



**Monitoring report form for CDM programme of activities
(Version 04.0)**

| MONITORING REPORT | | | |
|---|--|--|--|
| Title of the PoA | Tunki Small Scale Hydropower Program of Activities | | |
| UNFCCC reference number of the PoA | 6198 | | |
| Version numbers of the PoA-DD applicable to this monitoring report | 7 | | |
| Version number of this monitoring report | 04 | | |
| Completion date of this monitoring report | 14/06/2021 | | |
| Monitoring period number | 08 | | |
| Duration of this monitoring period | 19/09/2020 to 31/12/2020 (inclusive of both dates) | | |
| Monitoring report number for this monitoring period | 01 | | |
| Coordinating/managing entity | Carbonbay GmbH & Co. KG | | |
| Host Parties | Host Party of the PoA | Is this the host Party of a CPA covered in this monitoring report? (yes/no) | |
| | Peru | Yes | |
| Applied methodologies and standardized baselines | Applied methodology: AMS-I.D. ver. 18.0 – Grid connected renewable electricity generation Standardized baseline: Not applicable | | |
| Sectoral scopes | 1 : Energy industries (renewable - / non-renewable sources) | | |
| Amount of GHG emission reductions or net anthropogenic GHG removals achieved by all CPAs covered in this monitoring report in this monitoring period | Amount achieved before 1 January 2013 | Amount achieved from 1 January 2013 until 31 December 2020 | Amount achieved from 1 January 2021 |
| | 0 tCO ₂ e | 835 tCO ₂ e | 0 tCO ₂ e |
| Amount of GHG emission reductions or net anthropogenic GHG removals estimated ex ante for this monitoring period in the CPA-DDs for the CPAs covered in this monitoring report | 2,644 tCO ₂ e | | |

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 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* | 07 | 1 : Energy industries (renewable - / non-renewable sources) | AMS-I.D. ver 18.0 – Grid connected renewable electricity generation ¹ Methodological tools used: 1. Tool to calculate the emission factor for an electricity system. Version 2.2.1 ² Standardized baseline: Not applicable |

A.1.2. CPAs included in the PoA

| Title and UNFCCC reference number of the CPA | Version of the PoA-DD | Title and reference number of the corresponding generic CPA | Crediting period type and duration | Covered in this monitoring report? (yes/no) |
|--|-----------------------|---|--|---|
| 6198-P2-0001-CP2: Coelvihidro 1 Hydro Power Plant, Quipico – Tunki PoA CPA # 1, version 7.0 | 7 | Hydro Power Plant– Tunki PoA CPA #, version 1.0 | Renewable 19/09/2020 - 18/09/2027(2 nd) | Yes |

A.2. Coordinating/managing entity

Entity: CME

Organization: Carbonbay GmbH & Co. KG.

Name: Mr. Wolfgang Brueckner

Title: Managing Director

Email: wolfqnag.brueckner@carbonbay.com

¹ <https://cdm.unfccc.int/methodologies/SSCmethodologies/approved>

² <https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-07-v2.2.1.pdf>

SECTION B. Implementation of PoA

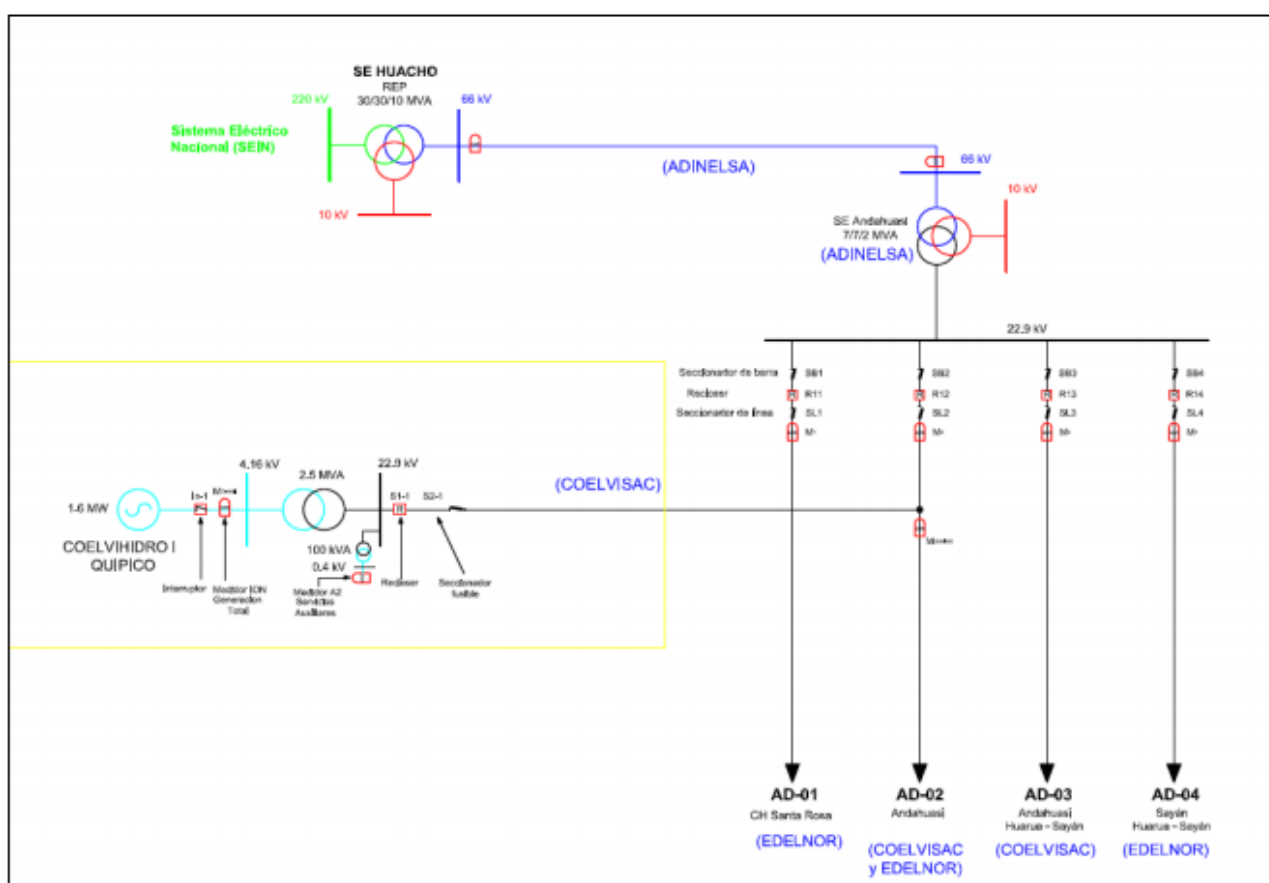
B.1. Description of implemented PoA

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-P2-0001-CP2:

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 users (which signed agreement with COELVISAC) through SEIN grid network started on 19/09/2013. The crediting period of the CPA is 19/09/2020 to 18/09/2027.

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 disconnector. Seccionador de barra: Bus taps disconnectors.

Seccionador de línea: Feeder disconnector

At the site the following class 0.2 meter are present:

| | |
|---------|---------|
| Meter 1 | Meter 2 |
|---------|---------|

| | |
|--|---|
| <p>Meter 1 - main meter recording the electricity generation data Power Logic TM ION 7550 Class: 0.2 Serial number: MI-1206A729-03 New device installed on: 19/09/2013 Second calibration conducted on 28/10/2016 valid till 27/10/2019. Third calibration conducted on 08/11/2019 valid till 07/10/2022</p> | <p>Meter 2 - this meter is recording the electricity data for consumption: Elster Alpha Plus A2 Serial Number: 16318318 Class: 0.2 New device installed on: 19/09/2013 Second calibration conducted on 28/10/2016 valid till 27/10/2019. Third calibration conducted on 08/11/2019 valid till 07/10/2022.</p> |
|--|---|

B.2. Post-registration changes to PoA

B.2.1. Corrections

Not applicable

B.2.2. Inclusion of monitoring plan

Not applicable as there is post-registration change to include a monitoring plan into the PoA-DD

B.2.3. Permanent changes to the registered monitoring plan, or permanent deviation of monitoring from the applied methodologies, standardized baselines, or other methodological regulatory documents

Not applicable as there are no permanent changes to the registered monitoring plan, or permanent deviation of monitoring from the applied methodologies, standardized baseline, or methodological regulatory documents.

B.2.4. Changes to programme design

Not applicable as there are no changes to programme design in the PoA

B.2.5. Changes specific to afforestation or reforestation activities

Not applicable as the PoA does not involve afforestation or reforestation activities

PART II Monitoring of CPAs

The CME has opted to implement a verification system for the DOE that will individually verify each CPA (instead of sampling) in order to determine the emission reductions from the CPA. The central database managed by the CME includes data that can be directly attributed to each CPA within the PoA, thereby allowing unambiguous determination of the emission reductions attributable to each CPA.

As per EB 55 Annex 38, par. 37, each request for issuance shall relate to all CPAs included in the PoA prior or during the specified monitoring period. Thus all CPAs will have to be monitored and verified in identical monitoring period.

There are four CPAs included in the PoAs of now. The monitoring survey will be realized with 10% error margin and a 90% confidence interval for the CPAs.

| Title and UNFCCC | Version of | Title and reference number of | Crediting | Covered in this |
|------------------|------------|-------------------------------|-----------|-----------------|
|------------------|------------|-------------------------------|-----------|-----------------|

| reference number of the CPA | the PoA-DD | the corresponding generic CPA | period type and duration | monitoring report? (yes/no) |
|---|------------|--|--|-----------------------------|
| Coelviidro 1 Hydro Power Plant, Quipico – Tunki PoA CPA # 1 6198-P2-0001-CP2 | 7 | Hydro Power Plant – Tunki PoA CPA #, version 1.0 | Renewable 19/09/2020 - 18/09/2027(2 nd) | Yes |

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-P2-0001-CP2:

(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 to users (with whom COELVISAC have signed agreements with) 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 m³/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 users (which signed agreement with COELVISAC) through the SEIN grid network 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 19/09/2020 to 31/12/2020, the project has dispatched a total of 1,581.03 MWh of electricity, which represents a reduction of 835 tCO₂e for the presented monitoring period.

C.2. Location of CPAs**6198-P2-0001-CP2: 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 |
|------------------|-------------------------------|
| Power house | -11.11781423, -75.31547914 |
| Water intake | -11.11887526, -75.31617381 |
| Water devolution | -11.11766695, -75.33569134 |

C.3. Post-registration changes to CPAs**C.3.1. Temporary deviations from the monitoring plans in the included CPA-DDs, applied methodologies, standardized baselines or other methodological regulatory documents**

Not applicable as no temporary deviations from the monitoring plans in the included CPA-DDs, applied methodologies, standardized baselines or other methodological regulatory documents have taken place for this CPA

C.3.2. Corrections

Not applicable

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

No change of start date is applicable to this CPA

C.3.4. Inclusion of monitoring plan

Not applicable

C.3.5. Permanent changes to the included monitoring plans, or permanent deviation of monitoring from the applied methodologies, standardized baselines, or other methodological regulatory documents

Not applicable

C.3.6. Changes to project design

Not applicable

C.3.7. Changes specific to afforestation or reforestation CPA

Not applicable

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 if necessary.

Data Collection: The electricity supplied by the project activity to the grid will be measured by calibrated electricity meters. The parameter will be monitored at the substation and crosschecked with the invoices of electricity commercialized. Data will be monitored continuously, recorded hourly and consolidated in a monthly basis as required by the applicable methodology.

Data Recording: All data collected will be recorded monthly into an electronic spreadsheet.

Data Calibration: All measurements will be conducted with equipment certified 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..

Data Report: Data recorded (control value) and the invoices (main value) will be consolidated on a monthly basis and will be checked for quality control. If there are discrepancies in the data, the source of the variation will be identified, whatever is the main measured value or the control value. The data report will be consolidated monthly and will be verified by the CPA owner's Head Office.

Data Archives: The data recording, the data report and the invoices will be 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.

2. Data Quality Assurance and Control

An internal procedure to secure the correctness of data will be employed. Data and reports will be checked internally to secure correctness of data. In case of mistakes, corrective actions will be applied to avoid future similar mistakes.

3. Training and Monitoring Personnel

All people that participate in the monitoring process will be suitably qualified and trained in the operation and maintenance of the plant. They will also receive a training session on the application of the monitoring plan.

4. Emission factor calculation

The combined margin emission factor used in the emission reduction calculation will be the annually updated factor provided by the coordinating/managing entity. The factor will use information published by the local authorities.

5. Verification and Monitoring Results

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

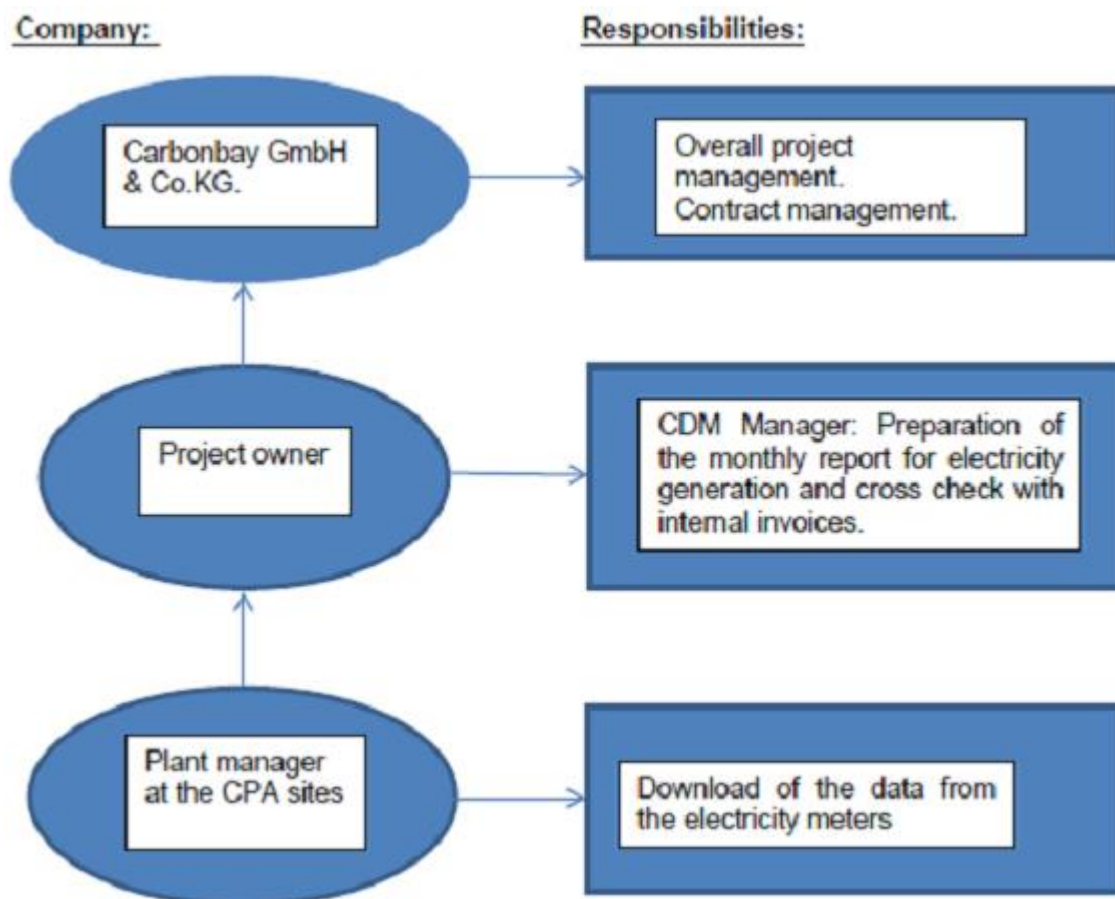
Leakage monitoring:

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.

The project activity involves electricity generation from hydro sources. The employed hydro energy generator can only convert hydro energy into electrical energy and cannot use any other input fuel

for electricity generation. Thus, in no ways and means are required to monitor leakage from the project activity.

GHG Data Management and responsibilities:



SECTION E. Data and parameters

E.1. Data and parameters fixed ex ante

| Data/Parameter | EF _{grid, BM, y} |
|--|--|
| Unit | tCO ₂ / MWh |
| Description | 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 website or directly sent to the coordinating/managing entity |
| Value(s) applied | 0.6532 |
| Choice of data or measurement methods and procedures | Based on official information and PoA guidelines. |
| Purpose of data/parameter | 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 |
|---------------------|---|

E.2. Data and parameters monitored

| Data/Parameter | EG PJ, facility,y | | | | | |
|---------------------------------------|---|---|---------|---------|---|---|
| Unit | MWh | | | | | |
| Description | Quantity of net electricity supplied to the grid by the project facility in year y | | | | | |
| Measured/calculated/default | Measured | | | | | |
| Source of data | Electricity meters | | | | | |
| Value(s) of monitored parameter | 1,581.03 | | | | | |
| Monitoring equipment | <table><tr><th>Meter 1</th><th>Meter 2</th></tr><tr><td>Meter 1 - main meter recording the electricity generation data Power Logic TM ION 7550 Serial number: MI-1206A729-03 Class: 0.2 New device installed on: 19/09/2013 Second calibration conducted on 28/10/2016 valid till 27/10/2019. Third calibration conducted on 08/11/2019 valid till 07/10/2022.</td><td>Meter 2 - this meter is recording the electricity data for consumption: Elster Alpha Plus A2 Serial Number: 16318318 Class: 0.2 New device installed on: 19/09/2013 Second calibration conducted on 28/10/2016 valid till 27/10/2019. Third calibration conducted on 08/11/2019 valid till 07/10/2022.</td></tr></table> | | Meter 1 | Meter 2 | Meter 1 - main meter recording the electricity generation data Power Logic TM ION 7550 Serial number: MI-1206A729-03 Class: 0.2 New device installed on: 19/09/2013 Second calibration conducted on 28/10/2016 valid till 27/10/2019. Third calibration conducted on 08/11/2019 valid till 07/10/2022. | Meter 2 - this meter is recording the electricity data for consumption: Elster Alpha Plus A2 Serial Number: 16318318 Class: 0.2 New device installed on: 19/09/2013 Second calibration conducted on 28/10/2016 valid till 27/10/2019. Third calibration conducted on 08/11/2019 valid till 07/10/2022. |
| | Meter 1 | Meter 2 | | | | |
| | Meter 1 - main meter recording the electricity generation data Power Logic TM ION 7550 Serial number: MI-1206A729-03 Class: 0.2 New device installed on: 19/09/2013 Second calibration conducted on 28/10/2016 valid till 27/10/2019. Third calibration conducted on 08/11/2019 valid till 07/10/2022. | Meter 2 - this meter is recording the electricity data for consumption: Elster Alpha Plus A2 Serial Number: 16318318 Class: 0.2 New device installed on: 19/09/2013 Second calibration conducted on 28/10/2016 valid till 27/10/2019. Third calibration conducted on 08/11/2019 valid till 07/10/2022. | | | | |
| | Considering the calibration dates of meters and QA/QC procedures, it can be concluded that there has not been any delay in calibration of meters. | | | | | |
| | | | | | | |
| Measuring/reading/recording frequency | The net electricity supplied to the grid is measured continuously and recorded at least each hour according to COES requirements | | | | | |
| 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-checked with available internal and/or external information as electricity invoices or COES information, as per the procedure described in section D. | | | | | |
| Purpose of data/parameter | Calculation of baseline emissions | | | | | |
| Additional comments | -- | | | | | |

| Data/Parameter | EF _{grid, CM,y} |
|---------------------------------------|--|
| Unit | tCO ₂ / 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 | 0.52838 |
| Monitoring equipment | Not Applicable |
| Measuring/reading/recording frequency | 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. With the available information, a Grid Emission Factor is calculated for each calendar year for which emission reductions are claimed. |
| 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 | Not Applicable |
| Purpose of data/parameter | Calculation of baseline emissions |
| Additional comments | The PoA CPAs uses the EF _{grid,CM,y} 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. 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 |

| Data/Parameter | EF _{grid,OM-DD,y} |
|---------------------------------------|---|
| Unit | tCO ₂ /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 website 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 | 0.40548 |
| Monitoring equipment | Not Applicable |
| Measuring/reading/recording frequency | Not Applicable |
| Calculation method (if applicable) | The dispatch data analysis operating margin emission factor (EF _{OM-DD,y} = EF _{gridOM,y} in tCO ₂ 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 | Not Applicable |
| Purpose of data/parameter | Calculation of baseline emissions |
| Additional comments | 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 |
|--|---|

| | | |
|---------------------------------------|--|---|
| Data/Parameter | EG PJ,h | |
| 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 | Refer to EF calculation sheet | |
| Monitoring equipment | Meter 1 | Meter 2 |
| | Meter 1 - main meter recording the electricity generation data Power Logic TM ION 7550 Serial number: MI-1206A729-03 Class: 0.2 New device installed on: 19//09/2013 Second calibration conducted on 28/10/2016 valid till 27/10/2019. Third calibration conducted on 08/11/2019 valid till 07/10/2022. | Meter 2 - this meter is recording the electricity data for consumption: Elster Alpha Plus A2 Serial Number: 16318318 Class: 0.2 New device installed on: 19/09/2013 Second calibration conducted on 28/10/2016 valid till 27/10/2019. Third calibration conducted on 08/11/2019 valid till 07/10/2022. |
| | | |
| Measuring/reading/recording frequency | The total electricity supplied to the grid is measured continuously and recorded at least each hourly 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/parameter | Calculation of baseline emissions | |
| Additional comments | -- | |

| | | |
|---------------------------------|--|--|
| Data/Parameter | EG PJ,y | |
| 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 | 1,581.03 | |
| Monitoring equipment | Meter 1 | Meter 2 |
| | Meter 1 - main meter recording the electricity generation data Power Logic TM ION 7550 Serial number: MI-1206A729-03 Class: 0.2 New device installed on: | Meter 2 - this meter is recording the electricity data for consumption: Elster Alpha Plus A2 Serial Number: 16318318 Class: 0.2 |

| | | |
|---------------------------------------|---|--|
| | 19/09/2013 Second calibration conducted on 28/10/2016 valid till 27/10/2019. Third calibration conducted on 08/11/2019 valid till 07/10/2022. | New device installed on: 19/09/2013 Second calibration conducted on 28/10/2016 valid till 27/10/2019. Third calibration conducted on 08/11/2019 valid till 07/10/2022. |
| 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 | Not Applicable | |
| Purpose of data/parameter | Calculation of baseline emissions | |
| Additional comments | -- | |

| | |
|---------------------------------------|---|
| Data/Parameter | EF _{EL, DD-h} |
| Unit | tCO ₂ e / MWh |
| Description | CO ₂ 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 | Date provided by COES |
| Value(s) of monitored parameter | Data used is presented in the spreadsheet for Grid Emission Factor calculation |
| Monitoring equipment | Not Applicable |
| 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/parameter | Calculation of baseline emissions |
| Additional comments | 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 |

| | |
|---------------------------------------|--|
| Data/Parameter | EG _{n,h} |
| Unit | MWh |
| Description | Electricity generated and delivered to the grid by power units n in hours h |
| Measured/calculated/default | Measured |
| Source of data | Date provided by COES |
| Value(s) of monitored parameter | Data used is presented in the spreadsheet for Grid Emission Factor calculation |
| Monitoring equipment | Not Applicable |
| Measuring/reading/recording frequency | Hourly |
| Calculation method | The proportion of data to be monitored is 100 % and the data is archived |

| | |
|---------------------------|--|
| (if applicable) | electronically |
| QA/QC procedures | Official data |
| Purpose of data/parameter | Calculation of baseline emissions |
| Additional comments | 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 |

| | |
|---------------------------------------|---|
| Data/Parameter | $EF_{EL, n, y}$ |
| Unit | tCO ₂ e / MWh |
| Description | CO ₂ emission factor of power unit n in year y |
| Measured/calculated/default | Calculated |
| Source of data | Date provided by COES |
| Value(s) of monitored parameter | Data used is presented in the spreadsheet for Grid Emission Factor calculation |
| Monitoring equipment | Not Applicable |
| Measuring/reading/recording frequency | Hourly |
| Calculation method (if applicable) | The $EF_{EL, n, y}$ 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/parameter | Calculation of baseline emissions |
| Additional comments | 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 |

| | |
|---------------------------------------|---|
| Data/Parameter | $\eta_{n, y}$ |
| Unit | Not Applicable |
| Description | Average net energy conversion efficiency of power unit n in year y (ratio) |
| Measured/calculated/default | Calculated |
| Source of data | Date provided by COES |
| Value(s) of monitored parameter | Data used is presented in the spreadsheet for Grid Emission Factor calculation |
| Monitoring equipment | Not Applicable |
| 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) | Not Applicable |
| 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/parameter | Calculation of baseline emissions |
| Additional comments | 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 |

| Data/Parameter | $EF_{CO_2,n,i,y}$ |
|---------------------------------------|---|
| Unit | kgCO ₂ /TJ |
| Description | Average CO ₂ emission factor of fuel type if used in power unit n 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 | Not Applicable |
| Measuring/reading/recording frequency | Annually |
| Calculation method (if applicable) | Not Applicable |
| QA/QC procedures | Every update of IPCC reports will be taken into account |
| Purpose of data/parameter | Calculation of baseline emissions |
| Additional comments | 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 |

| Data/Parameter | W_{OM} |
|---------------------------------------|---|
| 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 | For second crediting period $W_{OM} = 0.25$ |
| Monitoring equipment | Not Applicable |
| Measuring/reading/recording frequency | Annually |
| Calculation method (if applicable) | Not Applicable |
| QA/QC procedures | Not Applicable |
| Purpose of data/parameter | Calculation of baseline emissions |
| Additional comments | 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. |

| Data/Parameter | W_{BM} |
|-----------------------------|--|
| 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 | For second crediting period $W_{BM} = 0.75$ |

| | |
|---------------------------------------|---|
| parameter | |
| Monitoring equipment | Not Applicable |
| Measuring/reading/recording frequency | Annually |
| Calculation method (if applicable) | Not Applicable |
| QA/QC procedures | Not Applicable |
| Purpose of data/parameter | Calculation of baseline emissions |
| Additional comments | 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. |

| Data/Parameter | Merit Order |
|---------------------------------------|--|
| Unit | Text |
| Description | The merit order in which power plants are dispatched by documented evidence |
| Measured/calculated/default | Measured |
| Source of data | COES reports |
| Value(s) of monitored parameter | Data used is presented in the spreadsheet for Grid Emission Factor calculation. |
| Monitoring equipment | Not Applicable |
| 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) | Not Applicable |
| QA/QC procedures | Not Applicable |
| Purpose of data/parameter | Calculation of baseline emissions |
| Additional comments | 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. |

E.3. Implementation of sampling plan

No sampling is required for this CPA

SECTION F. Calculation of emission reductions or net anthropogenic removals

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

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

Where:

BE_y = Baseline emissions in year y (tCO₂)

$EG_{\text{facility},y}$ = 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 CO₂ emission factor for grid connected power generation in year y calculated using the "Tool to calculate the emission factor for an electricity system" (tCO₂/MWh) and based on the dispatch data provided by COES.

$$BE_y = 1,581.03 \text{ MWh} * 0.52838 \text{ tCO}_2 / \text{MWh}$$

$$BE_y = 835 \text{ tCO}_2\text{e}$$

Baseline Emissions(BE_y) = 835 tCO₂e (8th monitoring period, 1st in second CP)

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 (BM) 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).

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,

$EF_{ELn,y}$ = 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 SETsample 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 (SETsampleCDM) the annual electricity generation (AEGSET-sample-CDM, 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. $AEGSET\text{-sample-CDM} \geq 0.2 \times AEG_{total}$), then use the sample group SETsampleCDM to calculate the build margin. Ignore steps (e) and (f).

Otherwise: (e) Include in the sample group SETsample-CDM 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 (SETsample-CDM->10yrs). Out of SET5-units and SET_{≥20%}, the latter group was selected as SETsample 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 ($EF_{grid,CM,y}$) 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_{OM} : Weighting of OM emission factor (%)

W_{BM} : Weighting of BM emission factor (%)

For the proposed PoA, the following default values are used: $w_{OM} = 0.5$ and $w_{BM} = 0.5$.

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.

Project emissions (PE_y) = 0 tCO₂e

F.3. Calculation of leakage emissions

In accordance with the applied methodology, no leakage emissions are considered, hence Leakage (LE_y) = 0 tCO₂e

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

| CPA UNFCCC reference number | Baseline GHG emissions or baseline net GHG removals (t CO ₂ e) | Project GHG emissions or actual net GHG removals (t CO ₂ e) | Leakage GHG emissions (t CO ₂ e) | GHG emission reductions or net anthropogenic GHG removals (t CO ₂ e) | | | |
|-----------------------------|---|--|---|---|----------------------------------|-----------------|--------------|
| | | | | Before 01/01/2013 | From 01/01/2013 until 31/12/2020 | From 01/01/2021 | Total amount |
| 6198-P2-0001-CP2 | 835 | 0 | 0 | 0 | 835 | 0 | 835 |
| Total | 835 | 0 | 0 | 0 | 835 | 0 | 835 |

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 ₂ e) | Amount estimated ex ante for this monitoring period in the CPA-DD (t CO ₂ e) |
|-----------------------------|---|---|
| 6198-P2-0001-CP2 | 835 | 2,644 |
| Total | 835 | 2,644 |

F.5.1. Explanation of calculation of “amount estimated ex ante for this monitoring period in the CPA-DD”

Total annual estimated emissions reductions 9,279 tCO₂e. By determining the daily average estimated emissions reductions and then calculating the total number days in the monitoring period i.e.104 days, total emissions reductions (estimated) of for the monitoring period comes out to be 2,644 tCO₂e.

F.6. Remarks on increase in achieved emission reductions

Not applicable as achieved emissions reduction in this case (for both 6198-P2-0001-CP2 is lower than the estimate emission reductions in the monitoring period..

F.7. Remarks on scale of small-scale CPAs

Any of the project activities has never ever exceeded the maximal installed capacity of 15 MW per CPA set forth in the applied Methodology AMS-I.D. ver. 18.0 – Grid connected renewable electricity generation. All CPAs therefore comply with the eligibility criteria and can be included. All installations have been verified periodically during annual verifications and no increase of capacity exceeding the limit has ever been recorded.

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Document information

| <i>Version</i> | <i>Date</i> | <i>Description</i> |
|--|--------------|---|
| 04.0 | 6 April 2021 | Revision to: <ul style="list-style-type: none"> • Reflect the “Clarification: Regulatory requirements under temporary measures for post-2020 cases” (CDM-EB109-A01-CLAR). |
| 03.0 | 31 May 2019 | Revision to: <ul style="list-style-type: none"> • Ensure consistency with version 02.0 of the “CDM project standard for programmes of activities” (CDM-EB93-A07-STAN); • Add a section on remarks on the observance of the scale limit of small-scale CPAs during the crediting periods; • Add "changes specific to afforestation or reforestation activities/CPA" as a possible post-registration changes; • Clarify the reporting of net anthropogenic GHG removals for A/R PoAs between two commitment periods; • Make structural and editorial improvements. |
| 02.0 | 7 June 2017 | Revision to: <ul style="list-style-type: none"> • Ensure consistency with version 01.0 of the “CDM project standard for programmes of activities” (CDM-EB93-A07-STAN); • Make editorial improvements. |
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