Monitoring report form for CDM project activity
(Version 06.0)

Complete this form in accordance with the instructions attached at the end of this form.

MONITORING REPORT		
Title of the project activity	Santana I SHP CDM Project (JUN 1118)	
UNFCCC reference number of the project activity	2793	
Version number of the PDD applicable to this monitoring report	3a	
Version number of this monitoring report	3	
Completion date of this monitoring report	28/02/2018	
Monitoring period number	First Monitoring Period	
Duration of this monitoring period	01/11/2010 – 31/10/2017	
Monitoring report number for this monitoring report	1	
Project participants	Firenze Energética S/A Carbotrader Assessoria e Consultoria em Energia Ltda.	
Host Party	Brazil	
Sectoral scopes	Sectoral Scope 1 – Energy Industries (Renewable / Non-renewable Sources)	
Applied methodologies and standardized baselines	AMS-I.D. - Grid connected renewable electricity generation (version 13)	
Amount of GHG emission reductions or net anthropogenic GHG removals achieved by the project activity in this monitoring period	Amount achieved before 1 January 2013	Amount achieved from 1 January 2013
	11,077 tCO_2e	129,525 tCO_2e
Amount of GHG emission reductions or net anthropogenic GHG removals estimated ex ante for this monitoring period in the PDD	80,563 tCO_2e	

SECTION A. Description of project activity

A.1. General description of project activity

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 has been developed by 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 km^2 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 each;
-Generators: 2 (two) Synchronous, horizontal axis of 7.380 MW each.
-Installed Capacity: 14.758 MW
- Assured Energy: 8.89 MW[1]
- The reservoir area is 1.17 km^2

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.

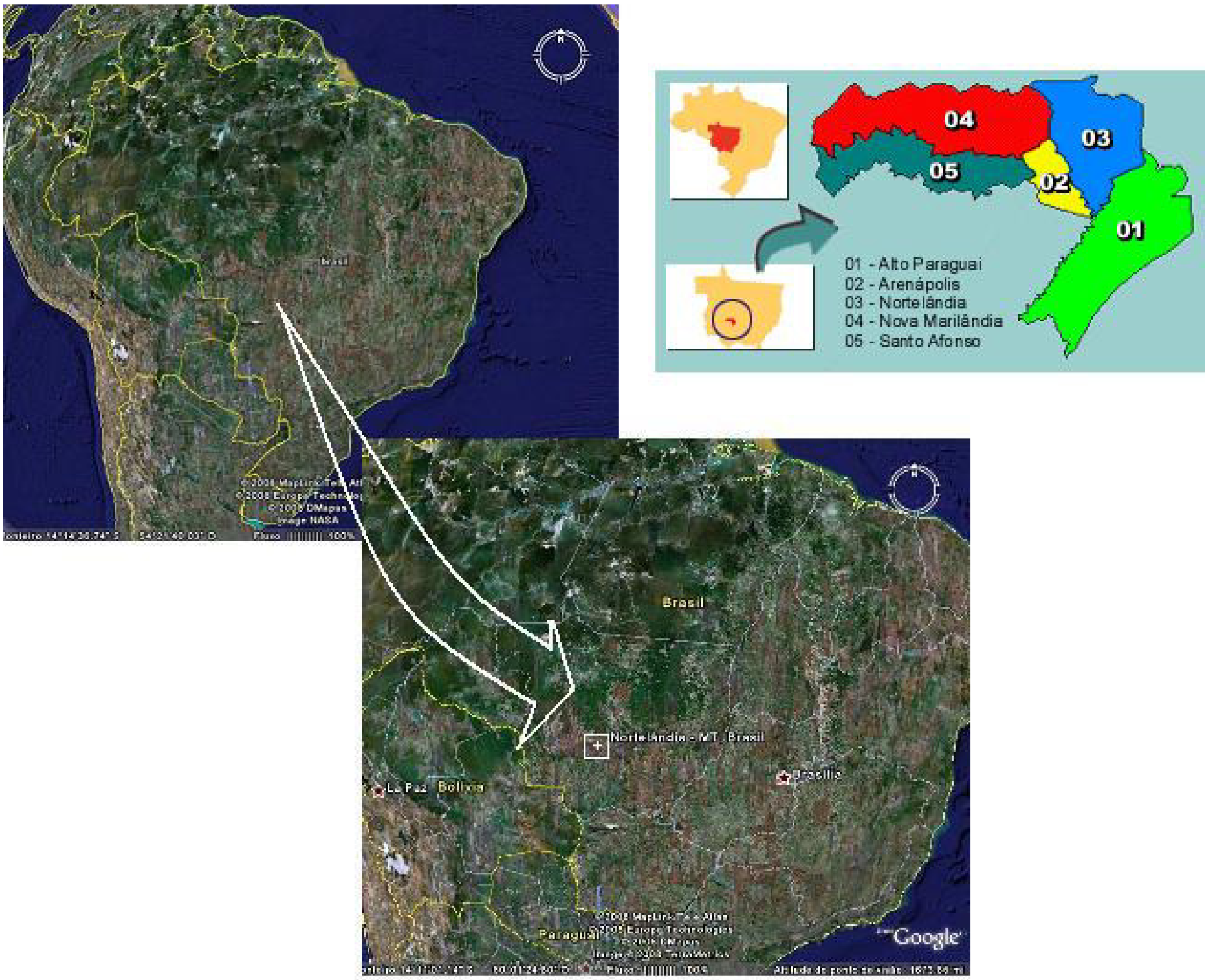
The operation of SHP Santana I occurred in 10/04/2012. The Project activity has achieved an total of 140,602 tCO_2e during the monitored period.

A.2. Location of project activity

The project activity is located in the river Santana in the Central West of Brazil, State of Mato Grosso in the municipality of Nortelândia. The geographical coordinates of the location of the dam are: 56º 49' 44" West and 14º 23' 28'' South. Below the Figure 1 illustrates the location of the enterprise:

[1] Value changed through the Mines and Energy Ministry Ordinance #21 of 27/06/2011

Figure 1: Geographical location of Nortelândia city.



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

A.3. 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)	Firenze Energética S/A Carbotrader Assessoria e Consultoria em Energia Ltda.	No

A.4. Reference to applied methodologies and standardized baselines

The methodology used was the AMS-I.D (version 13.0)[2]: "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)[3]

[2] https://cdm.unfccc.int/methodologies/DB/W3TINZ7KKWCK7L8WTXFQQOFQQH4SBK

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

A.5. Crediting period type and duration

01/11/2010 until 31/10/2017 renewable

SECTION B. Implementation of project activity

B.1. Description of implemented project activity

The project activity ***Santana I SHP CDM Project (JUN 1118)*** (hereinafter referred to as "SHP Santana I" or "the Project") was implemented by Firenze Energética S/A. 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 estimated average annual emission reductions are 14,069 tCO_2e[4].

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 m^2 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.

Figure 2 below shows the scheme of a run of the river power plant:

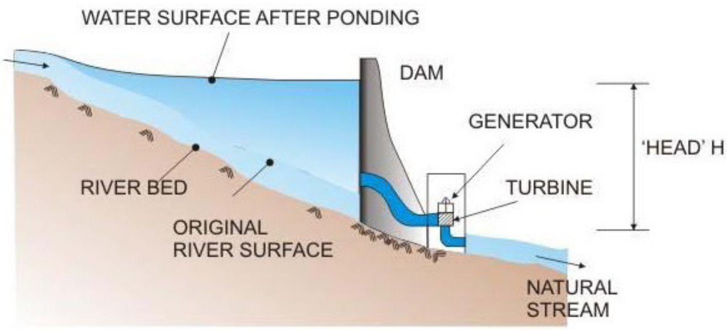


Figure 2 - Schematic view of a run of river power plant

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

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[4] The calculation is demonstrated in: https://cdm.unfccc.int/UserManagement/FileStorage/VMF8LE1C9GB6PJYDUR7XNQSWH32O0T .

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
1	Number: PT-1003A493-01 Manufacturer: Schneider/ION8600	Main meter	20/03/2012	2 years
2	Number: PT-1003A532-01 Manufacturer: Schneider/ION8600	Backup meter	20/03/2012	2 years
3	Number: PT-1003A493-01 Manufacturer: Schneider/ION8600	Main meter	12/03/2013	2 years
4	Number: PT-1003A532-01 Manufacturer: Schneider/ION8600	Backup meter	12/03/2013	2 years
5	Number: PT-1003A493-01 Manufacturer: Schneider/ION8600	Main meter	02/03/2015	5 years Valid After 01/01/2017
6	Number: PT-1003A532-01 Manufacturer: Schneider/ION8600	Backup meter	02/03/2015	5 years Valid After 01/01/2017
7	Number: MW-1612A263-02[5] Manufacturer: Schneider/ION8650C	Main meter	06/03/2017	5 years
8	Number: PT-1003A532-01 Manufacturer: Schneider/ION8600	Backup meter	06/03/2017	5 years

B.2. Post-registration changes

B.2.1. Temporary deviations from the registered monitoring plan, applied methodologies or standardized baselines

The start date of the crediting period remains the same as registered.

[5] Main meter exchanged

However, since the SHP becomes operational on April 2012 the crediting period starts effectively on 10/04/2012 and finished on 31/10/2017 (no CDM Deviation procedure was done). This change only was informed to the CDM Registration and Issuance. Was adopted zero ER for the period between 01/11/2010 until 09/04/2012.

E-mail: “RES: RES: Update of status of implementation of registered PA 2793” of 05/12/2013

“De: CDM Registration and Issuance [mailto:Cdmregistration@unfccc.int]
Enviada em: quinta-feira, 5 de dezembro de 2013 13:48
Para: Arthur Moraes
Assunto: Re: RES: Update of status of implementation of registered PA 2793

Dear Mr Moraes,

Thank you for your message. We confirm receipt.

Kind regards,
Your CDM team
UNFCCC secretariat

De: Arthur Moraes [mailto:moraes.arthur@carbotrader.com]
Enviada em: segunda-feira, 30 de setembro de 2013 09:57
Para: 'cdmregistration@unfccc.int'
Cc: 'Angelica'
Assunto: Update of status of implementation of registered PA 2793
Prioridade: Alta

Dear UNFCCC Secretariat,

The project activity Ref 2793, Title “Santana I SHP CDM Project (JUN 1118)” was implemented and become operational on April 2012. According to Clean Development Mechanism Project Cycle Procedure, version 04.0, item 182, the project is under the status described in letter (c), which is: “The Project Participants have not yet decided to proceed with the request for issuance stage.”

I ask you please to confirm the receipt of this e-mail.

Kind Regards,

Arthur Moraes”

B.2.2. Corrections

Not Applicable

B.2.3. Changes to the start date of the crediting period

Not Applicable

B.2.4. Inclusion of monitoring plan

Not Applicable

B.2.5. Permanent changes to the registered monitoring plan, or permanent deviation of monitoring from the applied methodologies, standardized baselines, or other applied standards or tools

Not Applicable

B.2.6. Changes to project design

Not Applicable

SECTION C. Description of monitoring system

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 Firenze Energética S/A through data acquisition software.

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

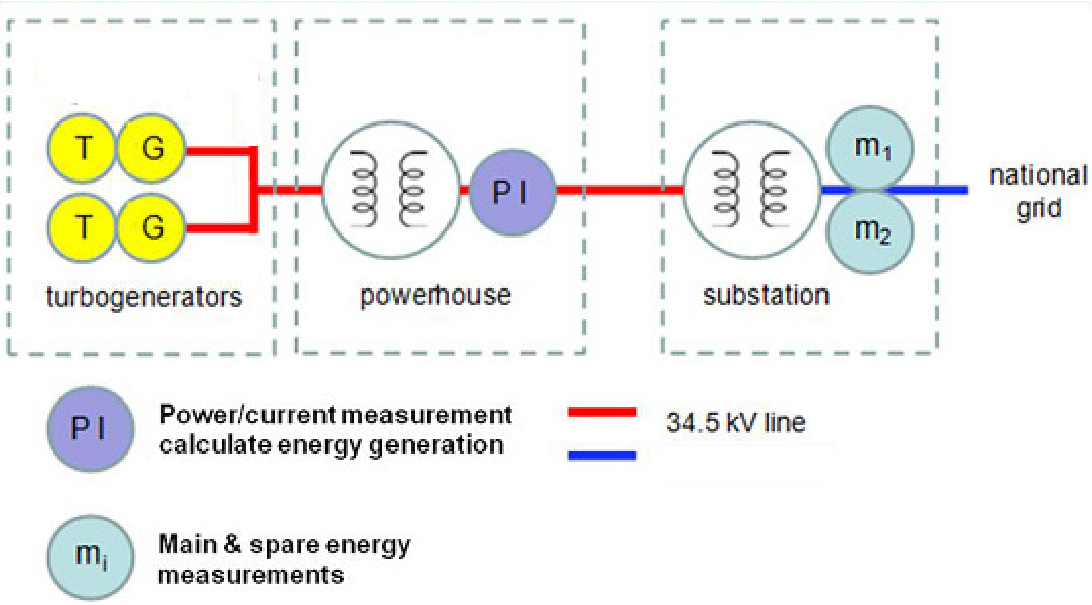

Figure 3 – Simplified unifilar diagram

All the procedures for measuring the electricity are defined by ONS according to “Module 12” of the Grid Procedures document, 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" 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
Firenze Energética S/A is responsible for the maintenance of the monitoring equipments for dealing with possible monitoring data adjustments and uncertainties.
Firenze Energética S/A 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 12.4 "Invoice Measurement Data Collection", 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*".

SECTION D. Data and parameters

D.1. Data and parameters fixed ex ante

All data and parameters used in the baseline emission calculation were monitored.

D.2. Data and parameters monitored

Data/parameter:	$EG_{Santana\ I}$
Unit	MWh
Description	Net electricity of the Santana I SHP delivered to grid
Measured/calculated/default	Measured.

D.2.

D.2.

Source of data	Electricity meter at output of substation.
Value(s) of monitored parameter	Per year: 2010= 0 2011= 0 2012 (April)= 28,487.42 2013= 56,937.82 2014= 77,890.93 2015= 59,357.12 2016= 62,277.38 2017 (October)= 60.527.10
Monitoring equipment	Two meters type ION8600 (one main and one back-up) installed in a metering panel, which is in Nortelândia substation. The main meter has the serial number PT-1003A493-01/ MW-1612A263-02. The back-up meter has the serial number PT-1003A532-01. Both have accuracy class 0.2 and the calibration frequency must be done according Brazilian regulations.
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	2012 = 0.3889; 2013 = 0.4331; 2014 = 0.4386; 2015 = 0.4097; 2016 = 0.3888; 2017 = 0.3664
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:	Not necessary the $EF_{grid,CM,2010}$;$EF_{grid,CM,2011}$ since there was not electricity generation on these years.

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	2012 = 0.5767; 2013 = 0.5950; 2014 = 0.5809; 2015 = 0.5640; 2016 = 0.6194; 2017 = 0.5747
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:	This data is available on the web-site: http://www.mctic.gov.br/mctic/opencms/ciencia/SEPED/clima/textogeral/emissao_despacho.html Not necessary the $EF_{grid,OM,2010}$ and $EF_{grid,OM,2011}$ since there was not electricity generation on these years.

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	2012 = 0.2010; 2013 = 0.2713; 2014 = 0.2963; 2015 = 0.2553; 2016 = 0.1581; 2017 = 0.1581
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:	This data is available on the web-site: http://www.mctic.gov.br/mctic/opencms/ciencia/SEPED/clima/textogeral/emissao_despacho.html Not necessary the $EF_{grid,BM,2010}$; $EF_{grid,BM,2011}$ since there was not electricity generation on these years.

D.3. Implementation of sampling plan

Not applicable.

SECTION E. Calculation of emission reductions or net anthropogenic removals

E.1. Calculation of baseline emissions or baseline net removals

The baseline methodology considers the determination of the emissions factor to the grid 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 ($EF_{grid,OM,y}$)

The Emission Factor (OM) calculated by the Dispatch Data Analysis is summarized as follows:

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

Where:

$EF_{grid,OM-DD,y}$	Dispatch data analysis operating margin CO_2 emission factor in year y (tCO_2/MWh));
$EG_{PJ,h}$	Electricity displaced by the project activity in hour h of year y (MWh);
$EF_{EL,DD,h}$	CO_2 emission factor for power units in the top of the dispatch order in hour h in year y (tCO_2/MWh);
$EG_{PJ,y}$	Total electricity displaced by the project activity in year y (MWh);
h	Hours in year y in which the project activity is displacing grid electricity;
y	Year in which the project activity is displacing grid electricity.

The calculation of the $EF_{grid,OM-DD,y}$ was done using the formula above and the datas from the document "CERs 1st MR_rev1.xls", tabs "Hourly 2012", "Hourly 2013" "Hourly 2014", "Hourly 2015" "Hourly 2016 and "Hourly 2017".

The $EF_{grid,OM,2016}$ was used in the SHP Santana I calculations for the year 2017, because it is the most recent value available in the DNA website.

Below, follow a summary of $EF_{OM,y}$ by month. In the document "CERs 1st MR_rev1.xls", tabs "Hourly 2012", "Hourly 2013" "Hourly 2014", "Hourly 2015" "Hourly 2016 and "Hourly 2017", it is possible to see the complete calculation.

$EF_{grid,OM,2012}$ (tCO_2/MWh)

JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
0.2935	0.3218	0.4050	0.6236	0.5943	0.5056	0.3942	0.4490	0.6433	0.6573	0.6641	0.6597

$EF_{grid,OM,2013}$ (tCO_2/MWh)

JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
0.6079	0.5958	0.5896	0.6010	0.5830	0.6080	0.5777	0.5568	0.5910	0.5891	0.6082	0.6102

$EF_{grid,OM,2014}$ (tCO_2/MWh)

JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
0.6155	0.5989	0.5699	0.5772	0.5605	0.5678	0.5674	0.5862	0.5994	0.5901	0.5885	0.5825

$EF_{grid,OM,2015}$ (tCO_2/MWh)

JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC

0.5953	0.5784	0.5767	0.5465	0.5469	0.5785	0.5686	0.5545	0.5308	0.5434	0.5513	0.5450

$EF_{grid,OM,2016}$ (tCO_2/MWh)

JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
0.5953	0.6032	0.6281	0.6291	0.6356	0.6368	0.6288	0.6344	0.6402	0.6180	0.6217	0.6022

$EF_{grid,OM,2017}$ (tCO_2/MWh)

JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
0.5419	0.5148	0.5867	0.5905	0.6086	0.5846	0.6052	0.6102	0.6060	0.5997	0.6019	0.6078

Thus, the Emission Factors of Operating Margin calculated in the tabs “Hourly 2012”, “Hourly 2013” “Hourly 2014”, “Hourly 2015” “Hourly 2016 and “Hourly 2017”, in the document “CERs 1st MR_rev1.xls”, are:

$EF_{grid,OM,2012}$ = 0.5767 tCO_2/MWh

$EF_{grid,OM,2013}$ = 0.5950 tCO_2/MWh

$EF_{grid,OM,2014}$ = 0.5809 tCO_2/MWh

$EF_{grid,OM,2015}$ = 0.5640 tCO_2/MWh

$EF_{grid,OM,2016}$ = 0.6194 tCO_2/MWh

$EF_{grid,OM,2017}$ = 0.5747 tCO_2/MWh

“Building Margin *BM* Emission Factor” ($EF_{grid,BM,y}$)

The $EF_{grid,BM,y}$ also is published by the Brazilian DNA annually and it is available in its website[6]. The last available data is for 2016 year.

$EF_{grid,BM,2012}$ = 0.2010 tCO_2/MWh

$EF_{grid,BM,2013}$ = 0.2713 tCO_2/MWh

$EF_{grid,BM,2014}$ = 0.2963 tCO_2/MWh

$EF_{grid,BM,2015}$ = 0.2553 tCO_2/MWh

$EF_{grid,BM,2016}$= 0.1581 tCO_2/MWh

$EF_{grid,BM,2017}$ = 0.1581 tCO_2/MWh

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

[6] http://www.mctic.gov.br/mctic/opencms/ciencia/SEPED/clima/textogeral/emissao_despacho.html

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

$$EF_{grid,CM,y} = EF_{grid,OM,y} *0.5 + EF_{grid,BM,y} *0.5 \text{ } (tCO_2/MWh)$$

For 2012, SHP Power Generation (MWh)

$EF_{grid,CM,2012}$ = 0.5767 *0.5 + 0.2010 *0.5

$EF_{grid,CM,2012}$ = 0.3889 tCO_2/MWh

For 2013, SHP Power Generation (MWh)

$EF_{grid,CM,2013}$ = 0.5950 *0.5 + 0.2713 *0.5

$EF_{grid,CM,2013}$ = 0.4331 tCO_2/MWh

For 2014, SHPP Power Generation (MWh)

$EF_{grid,CM2014y}$ = 0.5809 *0.5 + 0.2963 *0.5

$EF_{grid,CM,2014y}$ = 0.4386 tCO_2/MWh

For 2015, SHPP Power Generation (MWh)

$EF_{grid,CM,2015}$ = 0.5640 *0.5 + 0.2553 *0.5

$EF_{grid,CM,2015}$ = 0.4097 tCO_2/MWh

For 2016, SHP Power Generation (MWh)

$EF_{grid,CM,2016}$ = 0.6194 *0.5 + 0.1581 *0.5

$EF_{grid,CM,2016}$ = 0.3888 tCO_2/MWh

For 2017, SHP Power Generation (MWh)

$EF_{grid,CM,2017}$= 0.5747 *0.5 + 0.1581 *0.5

$EF_{grid,CM,2017}$ = 0.3664 tCO_2/MWh

Emission Reduction

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

$$ER = BE_y – (L_y + PE_y)$$

Since to this project leakages is not considered, thus:

$\boldsymbol{L_y = 0}$

And also the project emission is zero:

***PEy* =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).

$$BE_y = EF_{grid,CM,y} . EG_y$$

Then:
$ER_y=EF_{grid,CM,y}* EG_{BL,y}$

For 2012
ER_{2012}= 0.3889 * 28,487.42
ER_{2012}= 11,077 tCO_2

For 2013:
ER_{2013}= 0.4331 * 56,937.82
ER_{2013}= 24,661 tCO_2

For 2014:
ER_{2014}= 0.4386 * 77,890.83
ER_{2014}= 34,161 tCO_2

For 2015:
ER_{2015}= 0.4097 * 59,357.12
ER_{2015}= 24,316 tCO_2

For 2016:
ER_{2016}= 0.3888 * 62,277.38
ER_{2016}= 24,210 tCO_2
For 2017:
ER_{2017}= 0.3664 * 60,527.10
ER_{2017}= 22,177 tCO_2

E.2. Calculation of project emissions or actual net removals

According to the project category and the corresponding methodology, project emissions are zero.

E.3. Calculation of leakage emissions

There is no leakage associated with this project activity.

E.4. Calculation of emission reductions or net anthropogenic removals

	Baseline GHG emissions or baseline net GHG removals (t CO_2e)	Project GHG emissions or actual net GHG removals (t CO_2e)	Leakage GHG emissions (t CO_2e)	GHG emission reductions or net anthropogenic GHG removals (t CO_2e)		
				Before 01/01/2013	From 01/01/2013	Total amount
Total		0	0	11,077	129,525	140,602

E.5. Comparison of emission reductions or net anthropogenic removals achieved with estimates in the registered PDD

Amount achieved during this monitoring period (t CO_2e)	Amount estimated ex ante (t CO_2e)
140,602	80,563

E.6. Remarks on increase in achieved emission reductions

The Emission Factor measured was on average 119.5% greater than the Emission Factor *ex-ante* estimated. Since this one is achieved ex-post taken into consideration the emission factor calculated by the Brazilian DNA. Was greater than the ex-ante Emission Factor since Thermoelectric fossil-fuelled was used with more frequency during the years after Project Activity registration.
The Electricity Generation measured between 10/04/2012 until 31/10/2017 was 21% less than the Electricity Generation *ex-ante* estimated.[7] The difference in the electricity generation is due to the non-regular river water flow during the years after Project Activity registration. Was adopted zero ER for the period between 01/11/2010 until 09/04/2012.

Then, due these two parameters, the difference between the Emission Reductions estimated *ex-ante* and the actual values of Emission Reductions of item E.5 has occurred (74.5% over).

[7] The calculations are demonstrated in the document “CERs Comparison.xls”.