipment used in the project activity are developed and manufactured in Brazil and are not expected transfer of know-how or technology to the host country.

For the measuring system of the SHP Santana I, it was installed a billing metering panel, localized in Nortelândia substation, owned by CEMAT, 4.1 km from the SHP Santana I. This panel contains two meters (one main and one backup). The measuring system measures and records the energy. For this system the inviolability of the data is ensured by seals.

The measurement system comprises a communication system via dedicated encrypted link with fixed IP, which has the function of sending data electricity delivered to the grid for the CCEE and PCH Santana Ltda through data acquisition software.

The figure below shows the simplified unifilar diagram indicating the instruments location:



For more details see Section C.10.

B.2 Do no harm or Impact test of the project activity

- **Social benefits:**

Investment in the consolidation of the local economy in Nortelândia

PCH Santana Ltda entered into a partnership, sponsoring the renovation and expansion of sheds in the agroindustrial park, which houses several projects to generate local employment.

In this project, the project owner provided all the fencing of the APP area/track (permanent preservation area) in addition to supplying seedlings of native species for the recovery of this track.

It is important to emphasize here that the APP strip that is part of the SHP reservoir was not part of this Project, as it is already an area fully recovered by the plant during the operation phase until today (hiring local labor promoting employment opportunities).

See attached document: “*Official Letter No. 26/2021/SAMA of the Municipality of Nortelândia*”

Has also the project for the installation of net tanks in the Santana reservoir, program carried out in partnership with the municipality that allowed the installation of 150 net tanks for the cultivation and processing of fish inside the plant's reservoir. This activity is conducted by an association created by the population generating income and employment for the city.

See attached document: “*Ofício nº 284/2020/SAMA*”

- **Environmental benefits:**

SHP Santana I has a third party environmental engineering company contracted that annually carries out verification and analysis campaigns in various fields of the plant (ichthyofauna, wild fauna, degraded areas, limnology and water quality, hydrosedimentometric and water levels, etc.) constant contact with the surrounding population regarding information on good environmental practices and preservation of the surroundings and the plant.

- **Economic benefits:**

The distribution of income is directly related to the generation of direct and indirect jobs. The project requires skilled labor for its design - knowledge of engineers and specialists. However, a large part of the work is carried out by low-skilled operators, who needed special training to understand basic mechanisms of project operation, either in the generation of electricity from small hydroelectric dams or in the operation of the project. By doing so, it provides access to decent work and stable income to people who might eventually be marginalized, thus contributing to income distribution.

The installation of Small Hydroelectric Plants as well as other types of ventures allows the regional economic development and brings with it the possibility of increasing the wealth produced by a given municipality.

Normally the most used method to quantify the income distribution is the GDP per capita that can be applied in the analysis of a municipality or region.

For the current project, it was hoped that the distribution of income would be linked only to the generation of direct jobs. However, in addition to the income provided to contract workers, there is a local wage increase for the trade that is closer to the construction sites, causing a positive impact, although temporary.

However, a better distribution of income in the region where the project activity is located also results from increased income in the municipality, through taxes levied on energy generation. As for example, the Tax of Circulation of Goods and Services (ICMS), since the installation of a power plant in these regions will increase the energy sales, also will increase quality and reliability of energy, providing conditions for the installation of new industries, increased trade and leisure and consequently improving the standard of living and well-being of the citizen. At federal level, the increase in revenues occurs due to the payment of the Distribution System Use Tariff (TUSD). Other taxes are levied on energy generation, such as PIS, COFINS and Corporate Income Tax. All

these taxes, in a certain way, must be applied with a view to improving the quality of life of the population.

The project's monthly tax collection, a positive balance for the region, can be translated into investments in improving infrastructure, productive capacity and coverage of basic needs of the population (education and health). Such investments benefit the local population, and indirectly also lead to a better distribution of income.

In this way, the contribution of the project is expected to occur through the creation of jobs that must be occupied by inhabitants who are seeking to insert in the market or qualification to re-enter the labor market.

B.3. Baseline Emissions>>

The baseline scenario identified at the PCN stage of the project activity is:

The current Brazilian scenario shows a supplied energy grid in large part by large hydro power plants, however with an important participation of mineral coal, fuel oil and natural gas fired thermal power plants, which jointly represent 15.9%⁸ of national production. In the South-Southeast region of the country, where the main consumption centers are concentrated, the potential of hydro power production through large-scale plants is found to be practically exhausted. The absence of a system that guarantees energy reserves capable of supplying basic and emergency needs and the increasing demand for energy verified in the country, mainly in the regions mentioned above, makes it necessary to add energy production plants which, for different reasons, are frequently based on fossil fuels.

Kartha et al. (2002) state that “the central matter of the challenge of a baseline for electricity projects clearly lies in calculation the “avoided generation”, which is, what occurs without CDM or another GHG mitigation project. The fundamental point is if avoided generation is in the “**build margin**” (which is, to substitute an installation that *would have*, in another way, been constructed) and/or in the **operating margin**” (thus, that affects the *operation* of current or future plants)”.

The emission factor of the baseline is calculated with a **combined margin**, consisting of operating margin and build margin. For purposes of determining the emission factors “build margin” and “operating margin”, an electric system project is defined as the spatial extension of plants that can be dispatched without significant restrictions in transmission. In a similar way, an **interconnected electric system** is defined as any electric system that is connected by transmission lines to project, in which plants can dispatch without significant restrictions in transmission.

The methodology approved for small-scale AMS - ID - “Grid connected renewable electricity generation”, applies the increases in electricity capacity of small hydro power plants, which is the proposed project activity.

The baseline scenario considers electricity that has been in a different manner generated by operation of plants connected to the grid and by addition of new generation sources.

Thus, the baseline is the kWh produced by the renewable generating unit multiplied by an emission coefficient calculated according to the “Tool to calculate the emission factor for an electricity system” as given in AMS I.D.

⁸ Information Bank of Generation (BIG) from National Electric Energy Board. March 25 2008 <http://www.aneel.gov.br/aplicacoes/capacidadebrasil/OperacaoCapacidadeBrasil.asp>

The reduction in CO₂ emission by the project activity of SHP is the result of dislocation of fossil fuel fired thermal generation plants that would have been placed in the interconnected electric system in another way. Environmentally speaking, the addition of small hydro power plants has appeared to be a very interesting option, since in addition to not producing Greenhouse Gases emissions it is a renewable type, even presenting reduced local environmental impact.

The region where the project activity is located and its neighbouring municipalities is supplied by the National Interconnected Electric Grid. Part of the electricity produced by the project activity would have to be generated, in the case of its absence, by thermal plants connected to the electrical grid and fed by fossil fuels, increasing anthropogenic emissions. The addition of 14.758 MW by Santana I SHP shall comply all requirements of a small scale project activity under Clean Development Mechanism.

From this exposed, the project activity uses as a data source for the calculation of the Emission Factor of the National Interconnected System (SIN), data of the operating margin and the margin of construction provided by the Designated National Authority (DNA) of the host country.

The Emission Factor of CO₂ resulting from the generation of electric energy in the system checked in the National Interconnected System (SIN) in Brazil is calculated based on generating records from plants centrally operated by the **National Electric System Operator (ONS)**, which includes thermoelectric plants that use fossil fuels as energy.

The method used to make this calculation is the method of dispatch analysis, which is the most appropriate in determining the emission factor of the electrical grid.

This information is needed for renewable energy projects connected to the electric grid and implanted in Brazil under the **Clean Development Mechanism (CDM)** of the Kyoto Protocol.

The data result from the work of the Electrical System Operator (ONS) of the Ministry of Mines and Energy (MME) and the Ministry of Science and Technology, which are available to proponents of CDM projects. Thus, they can be applied in calculating ex-ante emissions avoided by the project activity, where the emission reduction will be calculated ex-post.

Further details of the development of the project baseline can be viewed through the link: <https://www.gov.br/mcti/pt-br/acompanhe-o-mcti/sirene/dados-e-ferramentas/fatores-de-emissao>

B.4. Debundling>>

This is a single small scale project activity with installed capacity under 15 MW and is not a debundling of a large scale project.

SECTION C. Application of methodologies and standardized baselines

C.1. References to methodologies and standardized baselines >>

SECTORAL SCOPE - 01 Energy industries (Renewable/Non-renewable sources)

TYPE I - Renewable Energy Projects

CATEGORY- AMS. I.D. Grid connected renewable electricity generation (version 13)

C.2. Applicability of methodologies and standardized baselines >>

In accordance to the list of sector scopes available on the UNFCCC website, the category in which the project is classified is the Sector Scope I - Energy Industries (renewable/non-renewable sources).

The project activity is applicable for type I of small-scale projects (renewable energy), methodology I.D. – Grid connected renewable electricity generation – because it is in accordance with all the applicability requirements necessary for this category.

This category encompasses renewable sources (4. *a – Install a Greenfield plant*), as hydro, which supplies electricity to a national or a regional grid. In order to be eligible to project category the small hydro power plants must satisfy at least one of the following conditions:

5. Hydro power plants with reservoirs that satisfy at least one of the following conditions are eligible to apply this methodology:

(a) The project activity is implemented in an existing reservoir with no change in the volume of reservoir (not applicable);

(b) The project activity is implemented in an existing reservoir, where the volume of reservoir is increased and the Power Density of the project activity in the Project Emissions section is greater than 4 W/m² (not applicable) ;

(c) The project activity results in new reservoirs and the power density of the power plant, as per definitions given in the Project Emissions section, is greater than 4 W/m² (applicable).

The SHP Santana I installed capacity implemented in this project activity is 14.758 MW. The maximum limit established for Small Scale CDM Projects is 15 MW. So, the project capacity is below the limit established by the methodology. This is a Greenfield power plant and it results in new reservoir with Power Density (PD) of 12.61 W/m², so greater than 4 W/m² eligible for this methodology.

All the conditions below **aren't applicable** for this PA:

6. If the new unit has both renewable and non-renewable components (e.g. a wind/diesel unit), the eligibility limit of 15 MW for a small-scale CDM project activity applies only to the renewable component. If the new unit co-fires fossil fuel, the capacity of the entire unit shall not exceed the limit of 15 MW.

7. Combined heat and power (co-generation) systems are not eligible under this category.

8. In the case of project activities that involve the capacity addition of renewable energy generation units at an existing renewable power generation facility, the added capacity of the units added by the project should be lower than 15 MW and should be physically distinct from the existing units.

9. In the case of retrofit, rehabilitation or replacement, to qualify as a small-scale project, the total output of the retrofitted, rehabilitated or replacement power plant/unit shall not exceed the limit of

15 MW.

10. In the case of landfill gas, waste gas, wastewater treatment and agro-industries projects, recovered methane emissions are eligible under a relevant Type III category. If the recovered methane is used for electricity generation for supply to a grid then the baseline for the electricity component shall be in accordance with procedure prescribed under this methodology. If the recovered methane is used for heat generation or cogeneration other applicable Type-I methodologies such as “AMS-I.C.: Thermal energy production with or without electricity” shall be explored.

11. In case biomass is sourced from dedicated plantations, the applicability criteria in the tool “Project emissions from cultivation of biomass” shall apply.

In addition, the applicability conditions take in consideration the use or not of the methodologies and tools below:

- (a) “Project emissions from cultivation of biomass” - **not used no biomass cultivation;**
- (b) “ACM0002: Grid-connected electricity generation from renewable source” - **used for project emission calculation;**
- (c) “AMS-I.A.: Electricity generation by the user” – **not used since no electricity used by the user;**
- (d) “AMS-I.C.: Thermal energy production with or without electricity” – **not used, no thermal energy production;**
- (e) “AMS-I.F.: Renewable electricity generation for captive use and mini-grid” – **not used since no captive or mini grid energy generation;**
- (f) “Tool to calculate project or leakage CO₂ emissions from fossil fuel combustion” – **not used since no fossil fuel combustion;**
- (g) “Tool to calculate the emission factor for an electricity system” – **used;**
- (h) “Tool to determine the remaining lifetime of equipment” – **not used since new equipments used;**
- (i) “Assessment of the validity of the original/current baseline and update of the baseline at the renewal of the crediting period” – **used.**

So the AMS I.D. methodology is applicable and has included the baseline scenario for Greenfield power plants.

C.3 Applicability of double counting emission reductions >>

Project prior registered on the CDM standard (until 30/10/2017) ID #2793.

Link: <https://cdm.unfccc.int/Projects/DB/RWTUV1248695748.41/view>

Period monitored: 01/11/2010 until 30/10/2017

Carbon credits issued on the period above = 140,602 tCO₂e

From 01/11/2017 no other GHG registration standard than UCR.

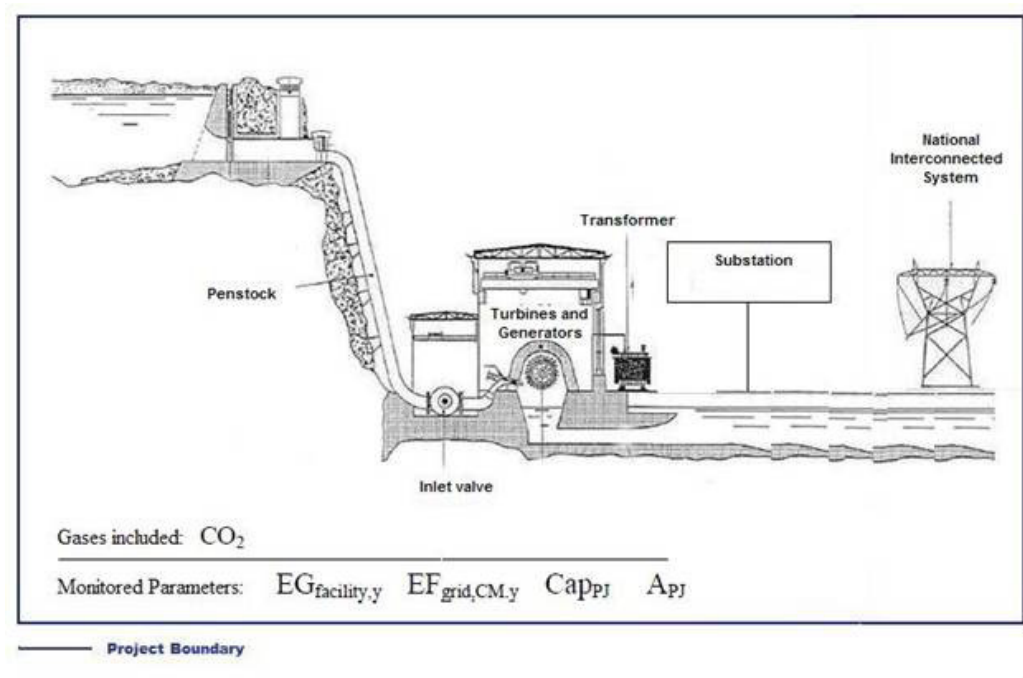
C.4. Project boundary, sources and greenhouse gases (GHGs)>>

According to methodology AMS-I.D.:

The spatial extent of the project boundary includes the project power plant and all power plants connected physically to the electricity system that the CDM project power plant is connected to.

In this way the project boundary is the area where the project is located, which contains the reservoir area, dam, powerhouse which includes the main equipments turbines and generators, the SHP substation, the measurement system and the National Interconnected Grid.

The diagram below presents the project boundary:



Regarding the grid connection point, the SHP Santana I delivery electricity through Nortelândia substation (that belongs to Centrais Elétricas Matogrossenses - the local utility grid system) located in Nortelândia city - MT, being this the connection point with the SIN.

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. In the absence of the project activity, the operation of other plants connected to the SIN would cause emission of GHGs.
		CH ₄	No	Minor Emission Source.
		N ₂ O	No	Minor Emission Source.

Project activity	For geothermal power plants, fugitive emissions of CH ₄ and CO ₂ from non-condensable gases contained in geothermal steam	CO ₂	No	This is not applicable, as the project activity is a hydro power plant and it is not a geothermal power plant.
		CH ₄	No	
		N ₂ O	No	

	CO ₂ emissions from combustion of fossil fuels for electricity generation in solar thermal power plants and geothermal power plants	CO ₂	No	This is not applicable, as the project activity is a hydro power plant and it is not a geothermal power plant.
		CH ₄	No	
		N ₂ O	No	

	For hydro power plants, emissions of CH ₄ from the reservoir	CO ₂	No	Minor Emission source, the power density of SHP Santana I is greater than 10W/m ² , so the GHGs' emissions from the project activities are zero (PEy = 0).
		CH ₄	No	
		N ₂ O	No	

C.5. Establishment and description of baseline scenario (UCR Protocol) >>

The baseline methodology considers the determination of the grid emissions factor which the project activity is connected as the core data to be determined in the baseline scenario. In Brazil, the grid is interconnected by the National Interconnected System (SIN) in a single system.

“Operating Margin *OM* Emission Factor” calculation ($EF_{grid,OM-DD,y}$)

The Emission Factor (OM) calculated by the Dispatch Data Analysis (see Section B.6.1) is described below:

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

Where:

$EF_{grid,OM-DD,y}$ Dispatch data analysis operating margin CO₂ emission factor in year y (tCO₂/MWh);

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

$EF_{EL,DD,h}$ CO₂ emission factor for grid power units in the top of the dispatch order in hour *h* in year y (tCO₂/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.

The calculation of the $EF_{grid,OM-DD,y}$ was done using the formula above and the datas from the spreadsheets “*CERs_2nd MR_rev2_1.xls*”.

Below, the summarized values of $EF_{grid,OM,y}$:

$EF_{grid,OM,2017}$ (tCO ₂ /MWh)	0.5882
$EF_{grid,OM,2018}$ (tCO ₂ /MWh)	0.5390
$EF_{grid,OM,2019}$ (tCO ₂ /MWh)	0.5181
$EF_{grid,OM,2020}$ (tCO ₂ /MWh)	0.4539
$EF_{grid,OM,2021}$ (tCO ₂ /MWh)	0.5985
$EF_{grid,OM,2022}$ (tCO ₂ /MWh)	0.3662

“Build Margin Emission Factor BM” calculation ($EF_{grid,BM,y}$)

The $EF_{grid,BM,y}$ also is published by Brazilian DNA annually and it is available on its website.

$EF_{grid,BM,2017}$ (tCO ₂ /MWh)	0.0028
$EF_{grid,BM,2018}$ (tCO ₂ /MWh)	0.1370
$EF_{grid,BM,2019}$ (tCO ₂ /MWh)	0.1020
$EF_{grid,BM,2020}$ (tCO ₂ /MWh)	0.0979
$EF_{grid,BM,2021}$ (tCO ₂ /MWh)	0.0540
$EF_{grid,BM,2022}$ (tCO ₂ /MWh)	0.0540

“Baseline Emission Factor” calculation ($EF_{grid,CM,y}$)

The baseline emission factor ($EF_{grid,CM,y}$) is calculated through a weighted-average formula, considering the $EF_{OM,y} = 50\%$ and the $EF_{BM,y} = 50\%$ weighted each, by definition, that gives:

$$EF_{grid,CM,y} = EF_{grid,OM,y} \times 0.50 + EF_{grid,BM,y} \times 0.50 \text{ (tCO}_2\text{/MWh)}$$

Year	$EF_{grid,OM,y}$ (tCO ₂ /MWh)	$EF_{grid,BM,y}$ (tCO ₂ /MWh)	$EF_{grid,CM,y}$ (tCO ₂ /MWh)
2017	0.5882	0.0028	0.2955
2018	0.5390	0.1370	0.3380
2019	0.5181	0.1020	0.3100
2020	0.4539	0.0979	0.2759
2021	0.5985	0.0540	0.3263
2022	0.3662	0.0540 ⁹	0.2101

Emission Reduction

The emissions reduction (**ER**) of this project activity is:

$$ER = BE_y - (L_y + PE_y)$$

⁹ 2021 value, since the ultimost data available

Since to this project leakages is not considered, thus:

$$L_y = 0$$

And also the project emission is:

The PD = 14,758,000 / 1,170,000 = 12.61 W/m²
So, since the PD is above 10 W/m²:

$$PE_y = 0$$

So

$$ER = BE_y$$

The baseline emissions (BE_y) would be then proportional to the electricity delivered to the grid throughout the project's lifetime. Baseline emissions due to displacement of electricity are calculated by multiplying the electricity baseline emissions factor (EF_{grid,CM,y}) with the electricity generation of the project activity (EG_y).

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

Then:

Year	EF _{grid,CM,y} (tCO ₂ /MWh)	EG _y (MWh)	BE _y (tCO ₂ e)
2017	0.2955	7,226.79	2,135
2018	0.3380	65,215.09	22,044
2019	0.3100	70,992.04	22,010
2020	0.2759	43,583.50	12,024
2021	0.3263	46,488.28	15,167
2022	0.2101	37,882.33	7,958
Total			81,338

C.6. Prior History>>

The project activity was registered on CDM standard with ID #2793 on 11/01/2010.

Link: <https://cdm.unfccc.int/Projects/DB/RWTUV1248695748.41/view>

Has the first 7 years certificated through this standard, covering the period: 01/11/2010 to 31/10/2017.

C.7. Monitoring period number and duration>>

First Issuance Period: 4years, 7 months – 01/11/2017 to 31/05/2022
(see section C.6. above other GHG standard)

C.8. Changes to start date of crediting period >>

There is no change in the start date of crediting period.

C.9. Permanent changes from PCN monitoring plan, applied methodology or applied standardized baseline >>

During this monitored period the project achieved an emission reduction of 15.63 % above the one forecasted in the PCN (81,338 x 70,345 tCO₂).

Beside the lower electricity generation achieved in this period (271,401.02 x 381,955.00 MWh forecasted) the average EF_{CM} over the monitored period was 58.87% higher (0.2926 x 0.18418 tCO_{2e}/MWh).

The reason for this is the major use of fossil-fuelled power plants in Brazil during the monitored period.

C.10. Monitoring plan>>

For the measuring system of the SHP Santana I, it was installed a billing metering panel, localized in Nortelândia substation, owned by CEMAT, 4.1 km from the SHP Santana I. This panel contains two meters (one main and one backup). The measuring system measures and records the energy. For this system the inviolability of the data is ensured by seals.

The measurement system comprises a communication system via dedicated encrypted link with fixed IP, which has the function of sending data electricity delivered to the grid for the CCEE and PCH Santana Ltda through data acquisition software.

The figure below shows the simplified unifilar diagram indicating the instruments location:

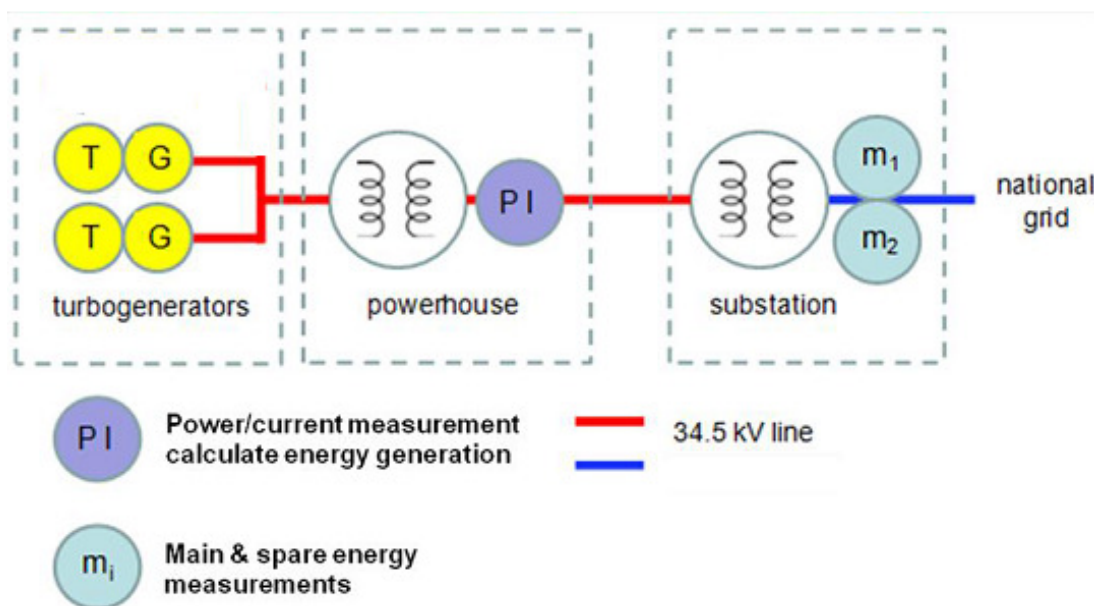


Figure 3 – Simplified unifilar diagram

All the procedures for measuring the electricity are defined by ONS “Grid Procedures”, which provides for measurements with invoice purposes aiming to establish the responsibilities, systematic and deadlines for the development of projects under the Billing Measurement System or SMF (from Portuguese, *Sistema de Medição para Faturamento*), for the maintenance and inspection of the system and for SMF standard meter readings and certification. The established procedures reflect good monitoring and reporting practices.

Management and organization structure

The project sponsor proceeds with the necessary measures for electricity control and monitoring. Additionally, using the data collected from the meters, it was possible to monitor the electricity generation of the project.

Quality Control and Quality Assurance

Calibration

The meters calibration was done according to ONS's Sub-Module 12.5 "Work Standards Certification" and 12.3 "Maintenance of the Billing Measurement System"¹⁰ which attributes responsibilities regarding standards certification and establishes all necessary activities to guide responsible agents in the SMF maintenance, considering traceability guarantee and work standards calibration with reference to INMETRO's standards or RBC (the Brazilian Calibration Grid or in Portuguese *Rede Brasileira de Calibração*) laboratories.

Maintenance and training procedures

PCH Santana Ltda is responsible for the maintenance of the monitoring equipments for dealing with possible monitoring data adjustments and uncertainties.

PCH Santana Ltda hired an specialized third company responsible for project management as well as for staff organizing and training in the appropriate monitoring, measurement and reporting techniques.

Data Archiving

All metering data is stored according to ONS's Sub-Module 7.11 "Invoice Measurement Data Implementation", which establishes all responsibilities and activities regarding the direct and/or indirect collection of energy generation data, the quality of this energy and the meters in the SMF. The direct collection of electricity related data from the SMF is done through direct access of the meters by the SCDE (the Energy Collection Data System or *Sistema de Coleta de Dados de Energia*).

The SCDE is responsible for the daily collection and treatment of all measurement data, obtained directly from the meters. This system allows the performance of logical inspections with direct access to meters, providing a much more reliable and accurate data.

According to an internal procedure of SHP Santana I, all data collected as part of the monitoring plan will be archived electronically and will be kept for 2 years after the last credit issuance. The procedures for data collection and storage are described in the Document "*Plano de Monitoramento.doc*".

Data/parameter:	EG _{Santana I}
Unit	MWh
Description	Net electricity of the Santana I SHP delivered to grid

¹⁰ From 01/01/2021 onwards Module 6.16 on <http://www.ons.org.br/paginas/sobre-o-ons/procedimentos-de-rede/vigentes>

Measured/calculated/default	Measured.
Source of data	Electricity meter at output of substation.
Value(s) of monitored parameter	2017 (November) = 7,226.79 2018 = 65,215.09 2019 = 70,992.04 2020 = 43,583.50 2021 = 46,488.28 2022 (May) = 37,882.33
Monitoring equipment	Two meters type ION8600 and ION8650 (one main and one back-up) installed in a metering panel, which is in Nortelândia substation. Both have accuracy class 0.2 and the calibration frequency must be done according Brazilian regulations (see Table 1 on Section A.1).
Measuring/reading/recording frequency:	Hourly measuring and reading, Monthly Recording.
Calculation method (if applicable):	Not applicable.
QA/QC procedures:	The measurement of the energy generated and delivered to the grid will be done by two three-phases four wire electronic redundant meters which send data to the grid through a gateway. If the main meter fails the back-up meter starts reading and the information is not lost. The calibration of the meters is done complying with the National System Operator (Operador Nacional do Sistema – ONS) regulations.
Purpose of data:	Calculation of baseline emissions
Additional comments:	-

Data/parameter:	$EF_{grid,CM,y}$
Unit	tCO ₂ /MWh
Description	Combined margin CO ₂ emission factor for the project electricity system in year y
Measured/calculated/default	Calculated.
Source of data	Based on data provided by the DNA (Designated National Authority).
Value(s) of monitored parameter	2017 = 0.2955 2018 = 0.3380 2019 = 0.3100 2020 = 0.2759 2021 = 0.3263 2022 = 0.2101
Monitoring equipment	Not applicable.
Measuring/reading/recording frequency:	Annually.
Calculation method (if applicable):	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 weights w_{OM} and w_{BM} default 0.5 as defined in the latest version of “Tool to calculate the emission factor for an electricity system”.
QA/QC procedures:	Data will be archived electronically up to two years after the completion of the crediting period.
Purpose of data:	Calculation of baseline emissions.
Additional comments:	-

Data/parameter:	$EF_{grid,OM,y}$
Unit	tCO ₂ /MWh

Description	CO ₂ Operating Margin emission factor of the grid, in a year y
Measured/calculated/default	Calculated.
Source of data	Data provided by the DNA (Designated National Authority) monthly.
Value(s) of monitored parameter	2017 = 0.5882 2018 = 0.5390 2019 = 0.5181 2020 = 0.4539 2021 = 0.5985 2022 = 0.3662
Monitoring equipment	Not applicable.
Measuring/reading/recording frequency:	Monthly.
Calculation method (if applicable):	As defined in the “Tool to calculate the emission factor for an electricity system”.
QA/QC procedures:	Data will be archived electronically up to two years after the completion of the crediting period.
Purpose of data:	Calculation of baseline emissions.
Additional comments:	-

Data/parameter:	EF _{grid,BM,y}
Unit	tCO ₂ /MWh
Description	CO ₂ Build Margin emission factor of the grid, in a year y
Measured/calculated/default	Calculated.
Source of data	Data provided by DNA (Designated National Authority) to the year y.
Value(s) of monitored parameter	2017 = 0.0028 2018 = 0.1370 2019 = 0.1020 2020 = 0.0979 2021 = 0.0540 2022 = 0.0540 ¹¹
Monitoring equipment	Not applicable.
Measuring/reading/recording frequency:	Annually.
Calculation method (if applicable):	As defined in the “Tool to calculate the emission factor for an electricity system”
QA/QC procedures:	Data will be archived electronically up to two years after the completion of the crediting period.
Purpose of data:	Calculation of baseline emissions.
Additional comments:	-

¹¹ 2021 value, since the ultimost data available