



**Monitoring report form for CDM programme of activities  
(Version 02.0)**

**MONITORING REPORT**

<b>Title of the PoA</b>	Tunki Small Scale Hydropower Program of Activities	
<b>UNFCCC reference number of the PoA</b>	6198	
<b>Version numbers of the PoA-DD applicable to this monitoring report</b>	5	
<b>Version number of this monitoring report</b>	1	
<b>Completion date of this monitoring report</b>	23/01/2018	
<b>Monitoring period number</b>	Fourth	
<b>Duration of this monitoring period</b>	01/11/2016-31/12/2017 (including both dates)	
<b>Monitoring report number for this monitoring period</b>	1	
<b>Coordinating/managing entity</b>	Carbonbay GmbH & Co. KG	
<b>Host Parties</b>	Host Party of the PoA	Is this the host Party of a CPA covered in this monitoring report? (yes/no)
	Peru	Yes
<b>Sectoral scopes</b>	1	
<b>Applied methodologies and standardized baselines</b>	Methodology AMS-I.D. ver. 17 – Grid connected renewable electricity generation	
<b>Amount of GHG emission reductions or net anthropogenic GHG removals achieved by all CPAs covered in this monitoring report in this monitoring period</b>	Amount achieved before 1 January 2013	Amount achieved from 1 January 2013
	N.A.	19523
<b>Amount of GHG emission reductions or net anthropogenic GHG removals estimated ex ante for this monitoring period in the CPA-DDs for the CPAs</b>	54598	

covered in this monitoring report

## PART I Monitoring of programme of activities (PoA)

### SECTION A. Description of PoA

#### A.1. General description of PoA

The Tunki Small Scale Hydropower Program of Activities aims the development of a series of grid connected small hydroelectric projects in Peru.

The Tunki PoA supports the development of new small scale hydropower projects in Peru connected to the Peruvian National Electricity Grid (SEIN). Each small-scale CDM Program Activity (referred to as CPA) under this PoA comprises one or more hydropower plant projects having a combined installed capacity of no more than 15 MW in the case of new facilities or a capacity addition, replacement or retrofit<sup>1</sup> of no more than 15 MW for the total plant capacity in the case of existing facilities, considering the threshold for small-scale CDM projects. This PoA is a voluntary action being coordinated and managed by Carbonbay GmbH & Co. KG.

#### A.1.1. Corresponding generic component project activities (CPAs)

Title and reference number of the corresponding generic CPA	Version of the PoA-DD	Sectoral scopes	Applied methodologies and standardized baselines
Hydro Power Plant– Tunki PoA CPA #, version 1.0*	5	1	AMS-I.D. ver. 17– Grid connected renewable electricity generation Tool to calculate the emission factor for an electricity system. Version 0.2.2.1

#### A.1.2. CPAs included in the PoA

Title and UNFCCC reference number of the CPA	Title and reference number of the corresponding generic CPA	Version of the PoA-DD	Crediting period type and duration	Covered in this monitoring report? (yes/no)
6198-0001	Hydro Power Plant–Tunki PoA CPA #, version 1.0	5	19/09/2013-18/09/2020	Yes
6198-0002	Hydro Power Plant–Tunki PoA CPA #, version 1.0	5	13/12/2014-12/12/2021 (change requested to 01/01/2015 to 31/12/2021)	Yes
6198-0003	Hydro Power Plant–Tunki PoA CPA #, version 1.0	5	15/02/2015-14/02/2022 (change requested to 01/06/2015-31/05/2022)	Yes
6198-0004	Hydro Power Plant–Tunki PoA CPA #, version 1.0	5	01/10/2016-30/09/2023	No

**A.2. Coordinating/managing entity**

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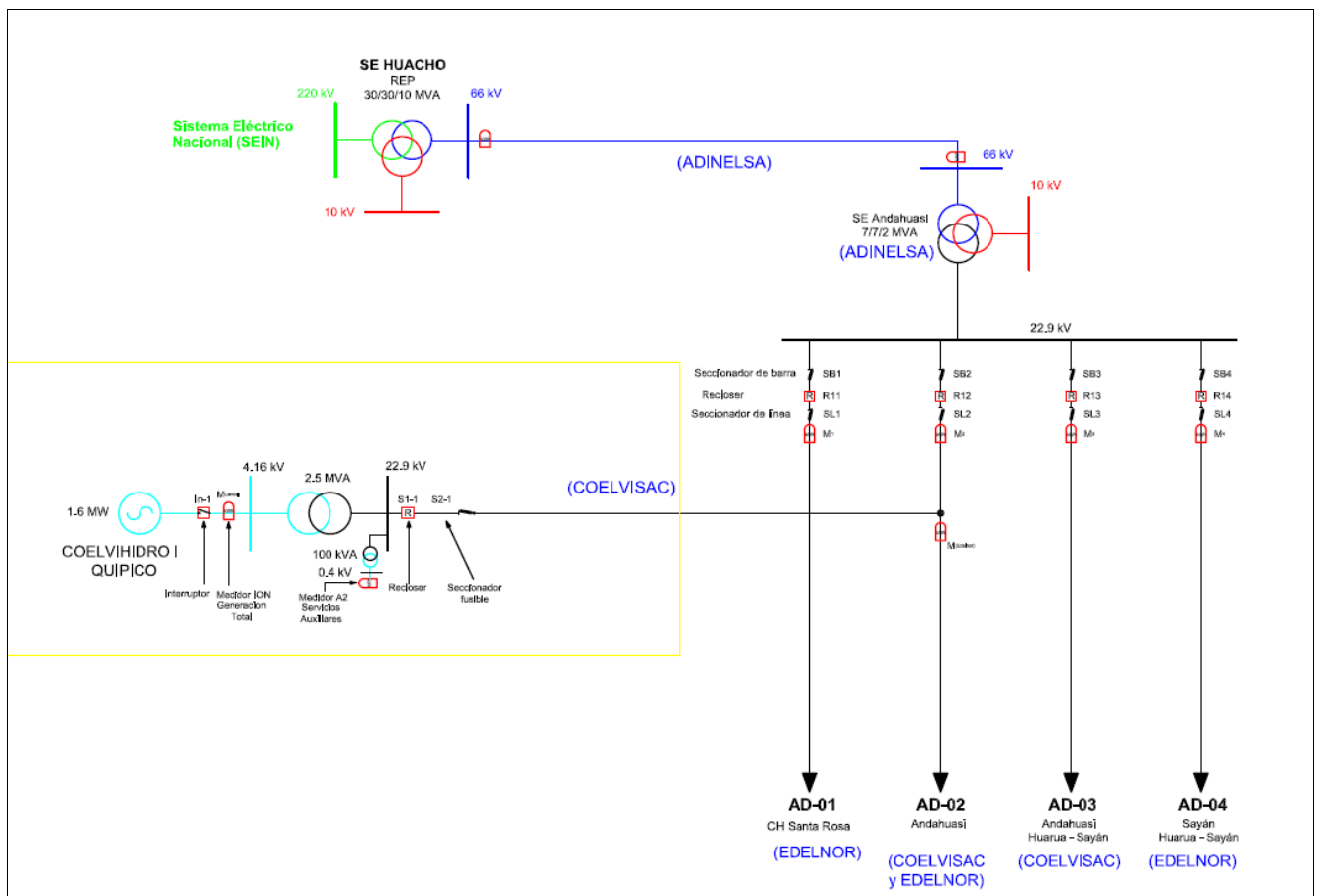
**SECTION B. Implementation of PoA**

**B.1. Description of implemented PoA**

In general, there has not been any event during the monitoring period that affects the applicability of the methodology in any of the CPAs requesting emission reductions. Implementation of the CPA has been performed as follows:

6198-0001: The starting date of the CPA is set as per 23/08/2011, the date of the land acquisition contract and approval to support the irrigation channel rehabilitations. The delivery of electricity to the national grid started on 19/09/2013. The monitoring period of the CPA has been changed to 19/09/2013-18/09/2020.

Line diagram with the connection of the project to the grid is presented below:



Note: The line diagram is taken from original documentation, there are phrases in Spanish that can be translated as follows:

Sistema Eléctrico Nacional: National Electricity System.

Interruptor: Switch.

Medidor ION Generación Total: Meter ION- total generation.

Medidor A2 Servicios Auxiliares: Meter A2 for auxiliary services.

Seccionador fusible: Fuse disconnecter.

Seccionador de barra: Bus taps disconnectors.

Seccionador de línea: Feeder disconnecter.

At the site the following class 0.2 meter are present-

Meter 1 - main meter recording the electricity generation data

Power Logic TM

ION 7550

Serial number: MI-1206A729-03

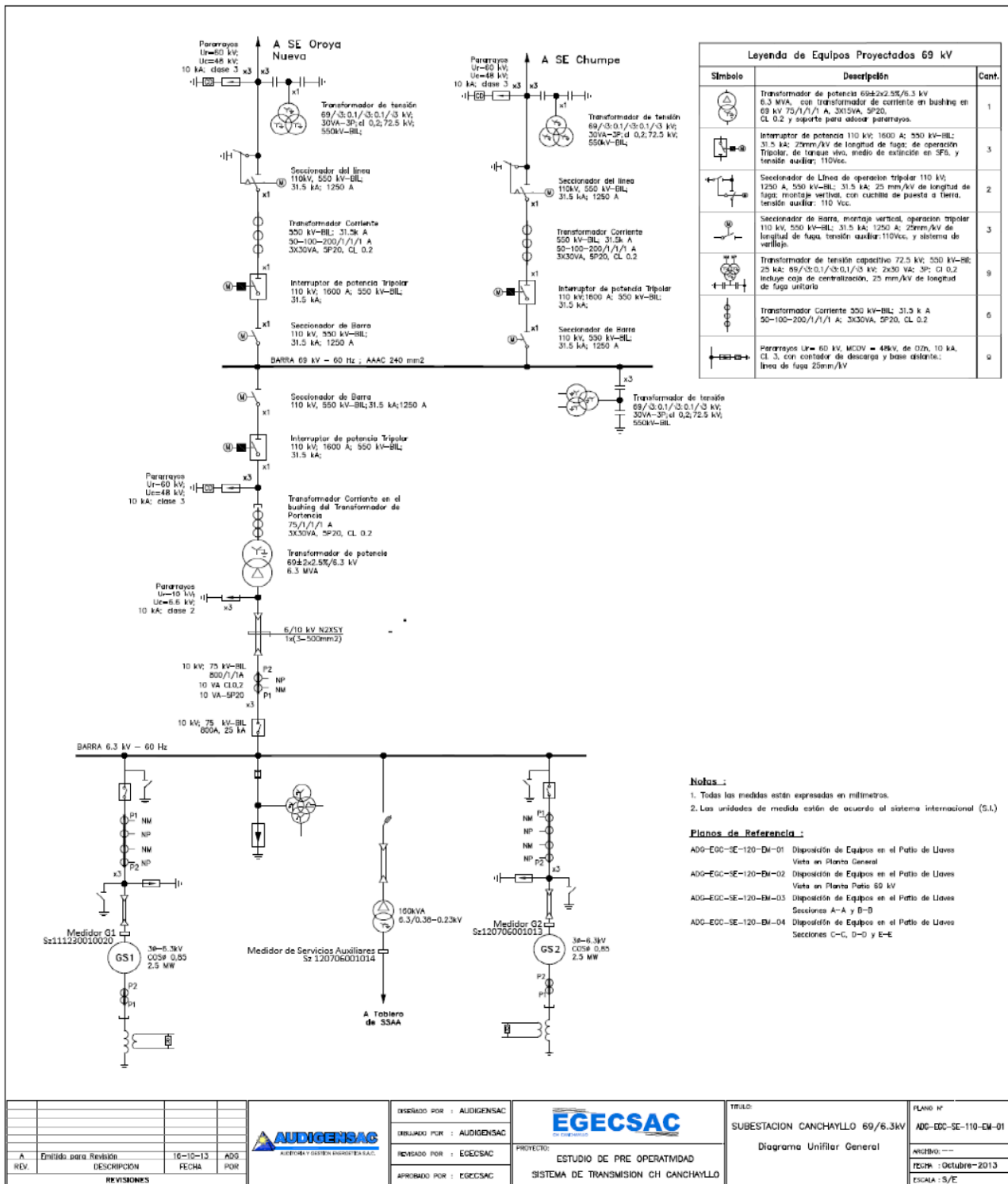
Meter 2 - this meter records the data for electricity consumption:

Elster Alpha Plus A2

Serial Number: 16318318

6198-0002: The starting date of the CPA is set as 12/11/2012, date in which the contract with the equipment supplier was signed. The delivery of electricity to the national grid started on 01/01/2015.

Line diagram with the connection of the project to the grid is presented below:



At the site the following class 0.2 meter are present-  
6198-0002:

Harbin Mechanical – this meter records the electricity generation data for turbine G1  
 Model : HB3300  
 Serial Nr.: Sz111230010020  
 Class: 0.2

Harbin Mechanical - this meter records the electricity generation data for turbine G2

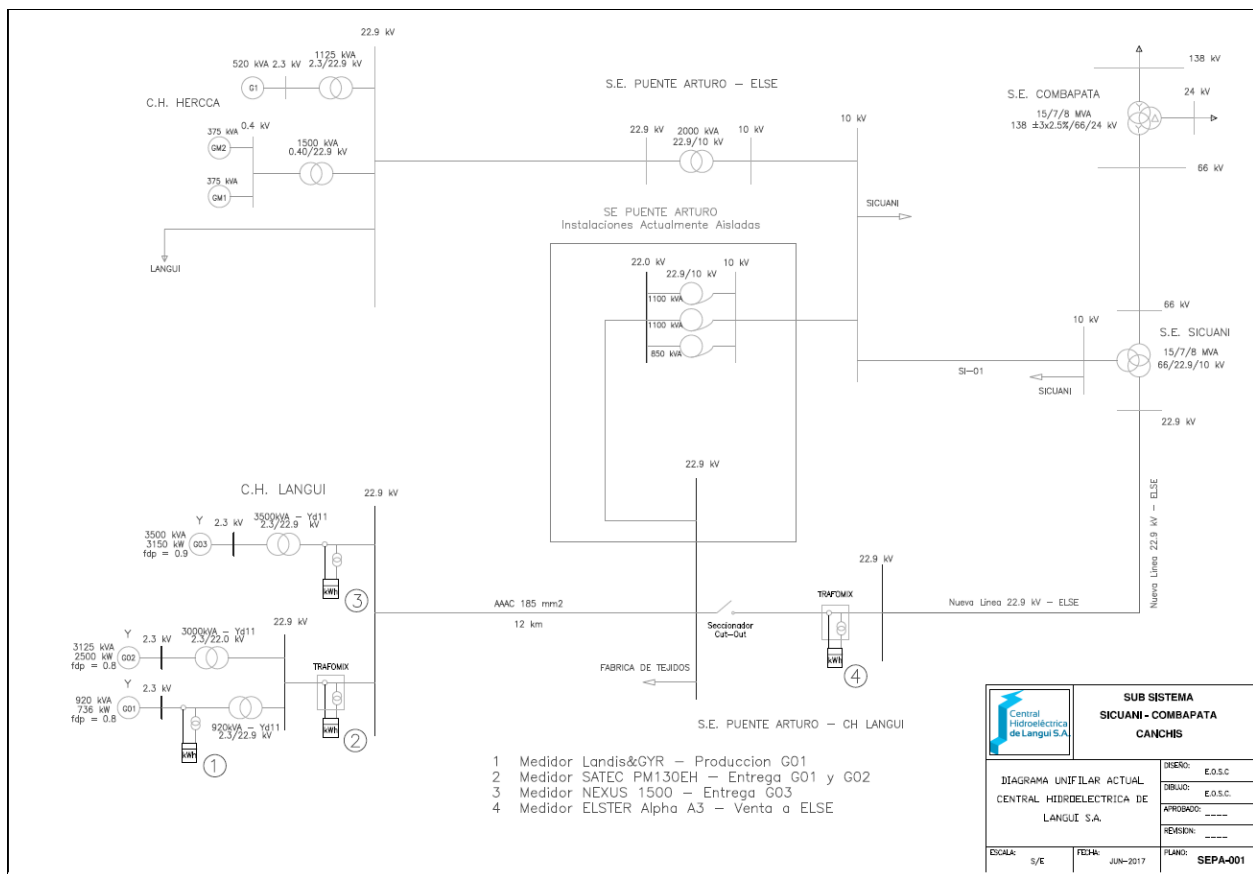
Model : HB3300  
 Serial Nr.: Sz120706001013  
 Class: 0.2

Harbin Mechanical – this meter records the data for auxiliary consumption

Model : HB3300  
 Serie : Sz120706001014  
 Class: 0.2

6198-0003: The starting date of the CPA is set as 19/11/2013, date in which the contract for financial support was signed. The delivery of electricity to the national grid started on 16/06/2015.

The project supplies the energy generated to the national Peruvian electricity grid.  
 Line diagram with the connection of the project to the grid is presented below:



At the site the following class 0.2 meter are present –  
 SE Puente Arturo 10 kV Schlumberger SV3AT meter- – this meter records the data at the substation Puente Arturo  
 Serial number: 01231458  
 Since 14 November 2016 Schlumberger SV3AT meter is replaced by ELSTER ALPHA A3 meter to record the data at the substation Puente Arturo  
 Serial number: 13443767  
 (The calibration of both these meters is under the control of the grid authority)

Nexus 1500– this meter records the data for the generator 3  
 Serial Nr: 148-0132929430

New device installed on 16/06/2015

## **B.2. Post-registration changes to PoA**

### **B.2.1. Corrections**

No corrections have been made in the PoA DD.

### **B.2.2. Inclusion of monitoring plan**

N.A.

### **B.2.3. Permanent changes to the registered monitoring plan, or permanent deviation of monitoring from the applied methodologies, standardized baselines, or other applied standards or tools**

N.A.

### **B.2.4. Changes to programme design**

N.A.

## **PART II Monitoring of CPAs**

### **SECTION C. Implementation of CPAs**

#### **C.1. Description of implemented CPAs**

All CPAs belonging to the Tunki PoA are small scale hydro power projects located in Peru.

6198-0001:

(a) Purpose of the specific-case CPA(s) and the measures taken for GHG emission reductions or net GHG removals by sinks;

The proposed CDM Programme Activity Quipico Hydro Power Plant is a run of river power plant with an installed capacity of 1.68 MW which is connected to the national Peruvian electricity grid (SEIN), where the generated electricity is delivered and the GHG emissions are reduced.

(b) Description of the technology employed and installed equipment and/or infrastructure, including information requested by the eligibility criteria;

The project uses a horizontal Francis turbine for a net height of 28 m and 7 m<sup>3</sup>/s water flow. The power plant uses the water flow from the Quipico irrigation channel for generation. After being turbinated, the water is discharged to the same channel, where it is further used for irrigation purposes.

(c) Relevant dates for the specific-case CPA(s) (e.g. construction, commissioning, continued Operation periods, etc.);

The starting date of the CPA is set as per 23/08/2011; the date on which the land acquisition contract and approval to support the irrigation channel rehabilitations was signed. The project has been delivering electricity to the national grid starting from 19/09/2013.

(d) Total GHG emission reductions or net GHG removals by sinks achieved in this monitoring period for the specific-case CPA(s), including information on how double counting is avoided.

During the presented monitoring period from 01/11/2016 to 31/12/2017, the project has generated a total of 9360.79 MWh of electricity, which represents a reduction of 4734 tCO<sub>2</sub>e for the presented monitoring period.

6198-0002:

(a) Purpose of the specific-case CPA(s) and the measures taken for GHG emission reductions or net GHG removals by sinks;

The proposed CDM Programme Activity (CPA) "Canchayllo Hydro Power Plant" is a new small scale run of river power plant with an installed capacity of 5.264 MW. The generated electricity is delivered to the Peruvian electricity grid (SEIN), reducing GHG emissions.

(b) Description of the technology employed and installed equipment and/or infrastructure, including information requested by the eligibility criteria;

The power plant consists of two (2) Francis horizontal axis turbines, each one with a capacity of 2,632.0 KW installed. The design flow is 7 m<sup>3</sup>/s, the net head is 83.12 m.

(c) Relevant dates for the specific-case CPA(s) (e.g. construction, commissioning, continued operation periods, etc.);

The starting date of the CPA is set as per 12/11/2012, the date, on which the contract with the equipment supplier was signed. The delivery of electricity to the national grid started on 01/01/2015.

(d) Total GHG emission reductions or net GHG removals by sinks achieved in this monitoring period for the specific-case CPA(s), including information on how double counting is avoided.

During the presented monitoring period from 01/11/2016 to 31/12/2017, the project has generated a total of 30750.44 MWh of electricity, which represents a reduction 14789 tCO<sub>2</sub>e for the presented monitoring period.

6198-0003:

(a) Purpose of the specific-case CPA(s) and the measures taken for GHG emission reductions or net GHG removals by sinks;

The proposed Component Project Activity (CPA) is a capacity expansion of a 3.39 MW small-scale run of the power plant to 6.54 MW. The generated electricity is delivered to the national grid, reducing GHG emissions.

(b) Description of the technology employed and installed equipment and/or infrastructure, including information requested by the eligibility criteria;

The existent power plant, named Langui I, consist of two (2) Francis horizontal axis turbines of 787.89 kW and 2,604 kW respectively. Langui II consists of 1 Francis turbine with an installed capacity of 3.15 MW. The design flow is 3 m<sup>3</sup>/s and a net head of 115.70 m. The water is taken from the same source of Langui I, the Langui Layo lagoon, start of the Hercca River, after optimization works performed at the water intake constructions.

(c) Relevant dates for the specific-case CPA(s) (e.g. construction, commissioning, continued operation periods, etc.);

The starting date of the CPA is set as per 19/11/2013, the date, on which the contract for financial support was signed. The delivery of electricity to the national grid started on 16/06/2015.

(d) Total GHG emission reductions or net GHG removals by sinks achieved in this monitoring period for the specific-case CPA(s), including information on how double counting is avoided.

During the presented monitoring period from 01/11/2016 to 31/12/2017, the project has generated 22524.96 MWh electricity, which represents a reduction of 0 tCO<sub>2</sub>e for the presented monitoring period due to the calculations applicable for capacity extension CDM project activities. Please see section H.1 for further details.

## C.2. Location of CPAs

The boundaries of the programme are the host country Peru. The location of each CPA included in this monitoring period are:



6198-0001: Coelvihidro 1 Hydro Power Plant, Quipico – Tunki PoA CPA # 1

The location of the project is in the km 31.5 of the Huaura- Sayan road, San Miguel community, district of Sayan, province of Huaura, department of Lima, Peru.

The project coordinates are:

Item	Location (decimals)
Power house	-11.11781423, -77.31547914
Water intake	-11.11887526, -77.31617381
Water devolution	-11.11766695, -77.33569134

6198-0002: Chancayllo Hydro Power Plant, Pachacayo – Tunki PoA CPA #2

The project is located at 15 km from Pachacayo, in the Pachacayo river basin, 230 km from Lima (Central Road to Pachacayo – Canchayllo), Junín Province. 3,700 m above sea level (average), Peru.

The project coordinates are:

Item	Location (decimals)
Power house	-11.815278, -75.724167
Water intake	-11.815278, -75.724167
Water devolution	-11.848611, -75.746389

6198-0003: Langui II Hydro Power Plant, Hercca – Tunki poA CPA #4

The location of the project is the district of Langui, province of Canas, Cusco, Peru.

The project coordinates are:

Item	Location (decimals)
Power house	-14.355278, -71.295833
Water intake	-14.357222, -71.313333
Water devolution	-14.354722, -71.295833

**Figure 1: Location of power houses described above**



### C.3. Post-registration changes to CPAs

#### C.3.1. Temporary deviations from the monitoring plans in the included CPA-DDs, applied methodologies or standardized baselines

N.A.

#### C.3.2. Corrections

No corrections have been made to the CPA DD.

#### C.3.3. Changes to the start date of the crediting period

A change to the start of the crediting period for the CPA 6198-0002 has been requested on 23/11/2015. The new start date of the crediting period is:

6198-0002: Crediting Period changed from 13/12/2014-12/12/2021 to 01/01/2015-31/12/2021

[https://cdm.unfccc.int/ProgrammeOfActivities/cpa\\_db/RFPBQX5AUOS820HIE3T1M6Y4NWD9LV/view](https://cdm.unfccc.int/ProgrammeOfActivities/cpa_db/RFPBQX5AUOS820HIE3T1M6Y4NWD9LV/view)

A change to the start of the crediting period for the CPA 6198-0003 has been requested on 23/11/2015. The new start date of the crediting period is:

6198-0003: Changed from 15/02/2015 to 01/06/2015. The request for change of start date has been approved, please check the UNFCCC link below for more details.

[https://cdm.unfccc.int/ProgrammeOfActivities/cpa\\_db/6YZDI30FVUS5KNXHA7LMB8O9JGPQEC/view](https://cdm.unfccc.int/ProgrammeOfActivities/cpa_db/6YZDI30FVUS5KNXHA7LMB8O9JGPQEC/view)

#### C.3.4. Inclusion of monitoring plan

N.A.

**C.3.5. Permanent changes to the included monitoring plans, or permanent deviation of monitoring from the applied methodologies, standardized baselines, or other applied standards or tools**

N.A.

**C.3.6. Changes to project design**

N.A.

**SECTION D. Description of monitoring system of CPAs**

**1. Management Structure and Responsibilities**

The CPA owner is the overall responsible for daily monitoring and reporting of net electricity generation and has the obligation to follow the PoA requirements in its local management system. The manager of the proposed project is the responsible person for reporting the monitoring data in a monthly basis and assure the correct maintenance and operation of the measuring and monitoring equipment, including the existence of appropriate calibration certificates. In the case of the Quipico HEPP project, all information is sent to the central offices in Lima and prepared for reporting.

**Data Collection:** The electricity supplied by the project activity to the grid is measured by calibrated electricity meters. The parameter is monitored at the project site and/or at the substation and crosschecked with the internal data of electricity commercialized. Data is monitored continuously, recorded hourly and consolidated in a monthly basis as required by the applicable methodology.

For 6198-0001 applies:

Cross-check value: The meter readings (electricity export and import) from Quipico will be cross-checked with the result of the following energy balance calculation, using data from installed electricity meters at the consumption or generation points before the connection to the El Huacho substation: Dispatch data provided by COEs at the substation of El Huacho plus direct electricity consumption by households and industry before the substation minus the total delivery to the substation by other generators.

In case a cross check value showing a technical malfunction of the monitoring meters, the electricity supplied to the grid will be considered 0 until the confirmation of correct functioning of the installed meters at Quipico.

This situation did not apply for the current monitoring period.

For 6198-0002: The net electricity generated by the project activities can be crosschecked with monthly invoices available.

For 6198-0003: The net electricity delivered to the grid in the substation can be crosschecked with the sum of the net electricity generated monitored at each of the 3 generation units.

**Data Recording:** All data collected is recorded monthly into an electronic spreadsheet.

**Data Calibration:** All measurements are conducted with equipment certified (or complying) to national or IEC standards and calibrated according to the national standards and reference points or IEC standards and recalibrated at appropriate intervals according to manufacturer specifications, but at least once in three years.

**Data Report:** The information of the electricity generation and the electricity consumption of the plant are downloaded from the meters and reported to the central office in Lima. The monthly values are copied in an excel sheet and provided to the managing entity upon request.

Cross Check for 6198-0001: The CDM manager prepares also the monthly cross check, based on dispatch data provided by COEs at the substation of El Huacho plus direct electricity consumption

by households and industry before the substation minus the total delivery to the substation by other generators.

**Data Archives:** The data recording, the data report and the invoices are archived, together with this monitoring plan. All data collected as part of monitoring should be archived electronically and be kept at least for 2 years after the end of the last crediting period or the last issuance of CERs, whichever occurs later. The coordinating/managing entity is also keep a copy of this data for at least 2 year after the end of the last crediting period or the last issuance of CERs, whichever occurs later.

## **2. Data Quality Assurance and Control**

Measured energy data will come from equipment complying with national or IEC regulations/standards. At the moment of submitting the PoA-DD, energy meters shall be at least with a precision class of 0.2. An internal procedure to secure the correctness of data is employed. Data and reports are checked internally to secure correctness of data. In case of mistakes, corrective actions are applied to avoid future similar mistakes. The maintenance of the equipment and the overall responsibility of the correct function of the plant is done by the plant manager located directly at the site. No relevant problems occurred during the monitoring period.

## **3. Training and Monitoring Personnel**

All people that participate in the monitoring process are suitably qualified and trained in the operation and maintenance of the plant. Training evidences are stored by the CDM manager.

## **4. Emission factor calculation**

The combined margin emission factor used in the emission reduction calculation is the annually updated factor provided by the coordinating/managing entity. The emission factor is updated using information published by the local authorities or sent after a formal request (the case for 15 minute generation data per power plant/unit). The spreadsheets used in the calculation of the 2010 emission factor (submitted for evaluation during the PoA registration) is updated each year when all the required information is available (this should be no later than every June). An internal report of the coordinating/managing entity will register the format, source of data, new power plants in the system and any other change in the process or data used in the grid emission factor calculation.

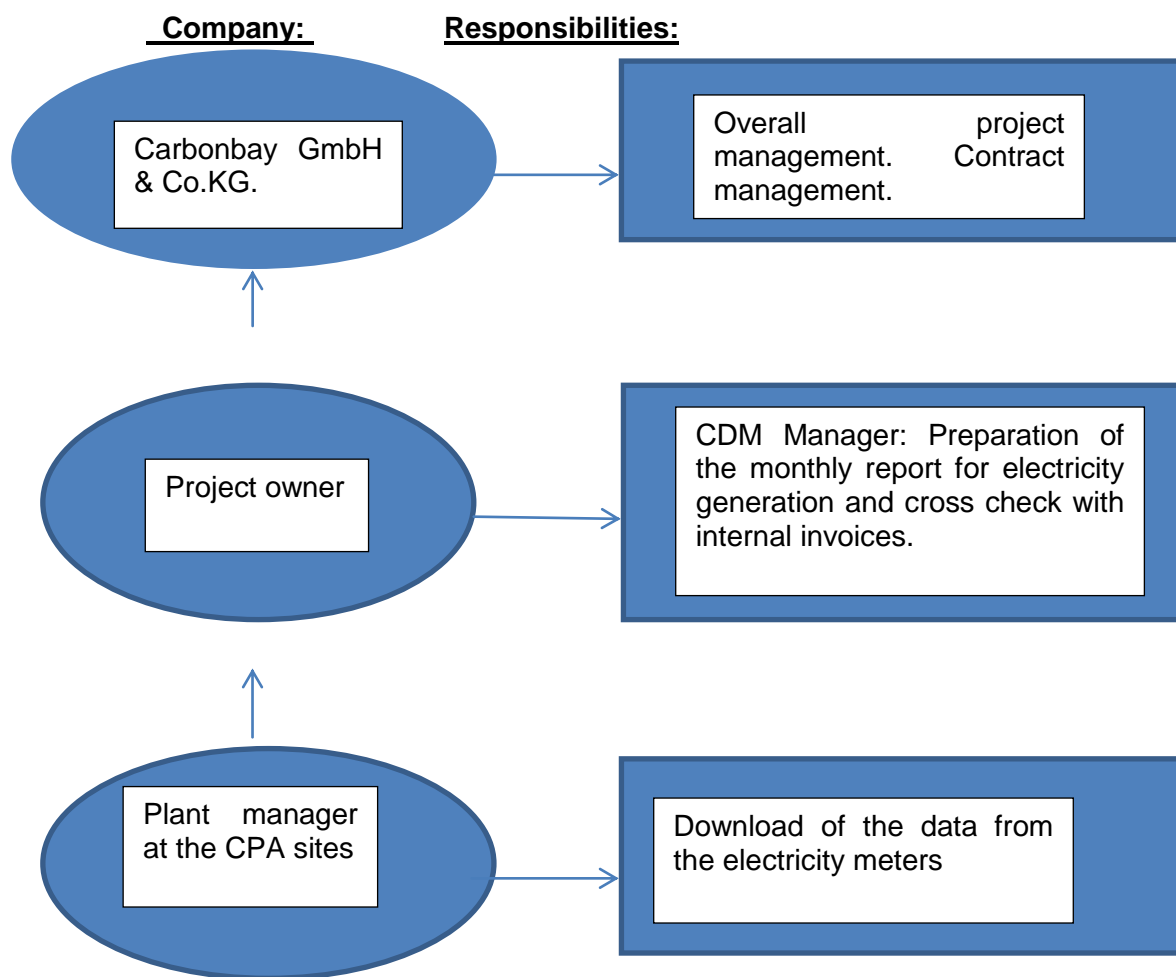
## **5. Verification and Monitoring Results**

The monitoring report will be prepared by the coordinating/managing entity. It contains the data report, the emission factor calculation and the results of the emissions reductions of the project for a certain period.

### **Leakage monitoring:**

No energy generating equipment is transferred from another activity developed in a non-Annex 1 Parties to this project and there is no existing equipment to be transferred to another activity. According to the "*General Guidelines to SSC methodologies*" version 17 (EB 61; Annex 21 paragraph 15) "In case where leakage is to be considered, shall only considered within the boundaries of non-Annex 1 Parties." The project activity involves electricity generation from hydro sources. The employed hydro energy generators can only convert hydro energy into electrical energy and cannot use any other input fuel for electricity generation. Thus, in no ways and means is required to monitor leakage from any project activity.

**GHG Data Management and responsibilities:**



**SECTION E. Data and parameters**

**E.1. Data and parameters fixed ex ante**

6198-0001 –

<b>Data/parameter</b>	EF <sub>grid, BM, y</sub>
Unit	tCO <sub>2</sub> /MWh
Description	The build margin emissions factor
Source of data	Official data provided by the administrator of the grid or the relevant national authority (COES) publicly available in its web site or directly sent to the coordinating/managing entity.
Value(s) applied	0.56934
Choice of data or measurement methods and procedures	Based on official information and PoA guidelines.
Purpose of data	Calculation of baseline emissions.
Additional comments	Data will be kept for two years after the end of the crediting period or the last issuance of CERs for this project activity, whatever occurs later.

6198-0002:

<b>Data/parameter</b>	$EF_{grid,BM,y}$
Unit	tCO <sub>2</sub> /MWh
Description	The build margin emissions factor
Source of data	Official data provided by the administrator of the grid or the relevant national authority (COES) publicly available in its web site or directly sent to the coordinating/managing entity.
Value(s) applied	0.52487
Choice of data or measurement methods and procedures	Based on official information and PoA guidelines.
Purpose of data	Calculation of baseline emissions.
Additional comments	Data will be kept for two years after the end of the crediting period or the last issuance of CERs for this project activity, whatever occurs later.

6198-0003:

<b>Data/parameter</b>	$EF_{grid,BM,y}$
Unit	tCO <sub>2</sub> /MWh
Description	The build margin emissions factor
Source of data	Official data provided by the administrator of the grid or the relevant national authority (COES) publicly available in its web site or directly sent to the coordinating/managing entity.
Value(s) applied	0.52572
Choice of data or measurement methods and procedures	Based on official information and PoA guidelines.
Purpose of data	Calculation of baseline emissions.
Additional comments	Data will be kept for two years after the end of the crediting period or the last issuance of CERs for this project activity, whatever occurs later.

<b>Data/parameter</b>	$EG_{historical}$
Unit	MWh
Description	Annual average historical net electricity generation by the existing renewable energy plant that was operated at the project site prior to the implementation of the project activity
Source of data	CPA owner information
Value(s) applied	15,469.96
Choice of data or measurement methods and procedures	There will be a meter located at Puente Arturo substation to measure net generation of the power plant and any consumption. The historical net electricity of the power plant will be calculated by subtracting the electricity exported with the electricity imported by the CPA, both measured with calibrated meters.
Purpose of data	Baseline emissions calculation
Additional comments	-

<b>Data/parameter</b>	$\sigma_{\text{historical}}$
Unit	MWh
Description	Standard deviation of the annual average historical net electricity supplied to the grid by the existing renewable energy plant that was operated at the project site prior to the implementation of the project activity.
Source of data	CPA owner information.
Value(s) applied	5,188.04
Choice of data or measurement methods and procedures	Data from electricity meters of the CPA owner and can be crosschecked.
Purpose of data	Baseline emissions calculation
Additional comments	-

## E.2. Data and parameters monitored

<b>Data / Parameter:</b>	<i>EGPJ, facility, y</i>
Unit:	MWh
Description:	Quantity of net electricity supplied to the grid by the project facility in year y.
Measured/ Calculated / Default:	Measured by electricity meter
Source of data:	Electricity meters
Value(s) of monitored parameter:	6198-0001: 1315.65 (year 2016) 8045.14 (year 2017)  6198-0002: 2545.61 (year 2016) 28204.836 (year 2017)  6198-0003: 1374.81 (year 2016) 21150.15 (year 2017)

Monitoring equipment:	<p><u>6198-0001:</u>  Meter 1 main meter recording the electricity generation data  Power Logic TM  ION 7550  Serial number: MI-1206A729-03  New device installed on: 19//09/2013  Second calibration conducted on 28/10/2016  Calibration valid for 3 years till 27/10/2019.  Class: 0.2</p> <p>Meter 2 -this meter records the data for electricity consumption:  Elster Alpha Plus A2  Serial Number: 16318318  New device installed on: 19/09/2013  Second calibration conducted on 28/10/2016  Calibration valid for 3 years till 27/10/2019.  Class: 0.2</p> <p><u>6198-0002:</u></p> <p>Harbin Mechanical- this meter records the electricity generation data for turbine G1  Model : HB3300  Serial Nr.: Sz111230010020  New device installed on 01/01/2015.  Calibration valid for 3 years till 31/12/2018  Class: 0.2</p> <p>Harbin Mechanical- this meter records the electricity generation data for turbine G2  Model : HB3300  Serial Nr.: Sz120706001013  New device installed on 01/01/2015.  Calibration valid for 3 years till 31/12/2018  Class: 0.2</p> <p>Harbin Mechanical– this meter records the electricity data for auxiliary consumption Model : HB3300  Serial Nr.: Sz120706001014  New device installed on 01/01/2015.  Calibration valid for 3 years till 31/12/2018  Class: 0.2</p> <p><u>6198-0003:</u>  SE Puente Arturo 10 kV Schlumberger SV3AT meter- – this meter records the data at the substation Puento Arturo Serial number: 01231458  New device installed on 12/12/1999  Class: 0.2  Since 14 November 2016 Schlumberger SV3AT meter is replaced by ELSTER ALPHA A3 meter to record the data at the substation Puento Arturo Serial number: 13443767  Class: 0.2</p> <p>Nexus 1500– this meter records the data for the generator 3  Serial Nr: 148-0132929430  New device installed on 16/06/2015  Calibration valid for 3 years till 15/06/2018  Class: 0.2</p>
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Measuring/ Reading/ Recording frequency:	6198-0001: The net electricity supplied to the grid is measured continuously and recorded at least each hour according to COES requirements 6198-0002: The net electricity supplied to the grid is measured continuously and recorded at least each hour according to COES requirements 6198-0003: The net electricity supplied to the grid will be measured continuously and recorded at least each month
Calculation method (if applicable):	The net electricity supplied to the grid is measured by a calibrated electricity meter located at the substation. The auxiliary consumption data at the site is deducted from the total generation data to calculate the net electricity generation.
QA/QC procedures:	Measuring energy equipment complies with updated national or IEC standards with a precision of at least class of 0.2 according to COES regulation, and calibrated according to the national standards and reference points or IEC standards and recalibrated at appropriate intervals according to manufacturer specifications, but at least once every three years.  The meter readings are cross-check with available internal and/or external information as electricity invoices or COES information, as per the procedure described in section C.
Purpose of data:	Calculation of the baseline emissions
Additional comment:	For 6198-0003, since 14 November 2016 Schlumberger SV3AT meter is replaced by ELSTER ALPHA A3 meter to record the data at the substation Puento Arturo. Also, the net grid export meter at Puento Arturo substation is constructed under the Peruvian government and the project participant has no information on its calibration details. Since no emission reductions are being claimed for this CPA, calibration details would not have any impact by any delay in calibration.

<b>Data / Parameter:</b>	EGBL, capacity addition,y
Unit:	MWh
Description:	Quantity of net electricity supplied to the grid as a result of the implementation of the CDM project activity in year y
Measured/ Calculated / Default:	Calculated
Source of data:	Parameter calculated as per the requirements of the methodology. AMS-I.D equation 1
Value(s) of monitored parameter:	<u>CPA 6198-0003:</u> 0 MWh (For year year 2016)  0 MWh (For year year 2017)

Monitoring equipment:	<p><u>6198-0003:</u>  SE Puente Arturo 10 kV Schlumberger SV3AT meter- – this meter records the data at the substation Puento Arturo  Serial number: 01231458  New device installed on 12/12/1999  Class: 0.2  Since 14 November 2016 Schlumberger SV3AT meter is replaced by ELSTER ALPHA A3 meter to record the data at the substation Puento Arturo  Serial number: 13443767  Class: 0.2</p> <p>Nexus 1500– this meter records the data for the generator 3  Serial Nr: 148-0132929430  New device installed on 16/06/2015  Calibration valid for 3 years till 15/06/2018  Class: 0.2</p>
Measuring/ Reading/ Recording frequency:	6198-0003: The parameter is calculated yearly in line with the requirements of the methodology. .
Calculation method (if applicable):	This parameter is calculated by subtracting the sum of parameters – Eghistorical (Annual average historical net electricity generation by the existing renewable energy plant that was operated at the project site prior to the implementation of the project activity )and ohistorical (Standard deviation of the annual average historical net electricity supplied to the grid by the existing renewable energy plant that was operated at the project site prior to the implementation of the project activity ) from total net electricity supplied to the grid by the project facility.
QA/QC procedures:	<p>Measuring energy equipment complies with updated national or IEC standards with a precision of at least class of 0.2 according to COES regulation, and calibrated according to the national standards and reference points or IEC standards and recalibrated at appropriate intervals according to manufacturer specifications, but at least once every three years.</p> <p>The meter readings are cross-check with available internal and/or external information as electricity invoices or COES information, as per the procedure described in section C.</p>
Purpose of data:	Calculation of the baseline emissions
Additional comment:	This parameter is only applicable for 6198-0003 as it is a capacity addition project. Referring to the 'Clarification on the accounting of emission reductions for projects involving capacity additions' - SSC_722 by Small-Scale Working Group (SSC WG) of the Executive Board, since the project electricity generation has fallen below the baseline threshold, neither any emission reductions are claimed nor negative emission reductions are attributed to a capacity addition project during this crediting period (please check the section H.1 below for more information). Therefore the net electricity supplied to the grid as a result of the implementation the CDM project activity has been set to "0".

<b>Data / Parameter:</b>	$EF_{grid,CM,y}$
Unit:	tCO <sub>2</sub> e/MWh
Description:	Emission factor for the Peruvian interconnected grid (SEIN)
Measured/ Calculated / Default:	Calculated
Source of data:	Official data provided by the administrator of the grid or the relevant national authority.
Value(s) of monitored parameter:	<p><u>6198-0001</u>: 0.5422 (year 2016) 0.4999 (year 2017)</p> <p><u>6198-0002</u>: 0.5211 (year 2016) 0.4773 (year 2017)</p> <p><u>6198-0003</u>: 0.5240 (year 2016) 0.4789 (year 2017)</p>
Monitoring equipment:	N/A
Measuring/ Reading/ Recording frequency:	<p>The emission factor is calculated hourly as per the requirements of the “Tool to calculate the grid emission factor of the grid”, dispatch data analysis.</p> <p>With the available information, a Grid Emission Factor is calculated for each calendar year for which emission reductions are claimed.</p>
Calculation method (if applicable):	The baseline emission factor ( $EF_{grid,CM,y}$ ) is calculated as a combined margin (CM), consisting of the combination of operating margin ( $EF_{grid,OM,y}$ ) and build margin ( $EF_{grid,BM,y}$ ) factors.
QA/QC procedures:	N/A
Purpose of data:	To calculate the baseline emissions.
Additional comment:	<p>The PoA CPAs uses the <math>EF_{grid,CM,y}</math> calculated by the coordinating/managing entity with the most recent value. The value is updated using official information from the administrator of the national grid when the information is available.</p> <p>Complete information of every year during the crediting period is available by COES during the first six months of the following year. Data is kept for two years after the end of the crediting period or the last issuance of CERs for this project activity, whatever occurs later.</p>

<b>Data / Parameter:</b>	$EF_{grid,OM-DD,y}$
Unit:	tCO <sub>2</sub> e/MWh
Description:	The Dispatch Data Analysis OM emission factor
Measured/ Calculated / Default:	Calculated

Source of data:	Official data provided by the administrator of the grid or the relevant national authority (COES) publicly available in its web site or directly sent to the CME. Raw data for generation is based on the 15 minute records of every power plant.
Value(s) of monitored parameter:	<p><u>6198-0001</u>: 0.5151 (year 2016) 0.4304 (year 2017)</p> <p><u>6198-0002</u>: 0.5174 (year 2016) 0.4298 (year 2017)</p> <p><u>6198-0003</u>: 0.5223 (year 2016) 0.4321 (year 2017)</p>
Monitoring equipment:	N/A
Measuring/ Reading/ Recording frequency:	N/A
Calculation method (if applicable):	The dispatch data analysis operating margin emission factor ( $EF_{OM-DD,y} = EF_{gridOM,y}$ in tCO <sub>2</sub> e/MWh) is a method which involves the power unit that are actually dispatched at the margin during each hour h, where the power unit are separated in power unit in the top of the dispatch n and other power unit.
QA/QC procedures:	N/A
Purpose of data:	To calculate baseline emissions.
Additional comment:	Data is kept for two years after the end of the crediting period or the last issuance of CERs for this project activity, whatever occurs later.

<b>Data / Parameter:</b>	<b>EG<sub>PJ,h</sub></b>
Unit:	MWh
Description:	Total electricity dispatched by the project activity in hour h of year y.
Measured/ Calculated / Default:	Measured
Source of data:	Project records and/or COES
Value(s) of monitored parameter:	See EF calculation sheet.

Monitoring equipment:	<p>6198-0001:  Meter 1 main meter recording the electricity generation data  Power Logic TM  ION 7550  Serial number: MI-1206A729-03  New device installed on: 19//09/2013  Second calibration conducted on 28/10/2016  Calibration valid for 3 years till 27/10/2019.  Class: 0.2</p> <p>Meter 2 this meter is recording the electricity data for consumption:  Elster Alpha Plus A2  Serial Number: 16318318 New device installed on: 19/09/2013  Second calibration conducted on 28/10/2016  Calibration valid for 3 years till 27/10/2019.  Class: 0.2</p> <p>6198-0002:</p> <p>Harbin Mechanical- this meter is recording the electricity generation data for turbine G1  Model : HB3300  Serial Nr.: Sz111230010020  New device installed on 01/01/2015.  Calibration valid for 3 years till 31/12/2018  Class: 0.2</p> <p>Harbin Mechanical- this meter is recording the electricity generation data for turbine G2  Model : HB3300  Serial Nr.: Sz120706001013  New device installed on 01/01/2015.  Calibration valid for 3 years till 31/12/2018  Class: 0.2</p> <p>Harbin Mechanical– this meter is recording the electricity data for auxiliary consumption  Model : HB3300  Serial Nr.: Sz120706001014  New device installed on 01/01/2015.  Calibration valid for 3 years till 31/12/2018  Class: 0.2</p> <p>6198-0003:  SE Puente Arturo 10 kV Schlumberger SV3AT meter- – this meter records the data at the substation Puento Arturo  Serial number: 01231458  New device installed on 12/12/1999  Class: 0.2  Since 14 November 2016 Schlumberger SV3AT meter is replaced by ELSTER ALPHA A3 meter to record the data at the substation Puento Arturo  Serial number: 13443767  Class: 0.2</p> <p>Nexus 1500– this meter records the data for the generator 3  Serial Nr: 148-0132929430  New device installed on 16/06/2015  Calibration valid for 3 years till 15/06/2018  Class: 0.2</p>
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Measuring/ Reading/ Recording frequency:	The total electricity supplied to the grid is measured continuously and recorded at least each hour according to COES requirements.
Calculation method (if applicable):	The total electricity supplied to the grid is calculated by subtracting the measured electricity exported with the measured electricity imported by the CPA, both measured with calibrated meters.
QA/QC procedures:	Information of invoices of electricity sold to the grid is crosschecked with metered information and/or COES information. To ensure consistency, and if applicable other records may be used if necessary.
Purpose of data:	To calculate baseline emissions.
Additional comment:	For 6198-0003, since 14 November 2016 Schlumberger SV3AT meter is replaced by ELSTER ALPHA A3 meter to record the data at the substation Puento Arturo. Also, the net grid export meter at Puento Arturo substation is constructed under the Peruvian government and the project participant has no information on its calibration details. Since no emission reductions are being claimed for this CPA, calibration details would not have any impact by any delay in calibration

<b>Data / Parameter:</b>	<b>EG<sub>P,J,y</sub></b>
Unit:	MWh
Description:	Total electricity dispatched by the project activity in year y.
Measured/ Calculated / Default:	Measured
Source of data:	Project records and/or COES
Value(s) of monitored parameter:	6198-0001: 1315.65 (year 2016) 8045.14 (year 2017)  6198-0002: 2545.61 (year 2016) 28204.836 (year 2017)  6198-0003: 1374.81 (year 2016) 21150.15 (year 2017)

Monitoring equipment:	<p>6198-0001:  Meter 1 main meter recording the electricity generation data  Power Logic TM  ION 7550  Serial number: MI-1206A729-03  New device installed on: 19//09/2013  Second calibration conducted on 28/10/2016  Calibration valid for 3 years till 27/10/2019.  Class: 0.2</p> <p>Meter 2 this meter is recording the electricity data for consumption:  Elster Alpha Plus A2  Serial Number: 16318318  New device installed on: 19/09/2013  Second calibration conducted on 28/10/2016  Calibration valid for 3 years till 27/10/2019.  Class: 0.2</p> <p>6198-0002:</p> <p>Harbin Mechanical- this meter is recording the electricity generation data for turbine G1  Model : HB3300  Serial Nr.: Sz111230010020  New device installed on 01/01/2015.  Calibration valid for 3 years till 31/12/2018  Class: 0.2</p> <p>Harbin Mechanical- this meter is recording the electricity generation data for turbine G2  Model : HB3300  Serial Nr.: Sz120706001013  New device installed on 01/01/2015.  Calibration valid for 3 years till 31/12/2018  Class: 0.2</p> <p>Harbin Mechanical– this meter is recording the electricity data for auxiliary consumption  Model : HB3300  Serial Nr.: Sz120706001014  New device installed on 01/01/2015.  Calibration valid for 3 years till 31/12/2018  Class: 0.2</p> <p>6198-0003:  SE Puente Arturo 10 kV Schlumberger SV3AT meter- – this meter records the data at the substation Puento Arturo  Serial number: 01231458  New device installed on 12/12/1999  Class: 0.2  Since 14 November 2016 Schlumberger SV3AT meter is replaced by ELSTER ALPHA A3 meter to record the data at the substation Puento Arturo  Serial number: 13443767  Class: 0.2</p> <p>Nexus 1500– this meter records the data for the generator 3  Serial Nr: 148-0132929430  New device installed on 16/06/2015  Calibration valid for 3 years till 15/06/2018  Class: 0.2</p>
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Measuring/ Reading/ Recording frequency:	Continuous measurement and at least hourly recording.
Calculation method (if applicable):	The proportion of data to be monitored is 100 % and the data is archived electronically.
QA/QC procedures:	N/A
Purpose of data:	To calculate baseline emissions.
Additional comment:	For 6198-0003, since 14 November 2016 Schlumberger SV3AT meter is replaced by ELSTER ALPHA A3 meter to record the data at the substation Puento Arturo. Also, the net grid export meter at Puento Arturo substation is constructed under the Peruvian government and the project participant has no information on its calibration details. Since no emission reductions are being claimed for this CPA, calibration details would not have any impact by any delay in calibration.

<b>Data / Parameter:</b>	<b><math>EF_{EL,DD,h}</math></b>
Unit:	tCO <sub>2</sub> e/MWh
Description:	CO <sub>2</sub> emission factor of power unit in the top of the dispatch order in hour h in year y.
Measured/ Calculated / Default:	Calculated
Source of data:	Data provided by COES.
Value(s) of monitored parameter:	Data used is presented in the spreadsheet for Grid Emission Factor calculation.
Monitoring equipment:	N/A
Measuring/ Reading/ Recording frequency:	Hourly
Calculation method (if applicable):	To calculate $EF_{EL,DD,h}$ the second option is chosen because for the power units, data on fuel consumption is available. The proportion of data to be monitored is 100 % and the data is archived electronically.
QA/QC procedures:	Official data.
Purpose of data:	To calculate baseline emissions.
Additional comment:	Data is kept for two years after the end of the crediting period or the last issuance of CERs for this project activity, whatever occurs later.

<b>Data / Parameter:</b>	<b><math>EG_{n,h}</math></b>
Unit:	MWh
Description:	Electricity generated and delivered to the grid by power units n in hours h.
Measured/ Calculated / Default:	Measured
Source of data:	Data provided by COES.
Value(s) of monitored parameter:	Data used is presented in the spreadsheet for Grid Emission Factor calculation.



Monitoring equipment:	N/A
Measuring/ Reading/ Recording frequency:	Hourly
Calculation method (if applicable):	The proportion of data to be monitored is 100% and the data is archived electronically.
QA/QC procedures:	Official data.
Purpose of data:	To calculate baseline emissions.
Additional comment:	Data is kept for two years after the end of the crediting period or the last issuance of CERs for this project activity, whatever occurs later.

<b>Data / Parameter:</b>	<b>EF<sub>EL,n,y</sub></b>
Unit:	tCO <sub>2</sub> e/MWh
Description:	CO <sub>2</sub> emission factor of power unit n in year y
Measured/ Calculated / Default:	Calculated
Source of data:	Data provided by COES.
Value(s) of monitored parameter:	Data used is presented in the spreadsheet for Grid Emission Factor calculation.
Monitoring equipment:	N/A
Measuring/ Reading/ Recording frequency:	Annually
Calculation method (if applicable):	The EF <sub>EL,n,y</sub> is determined for method the operating margin option A.2. The proportion of data to be monitored is 100% and the data is archived Electronically
QA/QC procedures:	Official data.
Purpose of data:	To calculate baseline emissions.
Additional comment:	Data is kept for two years after the end of the crediting period or the last issuance of CERs for this project activity, whatever occurs later.

<b>Data / Parameter:</b>	<b><math>\eta_{m,y}</math></b>
Unit:	N/A
Description:	Average net energy conversion efficiency of power unit m in year y (ratio)
Measured/ Calculated / Default:	Calculated
Source of data:	Data provided by COES
Value(s) of monitored parameter:	Data used is presented in the spreadsheet for Grid Emission Factor calculation.

Monitoring equipment:	N/A
Measuring/ Reading/ Recording frequency:	Each year this data is checked with the last available annual report of COES. The proportion of data to be monitored is 100% and the data is archived electronically.
Calculation method (if applicable):	N/A
QA/QC procedures:	If the data used is significantly lower than the default value of the applicable technology, CPA owners should assess the reliability of the values, and provide appropriate justification if deemed reliable. Otherwise, the default values above shall be used.
Purpose of data:	To calculate baseline emissions.
Additional comment:	Data is kept for two years after the end of the crediting period or the last issuance of CERs for this project activity, whatever occurs later.

<b>Data / Parameter:</b>	<b><math>EF_{CO_2,m,i,y}</math></b>
Unit:	kgCO <sub>2</sub> /TJ
Description:	Average CO2 emission factor of fuel type i used in power unit m in year y
Measured/ Calculated / Default:	Default
Source of data:	IPCC default values at the lower limit of the uncertainty at a 95% confidence interval as provided in Table 1.4 of Chapter 1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories
Value(s) of monitored parameter:	Diesel Oil = 72,600 Residual Fuel Oil = 75,500 Natural Gas = 54,300 Coal = 87,300
Monitoring equipment:	N/A
Measuring/ Reading/ Recording frequency:	Annually
Calculation method (if applicable):	N/A
QA/QC procedures:	Every update of IPCC reports will be taken into account.
Purpose of data:	To calculate baseline emissions.
Additional comment:	Data is kept for two years after the end of the crediting period or the last issuance of CERs for this project activity, whatever occurs later.

<b>Data / Parameter:</b>	<b><math>W_{OM}</math></b>
Unit:	%
Description:	Weighting of operating margin emissions factor
Measured/ Calculated / Default:	Default
Source of data:	As indicated in the "Tool to calculate emission factor for an electricity system" v.2.2.1.
Value(s) of monitored parameter:	The first crediting period, $W_{OM} = 0.5$ The second and third crediting period, $W_{OM} = 0.25$

Monitoring equipment:	N/A
Measuring/ Reading/ Recording frequency:	Annually
Calculation method (if applicable):	N/A
QA/QC procedures:	N/A
Purpose of data:	To calculate baseline emissions.
Additional comment:	Data is kept for two years after the end of the crediting period or the last issuance of CERs for this project activity, whatever occurs later.

<b>Data / Parameter:</b>	<b><math>W_{BM}</math></b>
Unit:	%
Description:	Weighting of build margin emissions factor
Measured/ Calculated / Default:	Default
Source of data:	As indicated in the "Tool to calculate emission factor for an electricity system" v.2.2.1.
Value(s) of monitored parameter:	The first crediting period, $W_{BM} = 0.5$ The second and third crediting period, $W_{BM} = 0.75$
Monitoring equipment:	N/A
Measuring/ Reading/ Recording frequency:	Annually
Calculation method (if applicable):	N/A
QA/QC procedures:	N/A
Purpose of data:	To calculate baseline emissions.
Additional comment:	For projects that are not solar or wind power generation. Data will be kept for two years after the end of the crediting period or the last issuance of CERs for this project activity, whatever occurs later.

<b>Data / Parameter:</b>	<b>Merit Order</b>
Unit:	Text
Description:	The merit order in which power plants are dispatched by documented evidence
Measured/ Calculated / Default:	Data provided by COES.
Source of data:	COES reports
Value(s) of monitored parameter:	Data used is presented in the spreadsheet for Grid Emission Factor calculation.

Monitoring equipment:	N/A
Measuring/ Reading/ Recording frequency:	For each year, the variable cost of thermal plants in the SEIN that are in effect in December will be used. The proportion of data to be monitored is 100% and the data will be archived electronically.
Calculation method (if applicable):	N/A
QA/QC procedures:	N/A
Purpose of data:	To calculate baseline emissions.
Additional comment:	Data will be kept for two years after the end of the crediting period or the last issuance of CERs for this project activity, whatever occurs later.

### E.3. Implementation of sampling plan

N.A.

## SECTION F. Calculation of emission reductions or net anthropogenic removals

### F.1. Calculation of baseline emissions or baseline net removals

#### For 6198-0001 and 6198-0002:

$$\gg BE_y = EG_{\text{facility},y} * EF_{\text{grid,CM},y}$$

Where:

$BE_y$  = Baseline emissions in year y (tCO<sub>2</sub>)

$EG_{\text{facility},y}$  = Quantity of net electricity generation that is produced and fed into the grid as a result of the implementation of the CDM project activity in year y (MWh)

$EF_{\text{grid,CM},y}$  = Combined margin CO<sub>2</sub> emission factor for grid connected power generation in year y calculated using the "Tool to calculate the emission factor for an electricity system" (tCO<sub>2</sub>/MWh) and based on the dispatch data provided by COES.

#### 6198-0001:

$$BE_y (2016) = 1315.65 \text{ MWh} * 0.5422 \text{ tCO}_2/\text{MWh}$$

$$BE_y (2016) = 713 \text{ tCO}_2$$

$$BE_y (2017) = 8045.14 \text{ MWh} * 0.4999 \text{ tCO}_2/\text{MWh}$$

$$BE_y (2017) = 4021 \text{ tCO}_2$$

$$BE_y = 4734 \text{ tCO}_2 \text{ (for the fourth monitoring period)}$$

#### 6198-0002:

$$BE_y (2016) = 2545.61 \text{ MWh} * 0.5211 \text{ tCO}_2/\text{MWh}$$

$$BE_y (2016) = 1326 \text{ tCO}_2 \text{ (for the fourth monitoring period)}$$

$$BE_y (2017) = 28204.83 \text{ MWh} * 0.4773 \text{ tCO}_2/\text{MWh}$$

$BE_y (2017) = 13462 \text{ tCO}_2$  (for the fourth monitoring period)

$BE_y = 14789 \text{ tCO}_2$  (for the fourth monitoring period)

**For 6198-0003:**

$$BE_{\text{capacity addition, CO}_2, y} = [EG_{\text{BL, capacity addition, y}}] * EF_{\text{CO}_2}$$

Where:

$$EG_{\text{BL, capacity addition, y}} = EG_{\text{PJ, facility, y}} - (EG_{\text{historical}} + \sigma_{\text{historical}})$$

$$EG_{\text{BL, capacity addition, y}} = 22524.96 - (18048.28 + 6052.71) \text{ MWh}$$

$$EG_{\text{BL, capacity addition, y}} = -1,576.04 \text{ MWh}$$

Referring to the 'Clarification on the accounting of emission reductions for projects involving capacity additions'<sup>1</sup> - SSC\_722 by Small-Scale Working Group (SSC WG) of the Executive Board, since the project electricity generation has fallen below the baseline threshold, neither any emission reductions are claimed nor negative emission reductions are attributed to a capacity addition project during this crediting period (please check the link below for more information). Therefore the net electricity supplied to the grid as a result of the implementation the CDM project activity has been set to "0".

$$BE_{\text{capacity addition, CO}_2, y} = 0 \text{ tCO}_2 \text{ (for the third monitoring period)}$$

The grid emission factor was calculated as follows (the exact description is included in the PoA-DD):

A combined margin (CM) is calculated, consisting of the combination of operating margin (OM) and build margin (BM) according to the procedures prescribed in the 'Tool to calculate the Emission Factor for an electricity system' version 02.2.1. following six steps:

STEP 1. Identify the relevant electricity systems.

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

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

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

STEP 5. Calculate the build margin emission factor).

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

Step 1: Identify the relevant electric power system

Each CPA will supply energy to the National Interconnected Electric Grid (SEIN), therefore, the identified electricity power system is the Peruvian National Electricity Grid (SEIN). The Project will displace electricity from an electricity distribution system (in this case, the SEIN) that is or would have been supplied by at least one fossil fuel fired generating unit.

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

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1

<https://cdm.unfccc.int/filestorage/T/P/2/TP23EFDN6BVL11ISWMZHKG509XR47C/Final%20response.pdf?t=NDZ8b2ZsZ2lsfDD74KP4evSMvkaUURJXyPHk>

The tool provides 2 options, including: Option I: Only grid power plants are included in the calculation. Option II: Both grid power plants and off-grid power plants are included in the calculation All CPAs will use Option I for calculating the grid emission factor.

Step 3: Select an OM method Out of four options for the OM, the Dispatch Data Analysis OM (OM-DD) is selected as the option for all CPAs located in Peru. The Simple OM method cannot be used since low cost, must-run resources constitute more than 50% of total grid generation in Peru. Also, it was not necessary to use either the Simple Adjusted OM approach or the Average OM approach because detailed dispatch data is available.

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

The formula for the OM-DD emission factor ( $EF_{grid,OM-DD,y}$ ) used was provided by the Tool as follows:

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

Where,

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

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

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

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

h = Hours in year, y, in which the CPA is displacing grid electricity

y = Year in which the CPA is displacing grid electricity

The hourly emissions factor is calculated based on the energy efficiency of the grid power unit and the fuel

type used, as follows:

$$EF_{EL,DD,h} = \frac{\sum_n EG_{n,h} \times EF_{EL,n,y}}{\sum_n EG_{n,h}}$$

Where,

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

$EG_{n,h}$  = Net quantity of electricity generated and delivered to the grid by power unit, n, in hour, h (MWh)

$EF_{EL,n,y}$  = CO2 emission factor of power unit, n, in year, y (tCO2/MWh)

n = Power units in the top of the dispatch.

h = Hours in year, y, in which the CPA is displacing grid electricity.

To determine the set of grid power units n that are in the top of the dispatch at each hour h, the power units were stacked using the merit order. The group of power units, n, in the dispatch margin includes the units in the top x% of total electricity dispatched in the hour, h, where x% is equal to the greater of either

a) 10%, or

b) The quantity of electricity displaced by the project activity during hour h divided by the total electricity generations by grid power plants during that hour h

**The CO2 emission factor of power unit ( $EF_{EL,m,y}$  is calculated as per the guidance for the simple OM, using the option A2.**

$$EF_{ELn,y} = \frac{EF_{CO2,n,y,i} \times 3.6}{N_{n,y}}$$

Where,

$EF_{EL,n,y}$  = CO2 emission factor of power unit m in year, y (tCO2/MWh)

$EF_{CO2,n,y,i}$  = Average CO2 emission factor of fuel type i used in power unit m in year y (tCO2/GJ)

$N_{n,y}$  = Average net energy conversion efficiency of power unit m, in year y, (ratio)

n = All power units serving the grid in year y except low-cost/must-run power units

y = Applicable year during monitoring (ex-post option)

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

The build margin emissions factor is the generation-weighted average emission factor (tCO2/MWh) of all power units, m, during the most recent year, y, for which power generation data is available, calculated as follows:

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

Where,

$EF_{grid,BM,y}$  : Build margin CO2 emission factor in year, y (tCO2/MWh)

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

$EF_{EL,m,y}$  : CO2 emission factor of power unit m in year y (tCO2/MWh)

m : Power units included in the build margin

y : Most recent historical year for which power generation data is available

According to the “Tool to calculate the emission factor for an electricity system”, version 02.2.1, the sample group of power units m used to calculate the build margin should be determined as per the following procedure, consistent with the vintage data selected above:

(a) Identify the set of five power units, excluding power units registered as CDM project activities, that started to supply electricity to the grid most recently (SET5-units) and determine their annual electricity generation (AEGSET-5-units, in MWh);

(b) Determine the annual electricity generation of the project electricity system, excluding power units registered as CDM project activities (AEGtotal, in MWh). Identify the set of power units, excluding power units registered as CDM project activities, that started to supply electricity to the grid most recently and that comprise 20% of AEGtotal (if 20% falls on part of the generation of a unit, the generation of that unit is fully included in the calculation) (SET≥20%) and determine their annual electricity generation (AEGSET-≥20%, in MWh);

(c) From SET5-units and SET≥20% select the set of power units that comprises the larger annual electricity generation (SETsample); Identify the date when the power units in SETsample started to supply electricity to the grid. If none of the power units in SETsample started to supply electricity to the grid more than 10 years ago, then use SETsample to calculate the build margin.



Ignore steps (d), (e) and (f). (d) Exclude from SET<sub>sample</sub> the power units which started to supply electricity to the grid more than 10 years ago. Include in that set the power units registered as CDM project activity, starting with power units that started to supply electricity to the grid most recently, until the electricity generation of the new set comprises 20% of the annual electricity generation of the project electricity system (if 20% falls on part of the generation of a unit, the generation of that unit is fully included in the calculation) to the extent is possible. Determine for the resulting set (SET<sub>sampleCDM</sub>) the annual electricity generation (AEG<sub>SET-sample-CDM</sub>, in MWh); If the annual electricity generation of that set is comprises at least 20% of the annual electricity generation of the project electricity system (i.e.  $AEG_{SET-sample-CDM} \geq 0.2 \times AEG_{total}$ ), then use the sample group SET<sub>sampleCDM</sub> to calculate the build margin. Ignore steps (e) and (f).

Otherwise: (e) Include in the sample group SET<sub>sample-CDM</sub> the power units that started to supply electricity to the grid more than 10 years ago until the electricity generation of the new set comprises 20% of the annual electricity generation of the project electricity system (if 20% falls on part of the generation of a unit, the generation of that unit is fully included in the calculation);

(f) The sample group of power units m used to calculate the build margin is the resulting set (SET<sub>sample-CDM->10yrs</sub>). Out of SET<sub>5-units</sub> and SET<sub>≥20%</sub>, the latter group was selected as SET<sub>sample</sub> due to the fact that it includes the larger annual electricity generation. In terms of vintage data, to calculate the build margin Option 1 shall be chosen for the proposed Project;

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

Step 6: Calculate the combined margin (CM) emissions factor. The calculation of the combined margin (CM) emission factor (EF<sub>grid,CM,y</sub>) is based on one of the following methods:

- (a) Weighted average CM; or
- (b) Simplified CM.

The simplified CM method (option b) can only be used if:

- The project activity is located in a Least Developed Country (LDC) or in a country with less than 10 registered projects at the starting date of validation; and
- The data requirements for the application of step 5 above cannot be met.

The weighted average CM method (option a) should be used as the preferred option:

$$EF_{grid,cm,y} = EF_{grid,om,y} \times w_{om} + EF_{grid,bm,y} \times w_{bm}$$

Where:

w<sub>OM</sub> : Weighting of OM emission factor (%)

w<sub>BM</sub> : Weighting of BM emission factor (%)

For the proposed PoA, the following default values are used: w<sub>OM</sub> = 0.5 and w<sub>BM</sub> = 0.5.

Please refer to the 'Emission factor calculation sheet' for further details on the calculations done for the emission factor.

## F.2. Calculation of project emissions or actual net removals

No project emissions apply for the project activity as per the applied methodology.

## F.3. Calculation of leakage emissions

No leakage is accounted as per the applied methodology

## F.4. Calculation of emission reductions or net anthropogenic removals

CPA UNFCCC reference number	Baseline GHG emissions or baseline net GHG removals (t CO <sub>2</sub> e)	Project GHG emissions or actual net GHG removals (t CO <sub>2</sub> e)	Leakage GHG emissions (t CO <sub>2</sub> e)	GHG emission reductions or net anthropogenic GHG removals (t CO <sub>2</sub> e)		
				Before 01/01/2013	From 01/01/2013	Total amount
6198-0001	4734	-	-	-	4734	4734
6198-0002	14789	-	-	-	14789	14789
6198-0003	0	-	-	-	0	0
<b>Total</b>	19523	-	-	-	19523	19523

## F.5. Comparison of emission reductions or net anthropogenic removals achieved with estimates in the included CPA-DDs

CPA UNFCCC reference number	Amount achieved during this monitoring period (t CO <sub>2</sub> e)	Amount estimated ex ante (t CO <sub>2</sub> e)
6198-0001	10073	4734
6198-0002	32803	14789
6198-0003	11722	0
<b>Total</b>	54598	19523

## F.6. Remarks on increase in achieved emission reductions

N.A. as the emission reductions are below as the values expected ex-ante in the CPA-DDs.