Monitoring report form for CDM project activity
(Version 09.0)

MONITORING REPORT			
Title of the project activity	Rio Amoyá Run-of-River Hydro Project		
UNFCCC reference number of the project activity	3461		
Version number of the PDD applicable to this monitoring report	9		
Version number of this monitoring report	1		
Completion date of this monitoring report	09/12/2021		
Monitoring period number	Fourth monitoring period		
Duration of this monitoring period	01/07/2019 – 30/06/2021		
Monitoring report number for this monitoring period	N/A		
Project participants	ISAGEN S.A. E.S.P.		
Host Party	Colombia		
Applied methodologies and standardized baselines	The ACM0002 Large-scale "Consolidated Methodology for Grid-connected electricity generation from renewable sources" version 19.0		
Sectoral scopes	Sectoral Scope 1: Energy industries (renewable - /non-renewable sources)		
Amount of GHG emission reductions or net anthropogenic GHG removals achieved by the project activity in this monitoring period	Amount achieved before 1 January 2013	Amount achieved from 1 January 2013 until 31 December 2020	Amount achieved from 1 January 2021
	0	117,365 tCO_2	26,396 tCO_2
Amount of GHG emission reductions or net anthropogenic GHG removals estimated ex ante for this monitoring period in the PDD	172,262 tCO_2		

SECTION A. Description of project activity

A.1. General description of project activity

The Rio Amoyá Run-of-River Hydro Project ("Project"), consists of a greenfield run-of-river power plant with a nominal capacity of 80 MW and an anticipated generation of approximately 513.6 GWh/year, based on the projected generation resulting from engineering studies contracted by ISAGEN S.A. E.S.P. ("ISAGEN") in 1998 and 2005. The power plant is connected to the national grid through an 18.6 km transmission line.

The Project is considered not only as a power plant, but also as an "Environmental Services Project". It contributes to decrease the global emissions of carbon through the substitution of polluting fuels as a source of electric power generation; and with its multiple benefits and capacity to yield and consolidate economic resources, it will contribute to the conservation and protection of the Amoyá River´s basin and to the conservation of the Las Hermosas Páramo ecosystem. About the environmental effects, the plant, thanks to its characteristics of being a run-of-river-intake hydroelectric with no dam, and the simplicity involving the civil works, had a minimum environmental impact, since it involved no settlement relocation or displacement whatsoever, it had a low effect on the ecosystems in the influence area and its land requirements were minimal.

The Project was expected to start its operation in 2011 and to reduce about 1.2 million tCO2e by 2018. However, the construction spent more time because of different circumstances and the plant started commercial operation on May 30th, 2013.

A.2. Location of project activity

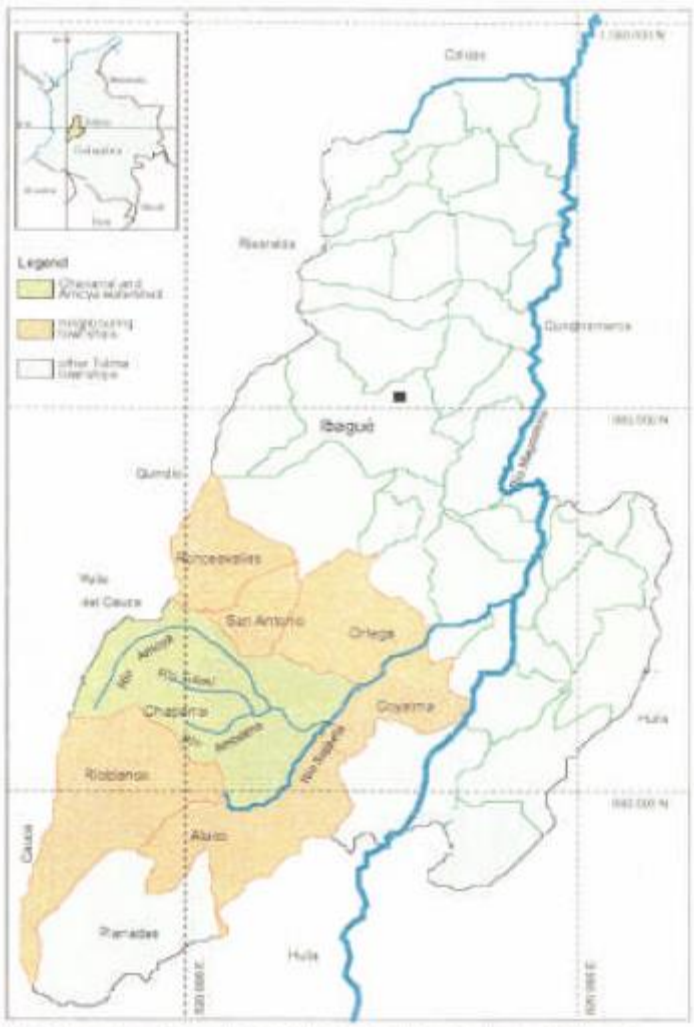
The Project is in the middle section of the Amoyá River Basin in the municipality of Chaparral, Tolima province, Colombia. Chaparral is 262 Km from Colombia´s capital, Bogota. The Amoyá River receives waters from *Las Hermosas Páramo* ecosystem.

The upper reaches of the Amoyá River basin are conformed by a *Páramo* ecosystem. This high-altitude ecosystem is considered of major importance given its great ecological value and the multiple environmental services it provides. Both reasons make the relation with the Project of relevance. *Páramos* in the Amoyá area form the largest patch in the Central Cordillera. Out of the *Páramo* total area; there are 650 km^2 under protection status in the *Las Hermosas Páramo* National Natural Park; 27% of this area is in the Amoyá River basin.

Project's Coordinates

	Y	X	Latitude	Longitude
Bogotá	**N 1'000,000.000**	**E 1'000,000.000**		
Power house	N 912,781.836	E 831,653.566	3° 48' 22"	-75° 35' 35"
Intake	N 917,584.603	E 824,852.432	3° 50' 58"	-75° 39' 15"

Civil works and generation equipment are located around the geographical coordinates 75º 40´W and 3º 50´N along the Amoyá River, at elevations between 1,486 and 939 meters above mean sea level, downstream from where the Davis River joints the Amoyá River.



Map 1. Location of project area: Chaparral and Amoyá river watershed in Tolima province

Figure 1: Geographical localization of the project activity

A.3. Parties and project participants

Parties involved	Project participants	Indicate if the Party involved wishes to be considered as project participant (Yes/No)
Republic of Colombia (host Party)	ISAGEN S.A. E.S.P. - Private entity	No

A.4. References to applied methodologies and standardized baselines

The ACM0002-version 19.0 “Consolidated baseline methodology for grid-connected electricity generation from renewable sources” is chosen as the most relevant to the project activity. This methodology, as applied in this project activity, also refers to the approved version of the following Tools: (i) the “tool to calculate the emission factor for an electricity system”[1] (version 7.0) - and (ii) the “Assessment of the validity of the original/current baseline and update of the baseline at the renewal of the crediting period” (version 03.0.1)”[2].

A.5. Crediting period type and duration

The crediting period is a renewable period for 7 years; from 01/07/2019 to 30/06/2026, (first and last days included).

[1] Source: https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-07-v7.0.pdf

[2] Source: https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-11-v3.0.1.pdf

This fourth monitoring period is for two operational years: from 01/07/2019 to 30/06/2021 (first and last days included).

SECTION B. Implementation of project activity

B.1. Description of implemented project activity

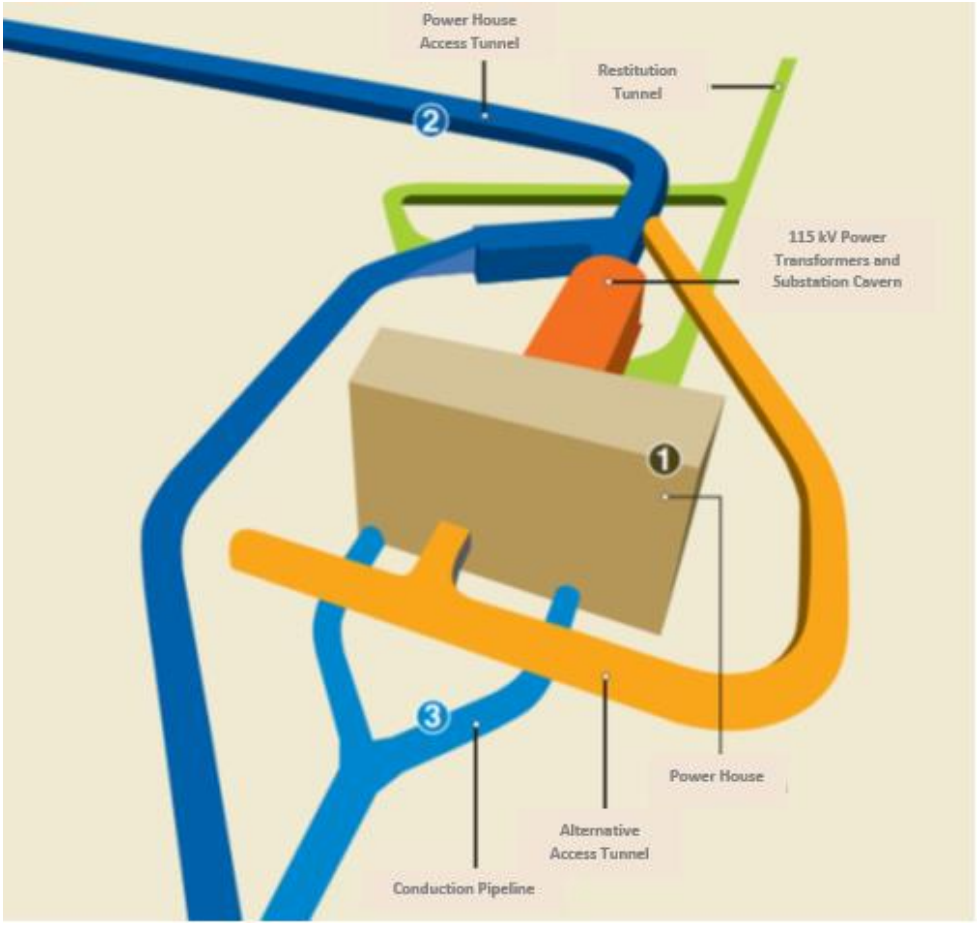
The Rio Amoyá Run-of-River Hydro Project began operations at cero (0:00) hours of May 30th, 2013, and it was implemented according to the PDD approved by UNFCCC.

The underground powerhouse takes advantage of maximum flow 18.4 m^3/s. The powerhouse has two Pelton turbines with a capacity of 40 MW each and two generators with a rated capacity 45.7 MVA each. The net power generation of the project was 857,259[3] GWh during the period to be verified.

The run-of-river power plant was built as stated in the PDD. It uses the water flow of the Amoyá and Davis rivers (See Figure 2).

The main components of the plant are:

1- Powerhouse: It has two generators with a capacity of 40 MW each.
2- Penstock: Access to tunnel Powerhouse.
3- Inflow: Conduction Pipeline



[3] Net electricity supply to the Grid = Electricity supply to the Grid (857,629,564 kWh) - Electricity consume from the Grid (370,980 kWh). Information reported by the monitoring equipment to ISAGEN according to the monitoring plan, details of the data on the *3461 Amoyá - CER 2019-2021_December 9 2021* spreadsheet.

Figure 2. Amoyá hydroelectric power plant diagram

The key technical data of the hydro turbines and the generators of the project is listed in Table 1.

Table 1. Technical data of the hydro turbines, generators and energy measurement equipment

Element	Value/description	Unit	Brand/Serial
Pelton Turbines (2)			
Vertical axis (2)	40	MW	VOITH
Valves (2)	1.10 m D	Meters	
Synchronic generator (2)	45.7	MVA	VOITH / 1DH5949-3WF07-Z Built numbers: SP.08.003438.02 and SP.08.003438.01
	13.8 nominal	kV	
Load Bridge	800	kN	MOCOM/120T/16T
Transformers (2)	13.8/115	kV	SIEMENS
Sub-station GIS	115	kV	SIEMENS/ION 9610
Sub-station Tuluní	115	kV	POWER LOGIC: ION8650

B.2. Post-registration changes

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

Not applicable.

B.2.2. Corrections

There are no corrections following the renewal of crediting period of the project activity.

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

Not applicable.

B.2.4. Inclusion of monitoring plan

Not applicable.

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

Not applicable.

B.2.6. Changes to project design

Not applicable.

B.2.7. Changes specific to afforestation or reforestation project activity

Not applicable.

SECTION C. Description of monitoring system

The Monitoring Plan defines a baseline against which it is possible to measure the Rio Amoyá Run-of-River Hydro Project performance in terms of its greenhouse gas (GHG) emissions and emission reductions that can be monitored and verified in conformity with the modalities and procedures of the Clean Development Mechanism.

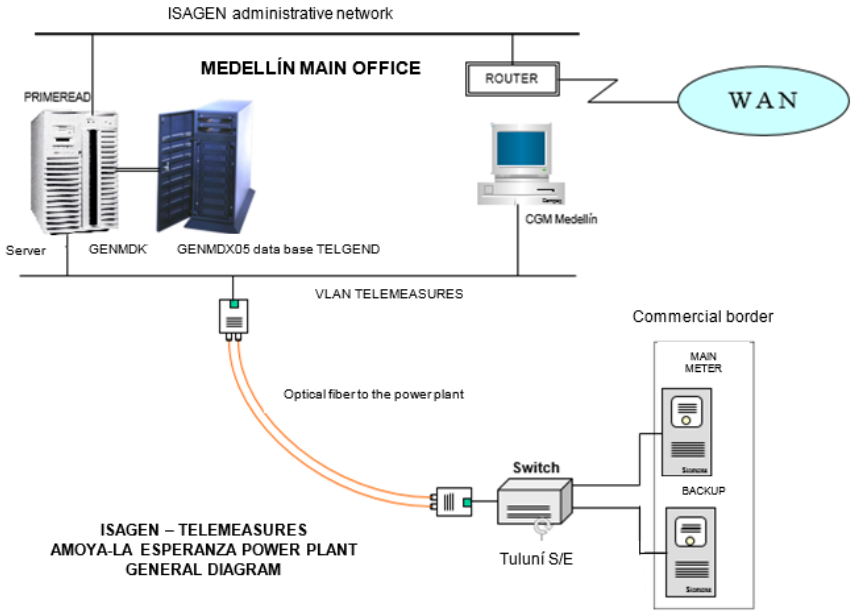


Figure 3. Operational and Management Structure

ISAGEN has incorporated explicitly into its internal procedures a detailed description of the activities regarding to the adequate management of the CDM monitoring system, including the roles and responsibilities associated with those activities (Internal Procedure number 0029).

ISAGEN has formed a multidisciplinary team, coordinated by the Production Department (*Gerencia de Producción*) which is responsible to monitor the parameters, to record them and to analyse the data. Since the project will be using an Ex-Ante option for the grid emission factor, the only parameter to monitor for upcoming verifications is the actual electricity dispatched to the grid. This is relatively simple process, as the Colombian interconnected system relies on a highly regulated metering setup, which is required for the electricity accountability and payments.

As per the metering, the Amoyá hydroelectric power plant is equipped with multi-function electronic metering devices, which register all information that needs to be monitored, such as exported energy, imported energy, power factor, electric tension, electric flow, etc. It is mandatory to install a backup equipment in addition to the main meter. The metering devices are located at the commercial frontier at the Tuluní substation, located 18.6 km away from the power plant. Before the starting of commercial energy exchanges in the wholesale market system, the equipment needs to be duly certified by authorized entities[4].

Information recorded by the metering equipment is sent every 24 hours to the Commercial Exchange System, operated by the National Dispatch Center (XM). All energy transactions are registered every hour. ISAGEN sends every day, before 8:00 am, the recorded values of the day before. According to that information, the National Dispatch Center (XM) processes the bills and payments for all transactions performed in the wholesale market. All this information is available to the market agents and to the system control authorities.

The Production Management Unit keeps a periodical maintenance and calibration program according to the codes approved by law and following recommendations by the equipment providers.

ISAGEN saves the data in the internal software ZSIGEN. The data system is composed by software and hardware that allow recording the data collected at the meters automatically. Using a

[4] According to Decree 2269 of 1993

system called PRIMEREAD, all data for outgoing and incoming energy are measured so that net electricity records are kept in files.

For verification purposes, the data will be easily available at ISAGEN. In addition, historic records of actual energy supplied to the grid are publicly available at the XM website www.xm.com.co.

SECTION D. Data and parameters

D.1. Data and parameters fixed ex ante

Data/Parameter	**$EF_{grid,CM,y}$**
Unit	tCO_2/MWh
Description	Combined margin CO_2 emission factor for grid connected power generation in year y calculated using the latest version of the "Tool to calculate the emission factor for an electricity system"
Source of data	Ex-ante calculations
Value(s) applied	0.1677
Choice of data or measurement methods and procedures	As per the "Tool to calculate the emission factor for an electricity system".
Purpose of data/parameter	Calculation of baseline emissions
Additional comments	As per the "Tool to calculate the emission factor for an electricity system". This value is calculated ex-ante and will be used throughout the crediting period.

D.2. Data and parameters monitored

Data/Parameter	**$EG_{PJ,y}$**
Unit	MWh
Description	Net electricity displaced by the project activity during year *y*
Measured/calculated/ default	Measured. Hourly values. XM monitors the value of this variable. It also keeps records for its customers.
Source of data	Data supplied by ISAGEN for ex-ante calculation, and later by XM for verification purposes. The data supplied by ISAGEN used for ex-ante calculations.
Value(s) of monitored parameter	857,259 MWh

<table>
<tr><td>Monitoring equipment</td><td>According to Colombian regulations, the electricity generated by each power plant connected to the grid will be monitored using metering equipment located at the commercial frontier of every plant. For Amoyá, this equipment is located at the Tuluní substation (Chaparral Municipality) and the commercial frontier is identified with the XM code Frt19972. An 18.6 km - 115 kV transmission line connects the plant and the Tuluní substation. This substation links the plant with the regional interconnected system. In Colombia, The Measurement Code “Código de Medida” establishes mandatory high technical standards, procedures for reading, registering and recording activities of electricity transactions performed in the Colombian energy market, according to the resolution CREG 038 of 2014 (Measurement Code).

The measuring equipment located at Tuluní has the following characteristics:

Principal Measurement Equipment
<table><tr><td>Type/Brand</td><td>POWER LOGIC: ION8650</td></tr><tr><td>Accuracy class</td><td>CL active accuracy:0.2S
Cl reactive accuracy: 2</td></tr><tr><td>Serial number</td><td>MW-1511A832-02</td></tr><tr><td>Calibration frequency</td><td>2 years</td></tr><tr><td>First Calibration date</td><td>23/01/2018</td></tr><tr><td>Validity Period</td><td>2018-2020</td></tr><tr><td>Calibration Certificate</td><td>180123-64574</td></tr><tr><td>Last Calibration date</td><td>23/01/2020</td></tr><tr><td>Validity Period</td><td>2020-2022</td></tr><tr><td>Calibration Certificate</td><td>200122-92437</td></tr></table>
Backup Measurement Equipment
<table><tr><td>Type/Brand</td><td>POWER LOGIC: ION8650</td></tr><tr><td>Accuracy class</td><td>CL active accuracy:0.2S
Cl reactive accuracy: 2</td></tr><tr><td>Serial number</td><td>MW-1511A833-02</td></tr><tr><td>Calibration frequency</td><td>2 years</td></tr><tr><td>First Calibration date</td><td>24/01/2018</td></tr><tr><td>Validity Period</td><td>2018-2020</td></tr><tr><td>Calibration Certificate</td><td>180124-64575</td></tr><tr><td>Last Calibration date</td><td>22/01/2020</td></tr><tr><td>Validity Period</td><td>2020-2022</td></tr><tr><td>Calibration Certificate</td><td>200122-92436</td></tr></table>
Additional to the Measurement Code, ISAGEN has implemented an administrative document (reference 0545) that defines the internal policy regarding to the technical characteristics, calibration conditions, maintenance of measurement equipment, etc.</td></tr>
<tr><td>Measuring/reading/recording frequency</td><td>Hourly measurement and monthly recording.</td></tr>
<tr><td>Calculation method
(if applicable)</td><td>N/A</td></tr>
<tr><td>QA/QC procedures</td><td>All metering devices used to monitor, and measure data follow rules that have been summarized in resolution CREG 038 of 2014. This resolution specifies the technical measurement, telecommunications and back-up equipment characteristics to meet installation, testing, certification, operation and maintenance procedures.</td></tr>
<tr><td>Purpose of data/parameter</td><td>This information is required to calculate baseline emissions</td></tr>
<tr><td>Additional comments</td><td>N/A</td></tr>
</table>

D.3. Implementation of sampling plan

Not applicable.

SECTION E. Calculation of emission reductions or net anthropogenic removals

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

The Baseline emissions are calculated as follows, according to the Consolidated Baseline Methodology ACM0002:

$$BE_y = EG_{PJ,y} * EF_{grid,CM,y}$$

BE_y = Baseline emissions in year *y* (tCO_2e)

$EG_{PJ,y}$ = 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/yr).

$EF_{grid,CM,y}$ = Combined margin CO_2 emission factor for grid connected power generation in year y calculated using the *"Tool to calculate the emission factor for an electricity system"* (tCO_2e/MWh) in year *y*.

FOURTH MONITORING PERIOD (July 1 2019 - June 30 2021)		
Year	**Month**	**Net electricity supply to the Grid (MWh)**
2019	July	54.849
	August	48.951
	September	32.800
	October	53.401
	November	41.199
	December	37.429
2020	January	25.155
	February	14.955
	March	21.130
	April	28.546
	May	48.479
	June	50.444
	July	53.351
	August	49.299
	September	37.366
	October	33.090
	November	34.642
	December	34.769
SUBTOTAL		**699.855**
2021	January	40.582
	February	23.234
	March	29.878
	April	46.496
	May	17.369
	June	-156
SUBTOTAL		**157.403**
TOTAL		**857.259**

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

Determine the net annual project electricity output for the period under verification from the XM (the official database of the National Dispatch Center), which can be accessed from the website, http://informacioninteligente10.xm.com.co. The output is available in kWh.

- Use the ex-ante combined emission factor calculated in the PDD.
- Multiply the project actual electricity supply to the Grid by the combined emission factor for the Colombian interconnected electricity grid.
- *Total CERs generated by the project for the period are calculated as:*

$$ER_y = BE_y - PE_y - L_y$$

Where:

ER_y = Emission reductions in year *y* (tCO_2e/yr.)

BE_y = Baseline emissions in year *y* (tCO_2/yr.)

PE_y = Project emissions in year *y* (tCO_2e/yr.)

PE_y is the project emissions in year ***y*** and

L_y refers to leakage in year *y* as defined in the methodology ACM0002.

According to the PDD, $PE_y = 0$ and $LE_y = 0$

E.3. Calculation of leakage emissions

According to the PDD, no leakage emissions are considered. The main emissions potentially giving rise to leakage in the context of electric sector projects are emissions arising due to activities such as power plant construction and upstream emissions from fossil fuel use (e.g. extraction, processing, and transport). These emissions sources are neglected.

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

	Baseline GHG emissions or baseline net GHG removals (tCO_2e)	Project GHG emissions or actual net GHG removals (tCO_2e)	Leakage GHG emissions (tCO_2e)	GHG emission reductions or net anthropogenic GHG removals (tCO_2e)			
				Before 01/01/2013	From 01/01/2013 until 31/12/2020	From 01/01/2021	Total amount
Total	143,762	0	0	0	117,365	26,396	143,761

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

Amount achieved during this monitoring period (tCO_2e)	Amount estimated ex ante for this monitoring period in the PDD (tCO_2e)
143,761	172,262

E.5.1. Explanation of calculation of "amount estimated ex ante for this monitoring period in the PDD"

The amount estimated ex ante for this monitoring period, corresponds to two years of operation of the project activity.

Considering that the estimated annual generation is 513,6 GWh resulting in an emissions reduction of 86,131 tCO_2.

For the period under evaluation, two years, the amount estimated ex ante would be 172,262 tCO_2.

E.6. Remarks on increase in achieved emission reductions

Not applicable.

E.7. Remarks on scale of small-scale project activity

Not applicable.

Document information

Version	*Date*	*Description*
09.0	8 October 2021	Revision to: • Ensure consistency with version 03.0 of the "CDM project standard for project activities" (CDM-EB93-A04-STAN).
08.0	6 April 2021	Revision to: • Reflect the "Clarification: Regulatory requirements under temporary measures for post-2020 cases" (CDM-EB109-A01-CLAR).
07.0	31 May 2019	Revision to: • Ensure consistency with version 02.0 of the "CDM project standard for project activities" (CDM-EB93-A04-STAN); • Add a section on remarks on the observance of the scale limit of small-scale project activity during the crediting period; • Add "changes specific to afforestation or reforestation project activity" as a possible post-registration changes; • Clarify the reporting of net anthropogenic GHG removals for A/R project activities between two commitment periods; • Make editorial improvements.
06.0	7 June 2017	Revision to: • Ensure consistency with version 01.0 of the "CDM project standard for project activities" (CDM-EB93-A04-STAN); • Make editorial improvements.
05.1	4 May 2015	Editorial revision to correct version numbering.
05.0	1 April 2015	Revisions to: • Include provisions related to delayed submission of a monitoring plan; • Provisions related to the Host Party; • Remove reference to programme of activities; • Overall editorial improvement.
04.0	25 June 2014	Revisions to: • Include the Attachment: Instructions for filling out the monitoring report form (these instructions supersede the "Guideline: Completing the monitoring report form" (Version 04.0)); • Include provisions related to standardized baselines; • Add contact information on a responsible person(s)/ entity(ies) for completing the CDM-MR-FORM in A.6 and Appendix 1; • Change the reference number from *F-CDM-MR* to *CDM-MR-FORM*; • Editorial improvement.
03.2	5 November 2013	Editorial revision to correct table in page 1.
03.1	2 January 2013	Editorial revision to correct table in section E.5.

Version	*Date*	*Description*
03.0	3 December 2012	Revision required to introduce a provision on reporting actual emission reductions or net GHG removals by sinks for the period up to 31 December 2012 and the period from 1 January 2013 onwards (EB 70, Annex 11).
02.0	13 March 2012	Revision required to ensure consistency with the "Guidelines for completing the monitoring report form" (EB 66, Annex 20).
01.0	28 May 2010	EB 54, Annex 34. Initial adoption.

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