



**Verification and certification report form for  
CDM project activities  
(Version 02.1)**

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

**BASIC INFORMATION**

<b>Title and UNFCCC reference number of the project activity</b>	<b>Santana I SHP CDM Project (JUN 1118)</b> <b>UNFCCC ref. #: 2793</b>
<b>Version number of the verification and certification report</b>	1
<b>Completion date of the verification and certification report</b>	01/03/2018
<b>Monitoring period number and duration of this monitoring period</b>	1 <sup>st</sup> Monitoring period <b>01/11/2010 – 31/10/2017 (both included)</b>
<b>Version number of the monitoring report to which this report applies</b>	3
<b>Crediting period of the project activity corresponding to this monitoring period</b>	Type: Renewable <b>Start date: 01/11/2010, Length: 7 years</b>
<b>Project participants</b>	Firenze Energética S/A Carbotrader Assessoria e Consultoria em Energia Ltda.
<b>Host Party</b>	Brazil
<b>Applied methodologies and standardized baselines</b>	AMS-I.D. - Grid connected renewable electricity generation (version 13)
<b>Mandatory sectoral scopes linked to the applied methodologies</b>	Sectoral Scope 1 – Energy Industries (Renewable / Non-renewable Sources)
<b>Conditional sectoral scope(s) linked to the applied methodologies</b>	N/A
<b>Estimated amount of GHG emission reductions or GHG removals for this monitoring duration in the registered PDD</b>	80,563 tCO <sub>2</sub> e <sup>1</sup>
<b>Certified amount of GHG emission reductions or GHG removals for this monitoring period</b>	140,602 tCO <sub>2</sub> e
<b>Name and UNFCCC reference number of the DOE</b>	Earthood Services Private Limited (ESPL) (ref E- 0066)

<sup>1</sup> This amount was accounted taking into consideration only CERs estimated during the same period which the SHP operated in the monitoring period. Although the MP started on 01/11/2010, the project activity started its operation only on 10/04/2012. It was done in this way in order to allow a fair comparison between the estimated and the achieved CERs.

**Name, position and signature of the  
approver of the verification and  
certification report**



Dr. Kaviraj Singh  
Managing Director

## SECTION A. Executive summary

### Brief summary of the project activity

The project activity consists in generating renewable energy through the construction of a small hydro power plant (SHP) with installed capacity of 14.758 MW called Santana I. The project also comprehends a small reservoir of 1.17 km<sup>2</sup>. The project activity reduces the GHG emissions through dispatching GHG-free electricity to the Brazilian National Grid (SIN).

The SHP is located in the Midwest region of Brazil, in river Santana, state of Mato Grosso and in the city of Nortelândia.

The PA started its operation on 10/04/2012. No ERs will be claimed prior to this date. This information was forwarded to the EB by e-mail on 30/09/2013<sup>/START/</sup>. However a temporary deviation has been requested. Refer to section E.4.1 below.

### Scope of verification

Firenze Energética S/A has contracted Earthood Services Private Limited to conduct the verification and certification of emission reductions reported for the CDM project activity “Santana I SHP CDM Project (JUN 1118)” for the period from 01/11/2010 to 31/10/2017 (including both days).

The verification is the periodic independent review and ex post determination of the monitored reductions in GHG emissions that have occurred due to the registered CDM project activity during the defined monitoring period.

The scope of the verification is to establish/verify that:

- the project activity has been implemented and operated as per the registered PDD or any approved revised PDD, and that all physical features (technology, project equipment, and monitoring and metering equipment) of the project are in place;
- the monitoring report and other supporting documents provided are complete in accordance with the latest applicable version of the completeness checklist for requests for issuance of CERs, verifiable, and in accordance with applicable CDM requirements;
- the actual monitoring systems and procedures comply with the monitoring systems and procedures described in the monitoring plan, any revised approved monitoring plan, the approved methodology including applicable tool(s) and/or, where applicable, the approved standardized baseline;
- the data recorded and stored as per the monitoring methodology including applicable tool(s) and, where applicable, the standardized baseline.

### Verification process

The verification process involved following:

- contract with Firenze Energética S/A for the scope of verification;
- publication of monitoring report;
- desk review;
- physical on-site inspection;
- issuance of verification findings;
- reporting, calculation checks, QA/QC and resolution of findings;
- issuance of draft verification report;
- independent technical review of the project documentation;
- issuance of the final verification report;
- submission of the request for issuance, as appropriate.

### Conclusion

Earthood Services Private Limited has performed the verification of the CDM PA “**Santana I SHP CDM Project (JUN 1118)**”, having UNFCCC Ref. Number 2793 for the monitoring period from 01/11/2010 to 31/10/2017. The verification team has confirmed the implementation of the project as per description in the PDD, the monitoring plan of the PDD and the application of the monitoring methodology (AMS-I.D. version 13). In

addition, it was confirmed that the monitoring system is in place and the emission reductions are calculated without material misstatements.

The verified emission reductions amount to 140,602 tCO<sub>2</sub>e in the above mentioned monitoring period.

The verification team concluded that the registered CDM PA complies with all relevant CDM procedures/standards/guidance and therefore request for issuance is being submitted in accordance with the CDM procedures.

## SECTION B. Verification team, technical reviewer and approver

### B.1. Verification team member

No.	Role	Type of resource	Last name	First name	Affiliation (e.g. name of central or other office of DOE or outsourced entity)	Involvement in			
						Desk/document review	On-site inspection	Interviews	Verification findings
1.	Team Leader	EI	Sebben	Marcelo	Central Office	Y	Y	Y	Y
2.	Verifier	EI	Lopes	Ricardo	Central Office	Y	Y	Y	Y
3.	Technical Expert	EI	Sebben	Marcelo	Central Office	Y	Y	Y	Y
4.	Methodological Expert	EI	Sebben	Marcelo	Central Office	Y	Y	Y	Y
5.	Local Expert	EI	Sebben	Marcelo	Central Office	Y	Y	Y	Y

### B.2. Technical reviewer and approver of the verification and certification report

No.	Role	Type of resource	Last name	First name	Affiliation (e.g. name of central or other office of DOE or outsourced entity)
1.	Technical reviewer	EI	Cruz	Sergio	Central Office
2.	Technical Expert	EI	Cruz	Sergio	Central Office
3.	Approver	IR	Singh	Kaviraj	Central Office

## SECTION C. Application of materiality

### C.1. Consideration of materiality in planning the verification

No.	Risk that could lead to material errors, omissions or misstatements	Assessment of the risk		Response to the risk in the verification plan and/or sampling plan
		Risk level	Justification	
1.	Human error in recording the readings	Low	Recording of readings for most of the parameters is automated and electronic and there is limited human intervention. Therefore, chances of possible human errors, in recording and archiving, are minimised.	Electronic records used for ER calculation to be checked with the source data available as plant records.
2.	Error in transferring the data to ER sheet	Medium	Transfer of data from source to ER calculation involve human intervention and might lead to inconsistencies.	The values reported in ER sheet to be checked with their respective source data. The values for all parameters

				reported at the interval of were verified from the source data.
3.	Calculation of parameters	Low	Human errors entering formulas and data.	All formulas are checked and compared to applied methodology and tools. In addition, entry data are crosschecked with raw data.

## C.2. Consideration of materiality in conducting the verification

In accordance with CDM VVS for PA – version 01.0 – para 329 the prescribed thresholds for materiality for CDM PAs are as under:

Emission Reductions (tCO <sub>2</sub> e)/year	500,000 or more	300,001 to 499,999	300,000 or less	Small Scale CDM PAs	Micro Scale CDM PAs
Materiality Threshold	0.5%	1.0%	2.0%	5.0%	10.0%

The materiality threshold is 5% as it is a small scale project activity. Nevertheless, it is not applicable to the project activity at this verification, as no sampling has been applied.

Particulars / Monitoring Report	MR Version (Public)	MR Version (Revised/Final)
Emission Reductions Achieved (tCO <sub>2</sub> e) in this monitoring period	142,003	140,602
Applicable Threshold (%) as per para 329 of CDM VVS for PA– version 01.0	7,100 (5%)	7,030 (5%)

The verification team has identified the impact of errors observed and those were corrected by PP during verification for all monitoring parameter at individual level. The extrapolation is not applicable as 100% of data was checked.

Monitored Parameter (Symbol / Description)	Reporting Frequency	Number of Discrete Data (Total)  Total (100%)	Sample selected for verification  Sample (100%)	Type of error identified	Impact on ERs	
					ERs impacted (Sample)	ERs impacted (Population based on extrapolation)
EG <sub>Santana I,h</sub>	Monthly and Yearly aggregated from continuous monitoring and also reported at 1 hour interval	100%	100%	No error identified	No impact	No impact
EF <sub>grid,CM,y</sub>	Yearly Calculated	100%	100%	The calculation was correct. However its correctness depends on parameter EF <sub>grid,OM-DD,y</sub>	Impact in ERs calculated during 2017	Not applicable as 100% of data was checked
EF <sub>grid,OM-DD,y</sub>	Hourly reported by the Brazilian DNA and yearly determined for the EF <sub>grid,CM,y</sub> calculations.	100%	100%	Use of wrong year-base data	Impact in ERs calculated during 2017	Not applicable as 100% of data was checked
EF <sub>grid,BM,y</sub>	Yearly reported by the Brazilian DNA.	100%	100%	No error identified	No impact	No impact

Based on the above table it can be confirmed that the materiality threshold -is not reached for the registered PA as per CDM VVS.

## SECTION D. Means of verification

### D.1. Desk/document review

A desk review was conducted by the verification team that included:

- a. a review of the data and information presented to verify its completeness;
- b. a review of the registered monitoring plan, the monitoring methodology including applicable tool(s) and, where applicable, the applied standardized baseline, paying particular attention to the frequency of measurements, the quality of metering equipment including calibration requirements, and the quality assurance and quality control procedures;
- c. an evaluation of data management and the quality assurance and quality control system in the context of their influence on the generation and reporting of emission reductions.

A complete list of documents/evidences reviewed is included as Appendix 3.

### D.2. On-site inspection

Duration of on-site inspection: 21/02/2018 to 22/02/2018				
No.	Activity performed on-site	Site location	Date	Team member
1.	Opening Meeting	SHP Santana I / Nortelândia - MS	21/02/2018	Marcelo Sebben Ricardo Lopes
2.	Physical inspection of the project activity: site visit and interview of monitoring personnel	SHP Santana I / Nortelândia - MS	21/02/2018	Marcelo Sebben Ricardo Lopes
3.	Checking of management and operational system	SHP Santana I / Nortelândia - MS	21/02/2018	Marcelo Sebben Ricardo Lopes
	Verification checklist: compliance of monitoring procedures followed at project site with registered PDD and monitoring methodology. Management and monitoring procedures followed at project site.	SHP Santana I / Nortelândia - MS	21/02/2018	Marcelo Sebben Ricardo Lopes
4.	Review of monitored data and relevant documents in accordance with registered monitoring plan and applied monitoring methodology	Central office / Curitiba - PR	22/02/2018	Marcelo Sebben Ricardo Lopes
5.	Review of ER calculations in accordance with applied methodology and relevant tools	Central office / Curitiba - PR	22/02/2018	Marcelo Sebben Ricardo Lopes
7.	Presentation of findings	Central office / Curitiba - PR	22/02/2018	Marcelo Sebben Ricardo Lopes
8.	Closing meeting	Central office / Curitiba - PR	22/02/2018	Marcelo Sebben Ricardo Lopes

**D.3. Interviews**

No.	Interviewee			Date	Subject	Team member
	Last name	First name	Affiliation			
1.	Mafre	Magnus	Firenze Energética S.A	21/02/2018	Description of project activity. Physical Inspection of site. Installed Capacity	Marcelo Sebben Ricardo Lopes
2	Silva	Edicléia	Firenze Energética S.A	21/02/2018	Operation and Maintenance of the SHP	Marcelo Sebben Ricardo Lopes
3	Taketa	Daniel	Vetorlog	22/08/2018	Download of electricity meter data	Marcelo Sebben
4	Ribeiro	Luciele	Vetorlog	22/08/2018	Download of CliqCCEE data (Cross-check data)	Ricardo Lopes
5	Cionek	Ivan	Vetorlog	22/08/2018	Generation and Cross-Check data	Marcelo Sebben
6	Matico	Simone	Firenze Energética S.A	22/08/2018	Calibration Certificates, Human Resources, technical information	Ricardo Lopes
7	Moraes	Arthur	Carbotrader	22/08/2018	MR and ER calculations	Marcelo Sebben

**D.4. Sampling approach**

Not applicable as no sampling has been used during the verification.

**D.5. Clarification requests (CLs), corrective action requests (CARs) and forward action requests (FARs) raised**

Areas of verification findings	No. of CL	No. of CAR	No. of FAR
Compliance of the monitoring report with the monitoring report form	CL 1		
Compliance of the project implementation and operation with the registered PDD			FAR 1 (raised during validation)
Post-registration changes			
Compliance of the registered monitoring plan with the methodologies including applicable tools and standardized baselines			
Compliance of monitoring activities with the registered monitoring plan	CL 2 CL 4		
Compliance with the calibration frequency requirements for measuring instruments			
Assessment of data and calculation of emission reductions or net removals	CL 3	CAR 1	
Assessment of reported sustainable development co-benefits			
Global stakeholder consultation			
Others (please specify)			
<b>Total</b>	<b>4</b>	<b>1</b>	<b>1</b>

**SECTION E. Verification findings****E.1. Compliance of the monitoring report with the monitoring report form**

<b>Means of verification</b>	The MR was crosschecked with the CDM-MR-FORM template available at the UNFCCC website and with the instructions for filling it out. Some inconsistencies were found when completing the MR. Refer to findings below
<b>Findings</b>	CL 01 Information regarding ERs achieved during monitoring period were not informed in section A.1 of the MR as required by the Instructions for completing the MR.
<b>Conclusion</b>	A valid version of the verification template (CDM-MR-FORM – version 06.0) available at the UNFCCC website has been used. It has been filled out in accordance with the “Instructions for filling out the monitoring report form”.

**E.2. Remaining forward action requests from validation and/or previous verifications**

<b>Means of verification</b>	The validation report <sup>/VAL/</sup> has been reviewed and it was observed a FAR open during the validation phase.
<b>Findings</b>	FAR 01 The installed capacity of the project (i.e. the effective power of the generators) shall be verified in order to ensure that it will not exceed the 15MW limit for small scale CDM project.
<b>Conclusion</b>	The verification team observed that the SHP installed capacity did not exceed 15MW. Please refer to finding resolution.

**E.3. Compliance of the project implementation and operation with the registered project design document**

<b>Means of verification</b>	During the on-site visit, the verification team checked the implementation status of the project activity as well as the monitoring equipment. In addition, interviews with personnel and PP's representatives were also performed. The project activity consists in generating renewable energy through the construction of a small hydro power plant (SHP) with installed capacity of 14.758 MW reducing the GHG emissions through dispatching GHG-free electricity to the Brazilian National Grid (SIN). The operational start date of the PA was in 10/04/2012, after the start date of the crediting period. No ERs will be claimed prior to this date as no generation was observed. The verification team checked prior dates and it was confirmed that no electricity was dispatched to the grid. The main equipment used at the project activity is given below: <ul style="list-style-type: none"> <li>- 02 horizontal axis turbines (Francis) with 7.656 MW each, Serial #s 1206/11-013 and 1206/11-013;</li> <li>- 02 horizontal axis Generators (Synchronous) with 7.380 MW each, Serial #s EDH227001663 and EDH227001664;</li> <li>- Assured energy 8.89 MW average<sup>/ANEEL/</sup>;</li> <li>- Reservoir area 1.17 km<sup>2</sup></li> </ul>
<b>Findings</b>	-
<b>Conclusion</b>	According to information verified during the site visit, the verification team has to confirm that all physical features (technology, project equipment, and monitoring and metering equipment) of the registered CDM project activity were in place. The project activity was been operated as per as the registered PDD from 10/04/2012 which is the operational start date of the Project activity. The project activity remains within the limit of small scale project activity with an installed capacity of 14.758 MW (<15MW).

**E.4. Post-registration changes****E.4.1. Temporary deviations from the registered monitoring plan, applied methodologies or applied standardized baselines**

<b>Means of verification</b>	According to the registered PDD, the start date of the project activity would be on 01/11/2010. By interviewing the project participants and by evidences provided, the
------------------------------	---



	operational start date of the PA was on 10/04/2012. The project participants have no intention of request change of start date of the crediting period. For that reason, a temporary deviation has been requested to deal with the period which the project activity was not monitored as per monitoring plan for the period between 01/11/2010 and 09/04/2012.
<b>Findings</b>	CL 2 It has been observed that the electricity measurements were not performed between 01/11/2010 and 09/04/2012 and no justification has been given
<b>Conclusion</b>	A temporary deviation has been requested to deal with these missing measurements. Please refer to Post Registration Changes report, attached to this verification report. No baseline emissions were claimed during the deviation period. Project emissions and Leakage emissions are equal to zero as per registered PDD and applied methodology and were not accounted during this period.

**E.4.2. Corrections**

No corrections have been identified for the present monitoring period.

**E.4.3. Change to the start date of the crediting period of the project activity**

Not applicable as there was no change in the start date of the crediting period. It is important to point out, however, that the start-up of the project activity was on 10/04/2012. This information has been duly informed to the EB by email<sup>START/</sup>. Please refer to the temporary deviation of the monitoring plan in the report "Assessment of Post registration Changes" which is attached to this report.

**E.4.4. Inclusion of a monitoring plan**

Not applicable as monitoring plan is part of the registered PDD

**E.4.5. Permanent changes from registered monitoring plan, or permanent deviation of monitoring from the applied methodologies, standardized baselines or other applied standards or tools**

Not applicable as no permanent changes from the registered monitoring plan or from monitoring methodology have been submitted to the UNFCCC prior and/or during the current monitoring period

**E.4.6. Changes to the project design**

Not applicable as no changes to the project design of the registered project activity took place prior and/or during the current monitoring period

**E.4.7. Changes specific to afforestation and reforestation project activities**

Not applicable as it is not an afforestation and reforestation PA.

**E.5. Compliance of the registered monitoring plan with the methodology including applicable tools and standardized baselines**

<b>Means of verification</b>	The MP of the registered PDD was reviewed against the monitoring requirements of the applied methodology and applicable tools.
<b>Findings</b>	-
<b>Conclusion</b>	The MP of the project activity is totally in accordance with the applied methodology (AMS-I.D – version 13 – Grid connected renewable electricity generation) and applicable tools.

**E.6. Compliance of monitoring activities with the registered monitoring plan****E.6.1. Data and parameters fixed ex ante or at renewal of crediting period**

<b>Means of verification</b>	According to the registered PDD, all parameters applied in the calculations will be monitored. However the information described in the MR section D.1 was not in accordance with PDD. Thus a CL has been raised.
<b>Findings</b>	CL 4 MR Section D.1: the PP states wOM and wBM as fixed parameters. However it is not in accordance with registered PDD.
<b>Conclusion</b>	The section D.1 is now in accordance to the registered PDD. The PDD does not foreseen fixed parameters for the monitoring plan.

**E.6.2. Data and parameters monitored**

<b>Means of verification</b>	<p>All monitored parameters listed in MR used to calculate baseline GHG emissions of the PA were checked against the registered PDD. No project or leakage emissions are due as per applied methodology and registered PDD.</p> <p>The parameters of the registered PDD were verified in order to check its consistency with CDM tools and guidance to ER calculations.</p>	
	<p>1. <b>EG<sub>Santana I,h</sub></b>: Net electricity of the Santana I SHP delivered to grid in hour h</p>	
	<b>Criteria/Requirements</b>	<b>Assessment Observation</b>
	Measuring / Reading / Recording frequency	The parameter is continuously read, measured and recorded every one hour automatically by two meters (main and backup) in the Nortelândia Substation.
	Is the measuring and reporting frequency in accordance with the monitoring plan and monitoring methodology?	Yes
	Monitoring equipment	02 (two) electricity meters (main and backup). 1- Main - S/N: PT-1003A493-01 replaced on 09/03/2017 by meter MW-1612A263-02. 2- Backup - S/N: PT-1003A532-01
	Is the accuracy of the monitoring equipment as stated in the monitoring plan? If the monitoring plan does not specify the accuracy of the monitoring equipment, does the accuracy of the monitoring equipment comply with local/national standards, or as per the manufacturer's specification?	The accuracy of the equipment is 0.2 as required by Brazilian Regulations <sup>/15/</sup>
	Is the accuracy valid for the entire measuring range or do different accuracy levels apply to different measuring ranges?	Accuracy class is valid for the entire range.
	Calibration frequency / interval	2 years until 31/12/2016 and 5 years from 01/01/2017 as per new resolution <sup>/15/</sup>
	Is the calibration interval in line with the monitoring plan and/or methodology? If the monitoring plan does not specify the frequency of calibration, is the selected frequency in accordance with the	The calibration interval is in line with the monitoring plan as it is set as per national regulations <sup>/15/</sup> .

	local/national standards, or as per the manufacturer's specifications?	
	Is the calibration of measuring equipment carried out by an accredited person or institution?	An accredited institution has carried out calibration of equipment.
	Is(are) the calibration(s) valid for the entire reporting period?	No gaps in calibration have been observed.
	Is the calibration carried out for a measuring range comparable with the range for which measurements have been carried out?	Yes.
	How were the values in the monitoring report verified?	The values of the MR were verified through the comparison between the raw data and their aggregated values of the Excel spreadsheets.
	If applicable, has the reported data been crosschecked with other available data?	The monitored values were reviewed during the site visit by crosschecking 100% of the data with reports from CliqCEE which is the Government Chamber of Electricity Commercialization (Official Source).
	Does the data management ensure correct transfer of data and reporting of emission reductions and are necessary QA/QC processes in place?	Data management system was found to be reliable and appropriate.
	In case project participants have temporarily not monitored the parameter, has either i) a deviation been approved by the CDM EB or ii) has the parameter been estimated as stipulated by paragraph 232 b) the CDM Project Standard for PA-version 01.0?	The crediting period started on 01/11/2010. However the start-up of the SHP was on 10/04/2012. Thus measurements between these dates were not performed as per monitoring plan and a CL was raised. Refer to CL 02

  

2. EF <sub>CM,y</sub> : Brazilian Grid Emission Factor	
Criteria/Requirements	Assessment Observation
Measuring / Reading / Recording frequency	The parameter is calculated yearly based on the values of EF <sub>OM</sub> and EF <sub>BM</sub> provided by the Brazilian DNA as per registered PDD and applied tool for calculating emission factor for an electricity system version 1.1.
Is the measuring and reporting frequency in accordance with the monitoring plan and monitoring methodology?	Yes
Monitoring equipment	N/A
Is the accuracy of the monitoring equipment as stated in the monitoring plan? If the monitoring plan does not specify the accuracy of the monitoring equipment, does the accuracy of the monitoring equipment comply with	N/A

	local/national standards, or as per the manufacturer's specification?	
	Is the accuracy valid for the entire measuring range or do different accuracy levels apply to different measuring ranges?	N/A
	Calibration frequency / interval	N/A
	Is the calibration interval in line with the monitoring plan and/or methodology? If the monitoring plan does not specify the frequency of calibration, is the selected frequency in accordance with the local/national standards, or as per the manufacturer's specifications?	N/A
	Is the calibration of measuring equipment carried out by an accredited person or institution?	N/A
	Is(are) the calibration(s) valid for the entire reporting period?	N/A
	Is the calibration carried out for a measuring range comparable with the range for which measurements have been carried out?	N/A
	How were the values in the monitoring report verified?	The calculation is checked in the ER calculations spreadsheet and their parameters $EF_{OM-DD,h}$ and $EF_{BM,y}$ are checked in the Brazilian DNA website. The parameter $EG_{Santana I,h}$ is also used in the determination of this parameter and was assessed above.
	If applicable, has the reported data been crosschecked with other available data?	Not applied as no cross-check is done in this parameter. It is determined based on public available parameters and electricity generated by the project activity.
	Does the data management ensure correct transfer of data and reporting of emission reductions and are necessary QA/QC processes in place?	Data management system was found to be reliable and appropriate.
In case project participants have temporarily not monitored the parameter, has either i) a deviation been approved by the CDM EB or ii) has the parameter been estimated as stipulated by paragraph 232 b) the CDM Project Standard for PA-version 01.0?	N/A	
<b>3. <math>EF_{grid,OM-DD,y}</math>: CO2 Operating margin emission factor of the grid, in a year y</b>		
<b>Criteria/Requirements</b>	<b>Assessment Observation</b>	
Measuring / Reading / Recording frequency	According to the applied tool for calculating emission factor for an electricity system, "For the dispatch data	

		analysis OM, use the year in which the project activity displaces grid electricity and update the emission factor annually during monitoring". The parameter was determined for all monitoring period as per applied tool. The parameter was calculated hourly by the Brazilian DNA and then aggregated yearly by the Project Participants as can be seen in the ER calculations spreadsheet <sup>/XLS/</sup> . However, not the latest available data was used for the calculations. Thus a CAR has been raised.
	Is the measuring and reporting frequency in accordance with the monitoring plan and monitoring methodology?	Yes
	Monitoring equipment	N/A
	Is the accuracy of the monitoring equipment as stated in the monitoring plan? If the monitoring plan does not specify the accuracy of the monitoring equipment, does the accuracy of the monitoring equipment comply with local/national standards, or as per the manufacturer's specification?	N/A
	Is the accuracy valid for the entire measuring range or do different accuracy levels apply to different measuring ranges?	N/A
	Calibration frequency / interval	N/A
	Is the calibration interval in line with the monitoring plan and/or methodology? If the monitoring plan does not specify the frequency of calibration, is the selected frequency in accordance with the local/national standards, or as per the manufacturer's specifications?	N/A
	Is the calibration of measuring equipment carried out by an accredited person or institution?	N/A
	Is(are) the calibration(s) valid for the entire reporting period?	N/A
	Is the calibration carried out for a measuring range comparable with the range for which measurements have been carried out?	N/A
	How were the values in the monitoring report verified?	The data was directly checked in the DNA website <sup>/18/</sup> and compared to the data used in the ER calculations.
	If applicable, has the reported data been crosschecked with other available data?	Not applied as no cross-check is done in this parameter. It is determined based on public available parameters and electricity generated by the project activity.

	Does the data management ensure correct transfer of data and reporting of emission reductions and are necessary QA/QC processes in place?	Data management system was found to be reliable and appropriate. However not the most recent data was used. Refer to CAR 1							
	In case project participants have temporarily not monitored the parameter, has either i) a deviation been approved by the CDM EB or ii) has the parameter been estimated as stipulated by paragraph 232 b) the CDM Project Standard for PA-version 01.0?	N/A							
	<b>4. <math>EF_{grid,BM,y}</math>: CO2 Build margin emission factor of the grid, in a year y</b>								
	<table border="1"> <thead> <tr> <th>Criteria/Requirements</th> <th>Assessment Observation</th> </tr> </thead> <tbody> <tr> <td>Measuring / Reading / Recording frequency</td> <td>According the registered PDD the parameter is determined ex-post. Thus, as per applied tool for calculating emission factor for an electricity system, the most recent data will be used for each year. The Brazilian DNA is the responsible entity for providing the yearly <math>EF_{BM}</math> value and the latest available data is the year of 2016 at the moment of the site visit. Bearing this in mind, the PP applied for 2012 to 2016, the corresponding value for each year. However, for the year 2017, the PP replied the value of 2016 as it was the most recent data available. The registered PDD states in the page 28 that the build margin emission factor to be applied is the latest available. Moreover, as per applied "The build margin emissions factor is the generation-weighted average emission factor (tCO<sub>2</sub>/MWh) of all power units m <u>during the most recent year y</u>". Further, again as per applied tool "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, <u>including those units built up to the latest year for which information is available</u>". Thus, the verification team concludes that the measure taken by the PP of using the most recent data available for each year for the determination of this parameter is a valid approach.</td> </tr> <tr> <td>Is the measuring and reporting frequency in accordance with the monitoring plan and monitoring methodology?</td> <td>Yes</td> </tr> <tr> <td>Monitoring equipment</td> <td>N/A</td> </tr> </tbody> </table>	Criteria/Requirements	Assessment Observation	Measuring / Reading / Recording frequency	According the registered PDD the parameter is determined ex-post. Thus, as per applied tool for calculating emission factor for an electricity system, the most recent data will be used for each year. The Brazilian DNA is the responsible entity for providing the yearly $EF_{BM}$ value and the latest available data is the year of 2016 at the moment of the site visit. Bearing this in mind, the PP applied for 2012 to 2016, the corresponding value for each year. However, for the year 2017, the PP replied the value of 2016 as it was the most recent data available. The registered PDD states in the page 28 that the build margin emission factor to be applied is the latest available. Moreover, as per applied "The build margin emissions factor is the generation-weighted average emission factor (tCO <sub>2</sub> /MWh) of all power units m <u>during the most recent year y</u> ". Further, again as per applied tool "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, <u>including those units built up to the latest year for which information is available</u> ". Thus, the verification team concludes that the measure taken by the PP of using the most recent data available for each year for the determination of this parameter is a valid approach.	Is the measuring and reporting frequency in accordance with the monitoring plan and monitoring methodology?	Yes	Monitoring equipment	N/A
Criteria/Requirements	Assessment Observation								
Measuring / Reading / Recording frequency	According the registered PDD the parameter is determined ex-post. Thus, as per applied tool for calculating emission factor for an electricity system, the most recent data will be used for each year. The Brazilian DNA is the responsible entity for providing the yearly $EF_{BM}$ value and the latest available data is the year of 2016 at the moment of the site visit. Bearing this in mind, the PP applied for 2012 to 2016, the corresponding value for each year. However, for the year 2017, the PP replied the value of 2016 as it was the most recent data available. The registered PDD states in the page 28 that the build margin emission factor to be applied is the latest available. Moreover, as per applied "The build margin emissions factor is the generation-weighted average emission factor (tCO <sub>2</sub> /MWh) of all power units m <u>during the most recent year y</u> ". Further, again as per applied tool "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, <u>including those units built up to the latest year for which information is available</u> ". Thus, the verification team concludes that the measure taken by the PP of using the most recent data available for each year for the determination of this parameter is a valid approach.								
Is the measuring and reporting frequency in accordance with the monitoring plan and monitoring methodology?	Yes								
Monitoring equipment	N/A								

	Is the accuracy of the monitoring equipment as stated in the monitoring plan? If the monitoring plan does not specify the accuracy of the monitoring equipment, does the accuracy of the monitoring equipment comply with local/national standards, or as per the manufacturer's specification?	N/A
	Is the accuracy valid for the entire measuring range or do different accuracy levels apply to different measuring ranges?	N/A
	Calibration frequency / interval	N/A
	Is the calibration interval in line with the monitoring plan and/or methodology? If the monitoring plan does not specify the frequency of calibration, is the selected frequency in accordance with the local/national standards, or as per the manufacturer's specifications?	N/A
	Is the calibration of measuring equipment carried out by an accredited person or institution?	N/A
	Is(are) the calibration(s) valid for the entire reporting period?	N/A
	Is the calibration carried out for a measuring range comparable with the range for which measurements have been carried out?	N/A
	How were the values in the monitoring report verified?	The data was directly checked in the DNA website <sup>18/</sup> and compared to the data used in the ER calculations.
	If applicable, has the reported data been crosschecked with other available data?	Not applied as no cross-check is done in this parameter. It is determined based on calculated values by the Brazilian DNA.
	Does the data management ensure correct transfer of data and reporting of emission reductions and are necessary QA/QC processes in place?	Data management system was found to be reliable and appropriate.
	In case project participants have temporarily not monitored the parameter, has either i) a deviation been approved by the CDM EB or ii) has the parameter been estimated as stipulated by paragraph 232 b) the CDM Project Standard for PA-version 01.0?	N/A
<b>Findings</b>	<p>CL 02 It has been observed that the electricity measurements were not performed between 01/11/2010 and 09/04/2012 and no justification has been given</p> <p>CAR 01 It has been observed that the EF OM in 2017 was not calculated as per applied tool for calculating emission factor of an electricity system version 1.1</p>	

<b>Conclusion</b>	After the findings resolutions all parameters were determined in a conservative manner and in accordance with requirements of applied tools, methodology and monitoring plan.
-------------------	---

### E.6.3. Implementation of sampling plan

<b>Means of verification</b>	The project participants have not applied sampling approach in the monitoring period. All parameters were fully checked as described in the monitoring plan during the operational period of the SHP. Documents were checked and interviews with PP's representatives and personnel were performed in order check this information.
<b>Findings</b>	-
<b>Conclusion</b>	No sampling plan was used.

### E.7. Compliance with the calibration frequency requirements for measuring instruments

<b>Means of verification</b>	<p>Manuals of equipment, national regulations registered monitoring plan and calibration certificates were checked in order to verify the compliance and frequency of the calibrations/inspections requirements of measuring equipment.</p> <p>In this project activity, the only equipment used are electricity meters that measure the parameter <b>EG<sub>Santana I,h</sub></b>. These equipment comprehend the following electricity meters: one main and one backup:</p> <ol style="list-style-type: none"> <li>1- Main - S/N: PT-1003A493-01 (operated until 09/03/2017) and MW-1612A263-02 (from 09/03/2017)<sup>/20/</sup>.</li> <li>2- Backup - S/N: PT-1003A532-01</li> </ol> <p>The calibration periods are as follows:</p> <p>S/N: PT-1003A493-01 (main meter)</p> <ul style="list-style-type: none"> <li>- 08/11/2011 valid until 07/11/2013</li> <li>- 12/03/2013 valid until 11/03/2015</li> <li>- 02/03/2015 valid until 01/03/2020 (meters under new regulation with 5 years calibration frequency)<sup>/15/</sup></li> </ul> <p>S/N: MW-1612A263-02 (main meter replaced on 09/03/2017)</p> <ul style="list-style-type: none"> <li>- 06/03/2017 valid until 05/03/2022</li> </ul> <p>S/N: PT-1003A532-01 (Backup meter)</p> <ul style="list-style-type: none"> <li>- 08/11/2011 valid until 07/11/2013</li> <li>- 12/03/2013 valid until 11/03/2015</li> <li>- 02/03/2015 valid until 01/03/2020 (meters under new regulation with 5 years calibration frequency)<sup>/15/</sup></li> </ul> <p>No gaps in calibration have been observed</p>
<b>Findings</b>	N/A
<b>Conclusion</b>	No gaps in calibration have been observed. The Electricity meters were all duly calibrated during the monitoring period.

### E.8. Assessment of data and calculation of emission reductions or net removals

#### E.8.1. Calculation of baseline GHG emissions or baseline net GHG removals by sinks

<b>Means of verification</b>	<p>The calculations of baseline emission have been done in accordance with registered monitoring plan and applied methodology. The equation used is the follow:</p> $BE_y = EF_{grid,CM,y} \times EG_{Santana I,y}$ <p>Where:</p> <p><math>BE_y</math> = Baseline emissions in the year y</p> <p><math>EF_{grid,CM,y}</math> = Combined Margin Emission factor of the grid in the year y</p> <p><math>EG_{Santana I,y}</math> = Net electricity of the Santana I SHP delivered to grid in the year y (hourly value aggregated for each year)</p> <p>The Combined margin emission factor of the grid (<math>EF_{grid,CM,y}</math>) was calculated as follows:</p> $EF_{grid,CM,y} = EF_{OM} \times w_{OM} + EF_{BM} \times w_{BM}$
------------------------------	---



	<p>Where <math>w_{OM}</math> and <math>w_{BM}</math> are the Operating margin weight and the build margin weight and both are fixed as 0.5 as per applied tool for calculating emission factor for an electricity system. For the determination of <math>EF_{OM-DD,y}</math> and <math>EF_{BM,y}</math> the PP applied the parameters provided by the Brazilian DNA. The <math>EF_{OM-DD,y}</math> was calculated with the hourly dispatch emission factor of the grid and with the hourly electricity generation of the project activity as follows:</p> $EF_{OM-DD,y} = \frac{\sum EF_{EL-DD,h} \times EG_{Santana I,h}}{EG_{Santana I,y}}$ <p>Where:  <math>EF_{OM-DD,y}</math> = Dispatch data analysis operating margin CO<sub>2</sub> emission factor in year y  <math>EF_{EL-DD,h}</math> = hourly dispatch emission factor of the grid  <math>EG_{Santana I,h/y}</math> = Net electricity of the Santana I SHP delivered to grid hourly and aggregated for each year. However as not the latest value was used, a CAR has been raised. Refer to CAR 1</p> <p><math>EF_{BM}</math> was directly provided by the Brazilian DNA yearly. For the year 2017, latest data available was used (year 2016) as required by the applied tool and registered PDD.</p> <p>Baseline emissions for the whole monitoring period are:</p> <p style="text-align: center;">BE 140,602 tCO<sub>2</sub>e</p>
<b>Findings</b>	<p>CAR 01</p> <p>It has been observed that the EF CM in 2017 was not calculated as per applied tool for calculating emission factor of an electricity system version 1.1</p>
<b>Conclusion</b>	<p>After the findings resolution, the verification team confirms that:</p> <ol style="list-style-type: none"> <li>the monitored data was available in accordance with the registered monitoring plan for the operational period of the SHP;</li> <li>the reported data were crosschecked, as prescribed in the revised approved PDD, with the relevant supporting and were found consistent;</li> <li>appropriate methods and formulae for calculating baseline GHG emissions have been followed;</li> <li>the assumptions, emission factors and default values that were applied in the calculations are correct and evidenced;</li> <li>the calculations are transparent, consistent, correct and complete.</li> </ol>

#### E.8.2. Calculation of project GHG emissions or actual net anthropogenic GHG removals by sinks

<b>Means of verification</b>	According to the applied methodology and registered PDD, no project emissions are due in this project activity. Thus, PE = 0
<b>Findings</b>	
<b>Conclusion</b>	No project emissions are to be accounted

#### E.8.3. Calculation of leakage GHG emissions

<b>Means of verification</b>	As this correspond to a greenfield project and no energy is generated from transferred equipment, leakage are considered to be equal to zero. $LE_y = 0$
<b>Findings</b>	
<b>Conclusion</b>	No leakage emissions are to be accounted

#### E.8.4. Summary calculation of GHG emission reductions or net anthropogenic GHG removals by sinks

<b>Means of verification</b>	<p>The emission reductions from the project activity are based on baseline emissions only.</p> <p>The calculations presented at the final MR and corresponding ER calculation spreadsheet were found to be appropriate and in compliance with the provisions of the registered monitoring plan of the approved PDD and applied methodology.</p> <p>The verification team confirms an audit trail that contains the evidences and records of validated figures.</p>
<b>Findings</b>	-

<b>Conclusion</b>	The verification team confirms that appropriate methods and formulae for calculating baseline GHG emissions reductions have been followed. The summary table has been correctly presented at the MR and the figures are correct and justified.
-------------------	---

#### E.8.5. Comparison of actual GHG emission reductions or net anthropogenic GHG removals by sinks with estimates in registered PDD

<b>Means of verification</b>	The monitoring period started on 01/11/2010 but the actual operation of the PA started only on 10/04/2012, Due to the actual PA operation period being smaller than the informed period, a fair comparison was not possible if the whole monitoring period estimated is taken into account. Thus a CL was raised to deal with this issue. Please refer to CL 3..
<b>Findings</b>	CL 3 1- MR front page and section E.5. The comparison between estimated ERs and actual ERs achieved in the monitoring period are not considering the same period as the start date of the project activity does not coincide with the start date of the crediting period.  2- Moreover in MR Section E.6, the reasons for the increase in the actual ERs are inconsistent with the actual increase, as applying the percentages of decrease of generation and increase in the value of EF.
<b>Conclusion</b>	The comparison of actual values of the monitoring period with the estimates in the registered PDD is properly presented at the MR. It is important to point out that in order to achieve a fair comparison, the compared period was between 10/04/2012 and 31/10/2017 which is the period which the PA was under operation.

#### E.8.6. Remarks on difference from estimated value in registered PDD

<b>Means of verification</b>	Although ERs actually achieved are higher than the estimated ones in the PDD, it could be observed that the electricity generated during the monitoring period is 21% smaller than the one stated in the registered PDD. The main reason for increase though, was that the emission factor of the grid increased from 0.18418 tCO <sub>2</sub> /MWh to an average of 0.4042 between 2012 and 2017, i.e. an increase of 119.5%. However as the justification was not duly included in the MR a CL was raised. Refer to CL 3..
<b>Findings</b>	CL 3
<b>Conclusion</b>	As the emission factor does not depend on the PP's operation, the value presented is not considered over-estimated by the verification team. The total electricity generation achieved being 21% smaller when comparing to the estimated is understandable as the generation depends on hydrologic regimes which are variable and difficult to predict. Nevertheless, the increase in the EF <sub>grid,CM</sub> (average of 119.5%) justifies the actual ERs that became 74.5% higher than the estimated ones. All the data was available as the activity parameters were monitored in accordance with registered monitoring plan. An appropriate method was followed to calculate emission reduction in line to registered PDD. For a full assessment with justification, please refer to the resolution of CL 3 in Appendix 4 below.

#### E.8.7. Actual GHG emission reductions or net anthropogenic GHG removals by sinks during the first commitment period and the period from 1 January 2013 onwards

<b>Means of verification</b>	Earthood Services Private Limited is able to certify that the emission reductions from the CDM project activity "Santana I SHP CDM Project (JUN 1118)" – Ref. 2793 for the monitoring period from 01/11/2010 to 31/10/2017 (including both days) is 140,602 CO <sub>2</sub> e Verified and certified emission reductions as per commitment period:				
	<table> <tr> <th>Commitment period</th><th>Amount</th></tr> <tr> <td>Up to 31/12/2012 (1<sup>st</sup> commitment period)</td><td>11,077 tCO<sub>2</sub>e</td></tr> </table>	Commitment period	Amount	Up to 31/12/2012 (1 <sup>st</sup> commitment period)	11,077 tCO <sub>2</sub> e
Commitment period	Amount				
Up to 31/12/2012 (1 <sup>st</sup> commitment period)	11,077 tCO <sub>2</sub> e				

	From 01/01/2013	129,525 tCO <sub>2</sub>	
<b>Findings</b>	-		
<b>Conclusion</b>	The GHG emissions reductions have been partially generated prior 31/12/2012 and partially from 01/01/2013.		

**E.9. Assessment of reported sustainable development co-benefits**

<b>Means of verification</b>	Not applicable
<b>Findings</b>	-
<b>Conclusion</b>	The PPs have not requested the DOE to verify the sustainable development co-benefits for this project activity

**E.10. Global stakeholder consultation**

<b>Means of verification</b>	According to the Project Cycle Procedure for project activities, version 01.0, paragraph 184, "For the monitoring report for the first monitoring period, stakeholders may submit comments, in English, within 14 days of publication of the monitoring report, to the DOE through a dedicated interface on the UNFCCC CDM website". The verification team checked the UNFCCC CDM website and observed that no comments have been made public during the comments period.
<b>Findings</b>	-
<b>Conclusion</b>	The assessment was made in accordance with VVS para. 394 and PCP para 184. No comments were received.

**SECTION F. Internal quality control**

The draft verification report that is prepared by verification team is reviewed by an independent technical review team (one or more members) to confirm if the internal procedures established and implemented by ESPL were duly complied with and such opinion/conclusion is reached in an objective manner that complies with the applicable CDM rules/requirements.

The technical review team is collectively required to possess the technical expertise of all the technical area/sectoral scope to which the project activity is related. All members of technical review team are independent of the verification team.

During the technical review process, additional findings may be identified or the closed out findings may be opened, which needs to be satisfactorily resolved before the request for issuance is submitted to UNFCCC. The independent technical reviewer may either approve the report as such or reject/return the same in such case providing the comments/findings/issues that needs to be resolved by the verification team. The decision taken by the technical reviewer is final and is authorized on behalf of ESPL

**SECTION G. Verification opinion**

Earthood Services Private Limited, contracted by Firenze Energética S/A, has performed the independent verification of the emission reductions for the CDM project activity "Santana I SHP CDM Project (JUN 1118)" – Ref.: 2793 – in Brazil, for the monitoring period from 01/11/2010 to 31/10/2017 (including both days) as reported in the Monitoring Report (public) – version 1. Carbotrader Assessoria e Consultoria em Energia Ltda. is responsible for the compilation of data in accordance with the monitoring plan and the reporting of GHG emissions reductions from the project activity.

ESPL commenced the verification based on the baseline and monitoring methodology AMS-I.D – version 13, the monitoring plan contained in the PDD – version 3a<sup>9/</sup>, Monitoring Report (public) – version 1<sup>5/</sup>.

ESPL's verification approach is based on the understanding of the risks associated with reporting of GHG emission data and the controls in place to mitigate these. ESPL planned and performed the verification by obtaining evidence and other information and explanations that ESPL considered necessary to give reasonable assurance that reported GHG emission reductions are fairly stated.

The verification team confirms that:

- the project activity was found completely implemented as per the description given in the registered PDD for the operational period of the PA; and
- the actual operation conforms to the description in the registered PDD.

**SECTION H. Certification statement**

Earthood Services Private Limited, contracted by Firenze Energética S/A, has performed the independent verification of the emission reductions for the CDM project activity "Santana I SHP CDM Project (JUN 1118)" – Ref.: 2793 – in Brazil, for the monitoring period from 01/11/2010 to 31/10/2017 (including both days) as reported in the Monitoring Report (public) – version 1. Carbotrader Assessoria e Consultoria em Energia Ltda. is responsible for the compilation of data in accordance with the monitoring plan and the reporting of GHG emissions reductions from the project activity.

ESPL commenced the verification based on the baseline and monitoring methodology AMS-I.D – version 13, the monitoring plan contained in the PDD – version 3a<sup>9/</sup>, Monitoring Report (public) – version 1<sup>5/</sup>.

ESPL's verification approach is based on the understanding of the risks associated with reporting of GHG emission data and the controls in place to mitigate these. ESPL planned and performed the verification by obtaining evidence and other information and explanations that ESPL considered necessary to give reasonable assurance that reported GHG emission reductions are fairly stated.

In our opinion the GHG emissions reductions reported for the project activity for the period from 01/11/2010 to 31/10/2017 (including both days) are fairly stated in the Monitoring Report (final)<sup>6/</sup>. The GHG emission reductions were calculated correctly based on the baseline and monitoring methodology AMS-I.D – version 13 and the monitoring plan contained in the PDD – version 3a<sup>9/</sup>.

Earthood Services Private Limited is able to certify that the emission reductions from the CDM project activity "Santana I SHP CDM Project (JUN 1118)" – Ref.: 2793 – in Brazil during the period from 01/11/2010 to 31/10/2017 (including both days) amount to 140,602 tCO<sub>2</sub>e.

**Verified and certified emission reductions as per commitment period:**

<b>Commitment period</b>	<b>Amount</b>
Up to 31/12/2012 (1 <sup>st</sup> commitment period)	11,077tCO <sub>2</sub> e
From 01/01/2013 onwards	129,525 tCO <sub>2</sub> e

## Appendix 1. Abbreviations

Abbreviations	Full texts
ABNT	Brazilian Association of Technical Regulation
BE	Baseline Emission
BM	Build Margin
CAR	Corrective Action Request
CCEE	Electric Energy Commercialization Chamber (Government Agency)
CDM	Clean Development Mechanism
CL	Clarification Request
CM	Combined Margin
CME	Coordinating/Managing Entity
CO <sub>2</sub>	Carbon dioxide
CO <sub>2</sub> e	Carbon dioxide equivalent
CP	Crediting Period
DNA	Designated National Authority
DOE	Designated Operational Entity
EB	Executive Board
EIA	Environmental Impact Assessment
EPE	Energy Research Company of the Ministry of Mines and Energy – Brazil
ESPL	Earthood Services Private Limited
FAR	Forward Action Request
GHG	Green House Gas
GSC/GSP	Global Stakeholder Consultation Process
GW	Giga Watt
GWh	Giga Watt hour
IPCC	Intergovernmental Panel on Climate Change
KP	Kyoto Protocol
kW	kilo Watt
kWh	kilo Watt hour
LoA	Letter of Approval/Authorization
MoC	Modalities of Communication
MoV	Means of Validation
MP	Monitoring Plan
MW	Mega Watt
MWh	Mega Watt hour
N <sub>2</sub> O	Nitrous Oxide
OM	Operating Margin
ONS	National System Operator (from Portuguese – Operador Nacional do Sistema)
PA	Project Activity
PCP	Project Cycle Procedure
PDD	Project Design Document
PE	Project Emission
PP	Project Participant
PS	Project Standard
tCO <sub>2</sub> e	Tonnes of Carbon di oxide equivalent
UNFCCC	United Nations Framework Convention on Climate Change
VT	Verification Team
VVS	Validation and Verification Standard

## Appendix 2. Competence of team members and technical reviewers

Competence Statement			
<b>Name</b>	Marcelo Sebben		
<b>Country</b>	Brazil		
<b>Education</b>	M.Sc. (Sustainable Energy System) B. Eng. (Chemical Engineering)		
<b>Experience</b>	11 Years		
<b>Field</b>	Chemical process industry, CDM, Energy, Climate Change		
Approved Roles			
<b>Team Leader</b>	Yes		
<b>Validator</b>	Yes		
<b>Verifier</b>	Yes		
<b>Methodology Expert</b>	Yes (ACM0001, ACM0002, ACM0006, AM0065, AMS ID)		
<b>Local expert</b>	Brazil		
<b>Financial Expert</b>	No		
<b>Technical Reviewer</b>	Yes		
<b>TA Expert</b>	Yes (TA 1.1, 1.2, 5.1, 13.1)		
<b>Reviewed by</b>	Abhishek Mahawar	<b>Date</b>	16/08/2017
<b>Approved by</b>	Ashok Kumar Gautam	<b>Date</b>	16/08/2017

Competence Statement			
<b>Name</b>	Ricardo Lopes		
<b>Country</b>	Brazil		
<b>Education</b>	Technical Diploma in Data Processing		
<b>Experience</b>	12 years		
<b>Field</b>	CDM, Energy, Environment		
Approved Roles			
<b>Team Leader</b>	Yes		
<b>Validator</b>	Yes		
<b>Verifier</b>	Yes		
<b>Methodology Expert</b>	Yes (ACM0001, ACM0002, AM0026, AMS ID, AMS IIH)		
<b>Local expert</b>	Brazil, Argentina, Chile, Colombia, Costa Rica, Dominican Republic, Ecuador, Honduras, Mexico, Nicaragua, Uruguay		
<b>Financial Expert</b>	NO		
<b>Technical Reviewer</b>	Yes		
<b>TA Expert</b>	Yes (1.2, 13.1)		
<b>Reviewed by</b>	Abhishek Mahawar	<b>Date</b>	22/02/2018
<b>Approved by</b>	Ashok Kumar Gautam	<b>Date</b>	22/02/2018

Competence Statement	
<b>Name</b>	Sergio Bonanno Cruz
<b>Country</b>	Brazil

<b>Education</b>	Post Graduate Diploma in Environment		
<b>Experience</b>	21 Years		
<b>Field</b>	Environmental Law, CDM, Energy, Climate Change		
<b>Approved Roles</b>			
<b>Team Leader</b>	Yes		
<b>Validator</b>	Yes		
<b>Verifier</b>	Yes		
<b>Methodology Expert</b>	Yes (ACM0001, ACM0002, AM0026, ACM0006, AMS ID)		
<b>Local expert</b>	Brazil		
<b>Financial Expert</b>	No		
<b>Technical Reviewer</b>	Yes		
<b>TA Expert</b>	Yes (TA 1.2, 13.1)		
<b>Reviewed by</b>	Abhishek Mahawar	<b>Date</b>	16/08/2017
<b>Approved by</b>	Ashok Kumar Gautam	<b>Date</b>	16/08/2017

### Appendix 3. Documents reviewed or referenced

No.	Author	Title	References to the document	Provider
1.	UNFCCC	Standard: CDM PS for PA	version 01.0	Others
2.	UNFCCC	Standard: CDM PCP for PA	version 01.0	Others
3.	UNFCCC	Standard: CDM VVS for PA	version 01.0	Others
4.	UNFCCC	Form: CDM-MR-FORM	version 6.0	Others
5.	PP	Monitoring Report (draft)	version 1 – 10/01/2018	PP
6.	PP	Monitoring Report (revised/final)	version 2 – 22/02/2018 version 3 – 28/02/2018	PP
7.	PP	ER Spreadsheet (draft)	version 1	PP
8.	PP	ER Spreadsheet (revised/final)	version 2	PP
9.	PP	Registered PDD	version 3a – 15/12/2009	Others
10.	UNFCCC	Methodology: AMS-I.D.: Grid connected renewable electricity generation -	Version 13	Others
11.	UNFCCC	- Tool to calculate the emission factor for an electricity system	version 1.1	
12.	ANEEL	- Aneel Generation Database – regarding assured energy of 8.89 MW average		Others

13.	PP	<ul style="list-style-type: none"> <li>- Evidence of Santana I Operation start date – Letter # 7507/2012/DO/CEMAT issued on 10/04/2012 by CEMAT (Concessionary).</li> <li>- Email to CDM Registration informing the start date of operation of the SHP Santana I</li> </ul>	10/04/2012  30/09/2013	
14.	TUV NORD	<ul style="list-style-type: none"> <li>- Validation Report “Santana Project (JUN1118)” issued by TUV-NORD, report # 5891/08 – 08/344</li> </ul>	Revision 2.b - 07/01/2010	
15.	ONS (National Electric System Operator)	<ul style="list-style-type: none"> <li>- Procedure 12.2 from ONS (National Electric System Operator) regulating the accuracy class of the electricity meters</li> <li>- Procedure Submodule 12.3 from ONS (National Electric System Operator) regulating the frequency of calibration (2 years calibration frequency)</li> <li>- New regulation (ONS Grid Procedure, submodule 12.3) issued on 01/01/2017 revision 2016/12 stating that from this date on 5 years calibration frequency is to be applied to electricity meters</li> </ul>		
16.	PP	<ul style="list-style-type: none"> <li>- Reports of electricity generated by the project activity (E-Meter) for all period</li> </ul>		
17.	CCEE	<ul style="list-style-type: none"> <li>- CliqCCEE reports – Official source of electric data used for cross-check electricity measurements</li> </ul>		
18.	EF	<ul style="list-style-type: none"> <li>- Data provided by the Brazilian DNA website regarding the EF<sub>OM-DD,h</sub> and EF<sub>BM,y</sub></li> </ul>	<a href="http://www.mctic.gov.br/mctic/opencms/ciencia/SEPED/clima/textogeral/emissao_despacho.html">http://www.mctic.gov.br/mctic/opencms/ciencia/SEPED/clima/textogeral/emissao_despacho.html</a>	
19.	Schneider	<p><u>Calibration Certificates:</u></p> <p><u>Electricity Meter:</u></p> <ul style="list-style-type: none"> <li>- Main: Serial # PT-1003A493-01 model ION 8600 operated until 08/03/2017 <ul style="list-style-type: none"> <li>o Certificate issued by CEMAT calibrated on 08/11/2011</li> <li>o Cert issued by CEMAT calibrated on 12/03/2013</li> <li>o Cert issued by CEMAT calibrated on 02/03/2015</li> </ul> </li> <li>- Main: Serial # MW-1216A263-02 model ION8650C operated from 09/03/2017 <ul style="list-style-type: none"> <li>o Cert # RCM 1075-17 calibrated on 09/03/2017</li> </ul> </li> <li>- Backup: Serial # PT-1003A532-01 model ION8600C</li> </ul>		



		<ul style="list-style-type: none"> <li>○ Certificate issued by CEMAT calibrated on 08/11/2011</li> <li>○ Certificate issued by CEMAT calibrated on 12/03/2013</li> <li>○ Certificate issued by CEMAT calibrated on 02/03/2015</li> <li>○ Certificate # RCM 1064/17 calibrated on 06/03/2017</li> </ul>		
20.	CEMAT	<u>Electricity meter Change</u> - Email from Energisa (CEMAT) informing the exchange of the main electricity meter Serial # PT-1003A493-01 model ION 8600 by the Serial # MW-1216A263-02 model ION8650C on 09/03/2017		
21.	LIC	- Operational Permit of the SHP Santana I # 316226/2017 issued by SEMA (State Environment Secretariat) - O Operational Permit of the Transmission line 34.5 kV SE Nortelândia # 314874/2017 issued by SEMA (State Environment Secretariat) - Localization and operation Permit issued by Municipality of Nortelândia # 80/2017	Validity: 14/12/2022  Validity: 21/05/2020  Validity: 31/12/2017	
22.	SEMI	<u>Manuals:</u> - Operation and Maintenance Manual of Turbine issued by SEMI # 1206-81-00-000 on 18/04/2012		PP
23.	PP	<u>Monthly Maintenance LogBook</u>	Jan/2018	
24.	PP	<u>Trainings and Duties of Personnel:</u> - SHP Automation Course – Magno Mafre - ElectroTechnical Course – Edicleia dos Santos Silva	20/07/2004  2017	PP
25.	PP	- ER calculation Spreadsheet	version 1: 10/01/2018 version 2: 22/02/2018	
26.	PP	- CERs Comparison.xls	28/02/2018	
27.	-	DNA of Brazil	<a href="http://www.mct.gov.br">http://www.mct.gov.br</a>	Other
28.	ANEEL	ANEEL – National Agency of Electric Energy	<a href="http://www.aneel.gov.br">www.aneel.gov.br</a>	
29.	IPCC	IPCC publications	<a href="http://www.ipcc-nggip.iges.or.jp">www.ipcc-nggip.iges.or.jp</a>	Other
30.	UNFCCC	UNFCCC	<a href="http://cdm.unfccc.int">http://cdm.unfccc.int</a>	Other

## Appendix 4. Clarification requests, corrective action requests and forward action requests

Table 1. Remaining FAR from validation and/or previous verifications

<b>FAR ID</b>	01	<b>Section no.</b>	E.2	<b>Date</b>	:07/01/2010
<b>Description of FAR</b>					
The installed capacity of the project (i.e. the effective power of the generators) shall be verified in order to ensure that it will not exceed the 15MW limit for small scale CDM project.					
<b>Project participant response</b>					<b>Date</b> :22/02/2018
Since the equipment are installed in the SHP Powerhouse, the technical data are promptly available through the plaques and also technical catalogue from the equipment (turbines and generators).					
<b>Documentation provided by project participant</b>					
Equipment plates evidenced during site visit					
<b>DOE assessment</b>					<b>Date:</b> 26/02/2018
During site visit the verification team had access to all equipment plates and it could be observed that the installed capacity of the SHP is 14.758 MW, below the threshold of 15 MW					
<b>FAR is closed</b>					

Table 2. CL from this verification

<b>CL ID</b>	01	<b>Section no.</b>	E.1	<b>Date</b>	:22/02/2018
<b>Description of CL</b>					
Information regarding ERs achieved during monitoring period were not informed in section A.1 of the MR as required by the Instructions for completing the MR.					
<b>Project participant response</b>					<b>Date</b> : 22/02/2018
The information regarding ERs achieved during monitoring period were informed in section A.1 of the MR version 2.					
<b>Documentation provided by project participant</b>					
MR version 02 (evidence # 6)					
<b>DOE assessment</b>					<b>Date:</b> 26/02/2018
The information was duly included in the MR section A.1					
<b>CL is closed</b>					

<b>CL ID</b>	02	<b>Section no.</b>	E.6.1	<b>Date</b>	:22/02/2018
<b>Description of CL</b>					
It has been observed that the electricity measurements were not performed between 01/11/2010 and 09/04/2012 and no justification has been given					
<b>Project participant response</b>					<b>Date</b> : 22/02/2018
Due to the project implementation delay (during the construction phase), the SHP only become operational on 10/04/2012. This date can be checked in the document "Letter N# 7507/2012/DO/CEMAT" from CEMAT company (the local energy distributor). Accepting the SHP Commercial Operation.					
<b>Documentation provided by project participant</b>					
Evidence #13					
<b>DOE assessment</b>					<b>Date:</b> 26/02/2018
In order to deal with this missing measurements, the PP requested a temporary deviation from the start of the crediting period (01/11/2010) until 09/04/2012, which is the previous day to the SHP start of operation. Complete assessment of this deviation can be observed in the Post registration changes form attached to this Verification Report. However, detailed description of temporary deviation and exact extent (start and end dates) were not informed as required by the instructions for completing the MR.					
<b>CL remains open</b>					
<b>Project participant response (2<sup>nd</sup> round)</b>					<b>Date</b> : 28/02/2018
The exact extent of the crediting period was informed in the MR version 3					
<b>Documentation provided by project participant</b>					

MR ver 3	
<b>DOE assessment</b>	<b>Date:</b> 01/03/2018
<p>As per instructions for completing the MR, the PP informed the start and end date of the temporary deviation requested. Moreover, the PP informed that during this deviation request no CERs were required. A full assessment of this deviation, taking into account the PS and VVS requirements can be seen in the Validation of Post Registration Changes report attached to this report. It is important to point out that this deviation was requested as the PP did not have the intention of postpone the start date of crediting period.</p>	
<b>CL was closed</b>	

<b>CL ID</b>	03	<b>Section no.</b>	E.8.5 and E.8.6	<b>Date :</b> 28/02/2018
<b>Description of CL</b>				
<p>1- MR front page and section E.5. The comparison between estimated ERs and actual ERs achieved in the monitoring period are not considering the same period as the start date of the project activity does not coincide with the start date of the crediting period.</p> <p>2- Moreover in MR Section E.6, the reasons for the increase in the actual ERs are inconsistent with the actual increase, as applying the percentages of decrease of generation and increase in the value of EF.</p>				
<b>Project participant response</b>				<b>Date :</b> 28/02/2018
<p>1- The comparison between ex-ante and ex-post ERs were provided in the MR revision 3 taking into consideration the same start date for the crediting period (10/04/2012 until 31/10/2017).</p> <p>2- The reasons for the increase in the ex-post ERs were provided accordingly in the MR version 3. For the period between 10/04/2012 until 31/10/2017 due to late shp operation start.</p>				
<b>Documentation provided by project participant</b>				
MR ver 3 CERs comparison.xls				
<b>DOE assessment</b>				<b>Date:</b> 01/03/2018
<p>1- The value informed as estimated CERs was accounted taking into consideration only CERs estimated during the same period while the SHP operated in the monitoring period. Although the MP started on 01/11/2010, the project activity started its operation only on 10/04/2012. It was done in order to allow a fair comparison between the estimated and the achieved CERs. It goes in accordance with "instructions for completing the MR" where it says: "(...) provide the total amount in tonnes of CO2 equivalent based on the ex-ante estimation in the PDD, with adjustment for the comparable period, as appropriate". The verification team considers the adjustment of the comparison period appropriate.</p> <p>2- The PP provided a spreadsheet where it was compared the estimated CERs with the actual achieved ones. It could be observed that the main reason for increasing the achieved CERs was due to the increase in 119.5% of the Grid Emission Factor value (or 219% higher than the estimated value). Moreover, the parameter that are under PP's control is the electricity generated. It was demonstrated that for the same period, it was reduced in aprox. 21% (or the real value was 79% of the estimated value). Thus, it is concluded that the PP did not underestimate the Project Activity's generation, but the CERs' increase occurred due to an increase of a parameter that is not under the PP's control.</p> <p>In order to justify this increase, by multiplying these percentages, 79% x 219% we will have a real value equal to 173% of the estimated value, or 73% higher. This values were all included in the section E.6 of the MR.</p>				
<b>CL was closed</b>				

<b>CL ID</b>	04	<b>Section no.</b>	E.6.1	<b>Date :</b> 28/02/2018
<b>Description of CL</b>				

MR Section D.1: the PP states wOM and wBM as fixed parameters. However it is not in accordance with registered PDD.	
<b>Project participant response</b>	<b>Date :</b> 28/02/2018
The D.1 section was adjusted accordingly in the MR version 3 (All data and parameters used in the baseline emission calculation was monitored).	
<b>Documentation provided by project participant</b>	
MR ver 3	
<b>DOE assessment</b>	<b>Date:</b> 01/03/2018
The monitoring plan is now in accordance with the registered PDD.	

Table 3. CAR from this verification

<b>CAR ID</b>	01	<b>Section no.</b>	E.6.2 and E.8.1	<b>Date :</b> 22/02/2018
<b>Description of CAR</b>				
It has been observed that the EF <sub>OM-DD</sub> in 2017 was not calculated as per applied tool for calculating emission factor of an electricity system version 1.1.				
<b>Project participant response</b>				<b>Date :</b> 22/02/2018
The EF <sub>CM</sub> 2017 was adjusted accordingly in the MR version 2 and also the CERs spreadsheet calculation				
<b>Documentation provided by project participant</b>				
Data provided by Brazilian DNA and ER calculations (evidences #18 and #25)				
<b>DOE assessment</b>				<b>Date:</b> 26/02/2018
According to the applied tool for calculating emission factor for an electricity system, "For the dispatch data analysis OM, use the year in which the project activity displaces grid electricity and update the emission factor annually during monitoring." Then, in order to calculate the EF <sub>OM-DD</sub> for the PA, the PP used values for EF <sub>EL</sub> and EG <sub>Grid</sub> for each hour which the SHP displaced electricity, as per formula 9 of the applied tool. For calculation of EF <sub>BM</sub> , the applied tool states: "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, <u>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</u> ". Thus, considering that EF <sub>BM</sub> for 2017 was not available, the PP applied EF <sub>BM</sub> of 2016 for calculating the EF <sub>CM</sub> for the year 2017. The verification team considers that this approach is in accordance with the provisions of the applied tool and monitoring plan.				
<b>CAR is closed</b>				

Table 4. FAR from this verification

<b>FAR ID</b>	XX	<b>Section No.</b>		<b>Date:</b> DD/MM/YYYY
<b>Description of FAR</b>				
N/A				
<b>Project participant response</b>				<b>Date:</b> DD/MM/YYYY
<b>Documentation provided by project participant</b>				
<b>DOE assessment</b>				
<b>Date:</b> DD/MM/YYYY				