Monitoring report form for CDM project activity
(Version 08.0)

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

MONITORING REPORT			
Title of the project activity	Bethlehem Hydroelectric project		
UNFCCC reference number of the project activity	2692		
Version number of the PDD applicable to this monitoring report	12		
Version number of this monitoring report	6		
Completion date of this monitoring report	30/08/2021		
Monitoring period number	3		
Duration of this monitoring period	08/10/2016 – 31/12/2020		
Monitoring report number for this monitoring period	Not applicable		
Project participants	Bethlehem Hydro (Pty) Ltd Statkraft Markets BV		
Host Party	South Africa		
Applied methodologies and standardized baselines	Methodology: AMS-1.D "Grid connected renewable electricity generation" (Version 18.0) Standardised baseline: ASB0001 "Standardized baseline: Grid emission factor for the Southern African power pool" (Version 01.0)		
Sectoral scopes	Sectoral scope: 01, 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	161,346 tCO2e	0
Amount of GHG emission reductions or net anthropogenic GHG removals estimated ex ante for this monitoring period in the PDD	136,671 tCO_2e		

SECTION A. Description of project activity

A.1. General description of project activity

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The Bethlehem Hydroelectric Project was registered on 08 October 2009. The project was implemented and the first crediting period ran from 08 October 2009 elapsed on 07 October 2016. The crediting period was renewed and second crediting period will run from 08 October 2016 and will lapse on 07 October 2023. This is the first monitoring report under the project's second crediting period.

The purpose of the project activity is to generate hydroelectricity, which will be distributed into the currently coal intensive South African grid. The hydro power generated from the project site will be replacing electricity from the national grid, consequently avoiding CO_2 emissions from fossil fuelled power plants connected to the grid. Prior to the implementation of the project activity, there was no hydro-power generated at the project sites.

The project involves the development and operation of 5.8 MW of hydro generation capacity within the boundaries of the Dihlabeng Local Municipality (Free State Province, South Africa). The project is comprised of two generation facilities i.e.

- A run of river site located on the As River, midway between Bethlehem and Clarens; and,
- Facility located at the existing concrete wall of the Sol Plaatje Dam, in the town of Bethlehem. The Sol Plaatje Dam supplies water to the town and is not used for hydropower generation so far.

The following dates are relevant to this project activity:

- Start date of project activity (defined in the PDD as the start of construction): 28 November 2006
- Commencement of Sol Plaatje unit generation based on the first metered power sales: 11 November 2009
- Commencement of the Merino unit generation based on the first metered power sales: 15 November 2010

The project involved the construction of these facilities as well as a 5km transmission line at 11kV, to the Panorama substation to link the Sol Plaatje plant to the national grid. A step-up transformer was required at the power station in order to deliver power at 11kVA. Existing access roads to the site were upgraded. The Merino plant is connected directly through a 22kV line.

The water resource in the As River is artificially fed from the Lesotho Highlands Water Project (LHWP). Water from the project is currently transferred from the Katse Dam in Lesotho to South Africa via the transfer tunnel and the delivery tunnel. During the transfer it is used to generate electricity for Lesotho in the Muela hydropower plant situated between the two tunnels. After driving the turbines the water flows to South Africa via the delivery tunnel, the outfall of which is located in the upper reaches of the As River (a tributary of the Liebenbergsvlei River). The flow rate in the river is therefore not seasonally dependent and remains almost constant throughout the year and over time. The project will contribute to sustainable development in South Africa through supporting the development of renewable energy in the country and assisting South Africa in the achievement of its renewable energy target of 10000 GWH renewable energy contribution to final energy consumption by 2013 (White Paper on Renewable Energy, Republic of South Africa, November 2003).

The total GHG emission reductions achieved in this monitoring period amounts to 161,346 metric tonnes of carbon dioxide equivalent (tCO_2e).

A.2. Location of project activity

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Host Party - South Africa

Region/State/Province etc. - Free State

City/Town Bethlehem - (Dihlabeng Municipality)

Physical/Geographical location - The Sol Plaatje facility is located at the Sol Plaatje dam which is 5km from the centre of Bethlehem. The actual location is at the existing concrete dam wall adjacent to a pumping station, which supplies the town of Bethlehem with water.

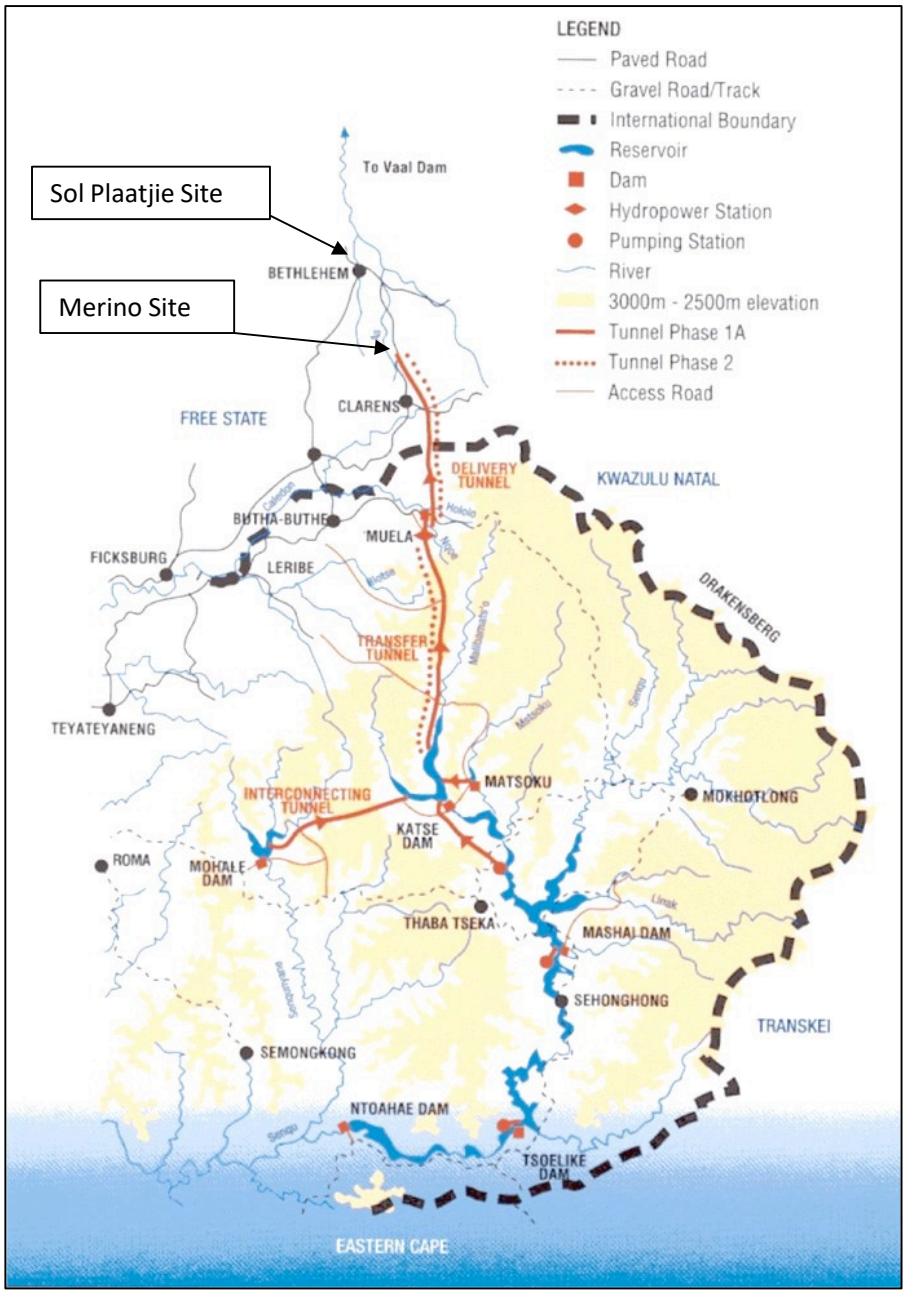
The Merino site is located on farmland on the As River on the farms ‘Merino’ and ‘De Burg Susan’, some 15 km outside Bethlehem in the direction of the town of Clarens.

The co-ordinates for the two sites are:

Merino:
28º 22' 09" S, 028º 21' 42" E

Sol Plaatje:
28º 12' 59" S, 028º 21' 50" E

The location of the sites are set out in the map below:



Bethlehem Hydro (Pty) Ltd is located at, Claremont Central, Corner of Main road and Vineyard road, Claremont, Cape Town, 7735, South Africa.

A.3. Parties and project participants

Parties involved	Project participants	Indicate if the Party involved wishes to be considered as project participant (Yes/No)
South Africa	Bethlehem Hydro (Pty) Ltd	No
The Netherlands	Statkraft Markets BV	No

A.4. References to applied methodologies and standardized baselines

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Methodology:

- AMS-I.D.: “Grid connected renewable electricity generation” (Version 18.0) https://cdm.unfccc.int/methodologies/DB/W3TINZ7KKWCK7L8WTXFQQOFQQH4SBK

Tools:

- "Methodological tool: Tool to determine the remaining lifetime of equipment" (Version 01) https://cdm.unfccc.int/EB/050/eb50_repan15.pdf
- "Methodological tool: 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) https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-11-v3.0.1.pdf

Water reservoir calculations use:

- ACM0002: "Grid-connected electricity generation from renewable sources" (Version 17.0) https://cdm.unfccc.int/methodologies/DB/8W400U6E7LFHHYH2C4JR1RJWWO4PVN

Standardised baseline:

- ASB0001 "Standardized baseline: Grid emission factor for the Southern African power pool" (Version 01.0) - Valid 31 May 2013 to 30 May 2017. https://cdm.unfccc.int/methodologies/standard_base/EB73_repan03_ASB-0001.pdf

  In accordance with par 263 of the CDM Project Standard for Project Activities (Version 02.0) the project participant shall apply, in the first monitoring report for the second crediting period, the version of the applied standardised baseline that contains the more conservative standardised value(s) of the parameter(s) between those latest version applicable on the submission date of the request for renewal of the crediting period, and those in the latest version applicable on the first day of the first monitoring period in the new crediting period.

  The revised monitoring report and ex ante calculations therefore reflect the application of the ASB0001 Standardized baseline throughout the project activity's second crediting period. This is aligned with the registered PDD for the project activity's second crediting period. Accordingly, the project activity's second crediting period commenced on 8 October 2016, which is within the validity period of the ASB0001 Standardized baseline: from 31 May 2013 to 30 May 2017. ASB0001 was therefore the latest version of the Standard Baseline on the submission date of the request for renewal of the crediting period (8 September 2016) The ASB0001 Standardized baseline represents the more conservative value of the Standardized Baseline applicable on the first day of the this first monitoring period in the new crediting period.

A.5. Crediting period type and duration

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Type: Renewable Crediting Period.
Duration: 08/10/2016 – 07/10/2023 (7 years).

SECTION B. Implementation of project activity

B.1. Description of implemented project activity

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The project activity has been implemented and has been operational during the monitoring period (08/10/2016 – 31/12/2020), producing electricity during this period.

Current Status of the project:

- The start date of the project is 28 November 2006.
- The project was registered by the CDM Executive Board on the 8 October 2009.
- The Sol Plaatje Power Plant has been fully operational from 11 November 2009. Generation of electricity and the export of power to the grid commenced on this date.
- The Merino power plant was commissioned in March 2012.

- The First crediting period ran from 8 October 2009 – 7 October 2016 and the second crediting period is running from 8 October 2016 – 7 October 2023.
- Credits have been issued for the period of 8 October 2009 – 30 November 2013 as well as the period from 1 December 2013 – 7 October 2016.

The tables below summarise significant shutdown events of the Sol Plaatje and Merino plants during the monitoring period. Most of the listed shutdown events reflect single shutdown events, summarised per month. A shutdown is considered to be significant where the plant is down for two or more hours during a 24-hour cycle. Accordingly, the durations listed in the tables below are the sum of the significant shutdown hours that occurred during the month.

The shutdowns are recorded by the project participant as and when they happen, in shutdown records. The shutdown records specify the times, dates and details of each shutdown. All shutdowns are recorded, irrespective of the amount of time the plants are down. However, for the purposes of this monitoring report, the duration of significant shutdown events have been summarised, per month.

There were shorter shutdowns recorded by the project participant, which vary between 5 minutes and 2 hours. However, such shutdowns do not have a material impact on the emission reduction calculations given the short periods of time which the plants were down and are consequently not reflected below.

Table 1: Sol Plaatje Significant Shutdowns (Hours)

Date	Duration (hours)	Reason for shutdown
December 2016	24.5	Planned - Water flow related
January 2017	4.8	Unplanned - Grid related
February 2017	38	Unplanned - Flow related and equipment failure
March 2017	29.5	Planned – Plant Maintenance
April 2017	44.3	Unplanned – Grind related and maintenance
May 2017	2.6	Unplanned – Equipment failure
September 2017	316.2	Planned – Plant Maintenance (314 hours) Unplanned - Grid related (2.2 hours)
November 2017	7.5	Planned – Plant Maintenance
February 2018	24.7	Unplanned – water flow related
March 2018	109.8	Unplanned – Grid related
April 2018	11	Unplanned – Equipment failure
September 2018	6.3	Planned – Grid related (3.6 hours) Unplanned – Grid related (2.7 hours)
October 2018	126.3	Unplanned – Grid related (4.3 hours) Planned – Plant Maintenance (122 hours)
November 2018	7.3	Unplanned – Grid related
December 2018	27.6	Unplanned – Grid related
February 2019	25.4	Unplanned – Grid related and Flow related
March 2019	12.1	Unplanned – Grid related
May 2019	2.7	Unplanned – Grid related
June 2019	2.2	Unplanned – Grid related
September 2019	9.8	Planned – Plant maintenance
October - December 2019	1587.3	Planned –Plant maintenance on cables and long-term water shutdown
January 2020	10.3	Unplanned – Grid related (2.5 hours) Planned – Plant maintenance (7.8 hours)
February 2020	5.5	Unplanned – Grid related and maintenance
October 2020	12.1	Unplanned – Grid related

November 2020	39.95	Planned – Maintenance (24.05hours), Unplanned – water shutdowns (15.9 hours)
December 2020	2.9	Planned – Gird Related

Further to the shutdown events listed above, there was no Power Purchase Agreement in place with an electricity off-taker for the power generated by the Sol Plaatje Plant for the period from 28 November 2019 to 1 June 2020. The plant remained in operation and generated electricity at times during this period, which was fed into the electricity grid. No power generation invoices were generated during this period, even though electricity was still being supplied into the grid, as no formal PPA was in place. No Eskom records of generation were available for the months of 1 December 2019 – 29 February 2020. Hence no emission reductions are claimed for Sol Plaatje for this period of 1 December 2019 – 29 February 2020. Project emissions from the consumption of electricity were however accounted for in this period.

However, during the period when there was no PPA, Eskom accepted generated electricity from Sol Plaatje that was fed into the grid and provided records of electricity generated by Sol Plaatje for the period 1 March 2020 – 31 May 2020. The source of these data generation records was the Eskom-owned meter that monitors net electricity generation at Sol Plaatje. Hence, these records of generation from Eskom prove that electricity was generated in this period and fed into the grid.

The tables below list shut down events of the Merino plant during the monitoring period. A shutdown is considered to be significant where the plant is down for two or more hours at a time.

Table 2: Merino Significant Shutdowns (Hours)

Date	Duration (hours)	Reason for shutdown
December 2016	4	Unplanned shutdown – Water Flow related
January 2017	120	Planned Shutdown – Annual Maintenance
February 2017	16	Unplanned Shutdown – Plant Trips, Equipment Failure and Water Flow related
May 2017	20	Planned shutdown (12.5 hours) – Grid related Unplanned shutdown (7.5 hours) – Unknown
July 2017	5	Unplanned – Water Flow related
November 2017	110.4	Planned shutdown – Annual Maintenance
January 2018	22	Unplanned – Grid related
February 2018	30.8	Planned (17.3 hours) – Water Flow related Unplanned (13.5 hours) – Water Flow related
March 2018	13.4	Planned (10.4) Water Flow related and plant maintenance. Unplanned (3 hours) – Equipment failure
April 2018	3.1	Planned – Plant Maintenance
July 2018	12.2	Unplanned – Grid related
November 2018	151.2	Planned – Annual Maintenance
December 2018	40.8	Unplanned – Equipment Failure
February 2019	153.6	Planned – Water Flow related
April 2019	6.6	Unplanned – Plant Trip and Grid related
May 2019	4.5	Unplanned – Water Flow related
August 2019	81	Planned – Plant Maintenance (3 days)
September 2019	8.7	Planned – Plant Maintenance
October – Nov 2019	1488	Planned – Annual maintenance
Dec 2019 – Jan 2020	1312	Planned – Annual Maintenance and Grid related
February 2020	67.2	Unplanned – Equipment Failure and Plant shut down
March 2020	11.9	Planned – Plant Maintenance
April 2020	36	Unplanned – Grid related

June 2020	12.2	Unplanned – Grid Related
September 2020	412.8	Unplanned – Annual Maintenance
October 2020	11.7	Planned – flow related
November 2020	41.5	Unplanned – Water shutdowns
December 2020	22.45	Unplanned – Grid related (6.45hours) and water shutdowns (16 hours)

The project activity contributes to technology transfer to the host country South Africa, since it utilises hydro power technology developed outside South Africa, imported from India.

The project is using small hydro technology at both of the following facilities:

1. Sol Plaatje unit – located at the Sol Plaatje dam but operates as a run-of-river power station and doesn't affect the water volumes of the dam. The facility uses a single 2.1m diameter, double-regulated horizontal axis Kaplan small hydro turbine with a 2.5 MW rating. The equipment was installed in 2009 and has been in operation for approximately 8 years. The lifespan of the equipment is in excess of 20 years. The overall efficiency at net operating head and maximum flow through the turbine is approximately 85.17%. The site has a generating head of approximately 11 meters.

2. Merino unit – located on the As River, is a run-of-river small hydro power plant that uses a single double-regulated horizontal axis Kaplan small hydro turbine with a 3.6 MW rating. The equipment was installed in 2010 and has been in operation for approximately 7 years. The lifetime of the equipment is in excess of 20 years. The overall efficiency at net operating head and maximum flow through the 3.6 MW Kaplan turbine installed at the Merino site is approximately 86.37%. The site has a generating head of approximately 13 meters.

Prior to the implementation of this project activity "the baseline scenario is that the electricity delivered to the grid by the project activity would have otherwise been generated by the grid-connected power plants and by the addition of new generation sources into the grid." The South African grid is predominantly coal-fired grid."

The arrangement of the two facilities in the project activity are as follows (Figure 1):

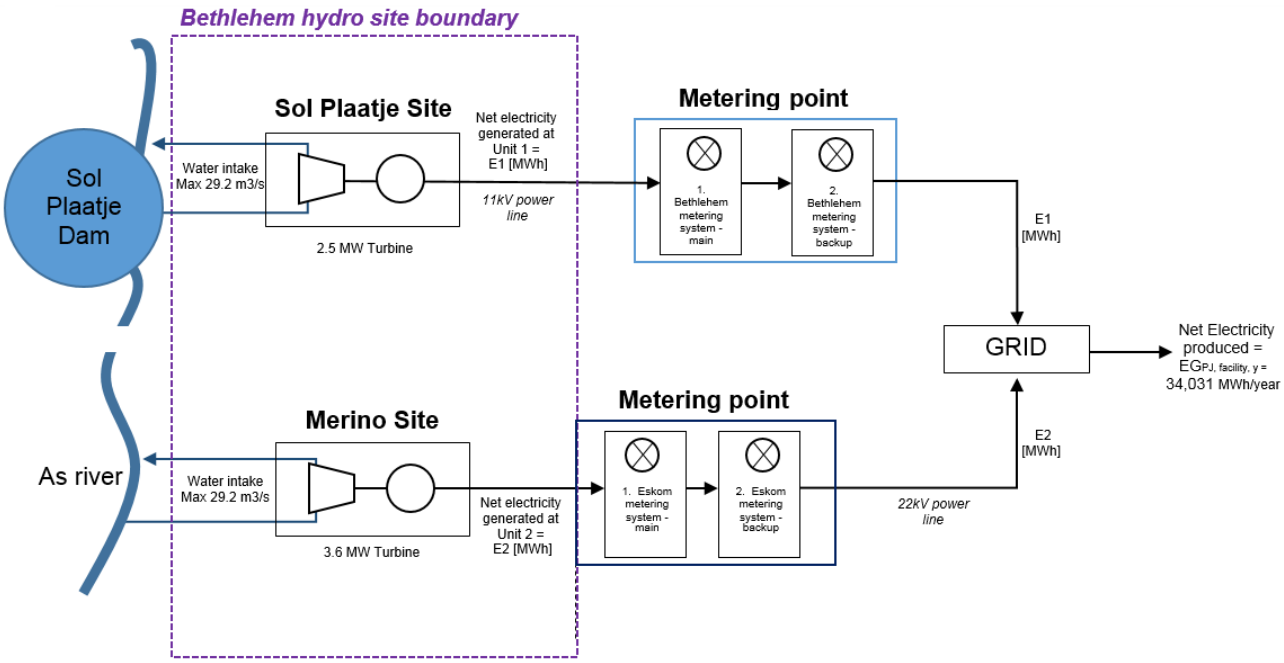

Figure 1: Project Activity Equipment Arrangement

B.2. Post-registration changes

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

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Not applicable.

B.2.2. Corrections

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Not applicable. No corrections to the monitoring plan are required since the renewal of the crediting period.

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

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Not applicable.

B.2.4. Inclusion of monitoring plan

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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

(a) Changes that have been approved by the Board as applicable from the period prior to this monitoring period

Permanent Changes to the Monitoring Plan:

1. Change in the calibration frequency and accuracy classes applicable for the electricity meters – In the revised Monitoring Plan, the calibration frequency is defined as once every three years, whereas the registered monitoring plan indicated that no calibration was needed. It has been confirmed with the equipment manufacturer that a recalibration of the equipment is not required. Also, the South African National Standards for electricity metering on electricity measurement do not require specific calibration beyond the manufacturer's recommendation. Only if any in-situ verification test shows that a meter is outside the required error limits, the meter shall be returned to an accredited calibration laboratory for calibration at reference conditions.
2. Change of power meter location – In the revised Monitoring Plan, the exact power meter location was newly defined as per the definition provided in the corresponding PPA to each power plant. The registered PDD stated that electricity meters are installed at each generation unit. The PPAs for Merino and Sol Plaatje define the power meters location at the power station and at the Panorama substation, respectively.
3. Addition of calculation of projects emissions due to use of back up diesel generator and addition of respective monitoring parameters FC1,j, FC2,j.
4. Addition of calculation of projects emissions for back up use of electricity and addition of respective monitoring parameters.

Reference number: PRC-2692-002
PRC Approval Date: 17 October 2013

B.2.6. Changes to project design

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Removal of the non-functional diesel generator equipment from site. The previous PDD included an existent diesel generator within the calculations. However, the generator has never been operational and now has been removed from the site, therefore mention to diesel consumption and diesel monitoring has been removed from the document and from the calculations.

Reference number: n/a The PRC was submitted along renewal of crediting period.
PRC Approval Date: 26/11/2016

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

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Not applicable.

SECTION C. Description of monitoring system

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Overall project management
Bethlehem Hydro has a clear and well defined management structure consisting of Managing Director, a Operational Manager and an Administrative Clerk. Overall responsibility at the plant lies with the Managing Director who also has final responsibility for the CDM project. The management structure is flat with the Managing Director and the Operational Manager having direct day to day responsibilities in the running of the plant.

Management of project registration, monitoring, measurement and reporting
The Operational Manager has final responsibility for all aspects relating to data measurements, monitoring of data recording and signs off all reports on monitoring.

Data is collected digitally and consolidated by the Bethlehem Hydro Administrative clerk, who also draws up the monthly and annual emission reduction monitoring reports.

Monitoring itself is integrated as far as possible into existing plant operating procedures. The data required for the monitoring of the emission reductions comes from data already collected as part of the plant's operations, i.e. the metering of electricity sales.

Training of monitoring personnel

Due to the nature of the project and its monitoring needs, there is no need for specific or specialized training of personnel for monitoring. The data which is collected is also collected for general plant operational and financial administration.

Monitoring equipment

The monitoring plan ensures that the project emission reductions are accurately monitored, recorded and reported. The only relevant monitoring equipment for this project relates to the electricity meters.

The relevant standardized baselines for the Southern African Power Pool, ASB0001 v1, has been used to calculate the baselines emissions.

The monitoring system includes the electricity meters installed at both the generating units' connection points (Sol Plaatje and Merino sites). There is a bidirectional meter recording imports and exports of energy for each of the two facilities, as well as a check meter in each facility. The total net electricity generation is obtained from the sum of the net electricity generation from both main meters (Sol Plaatje and Merino).

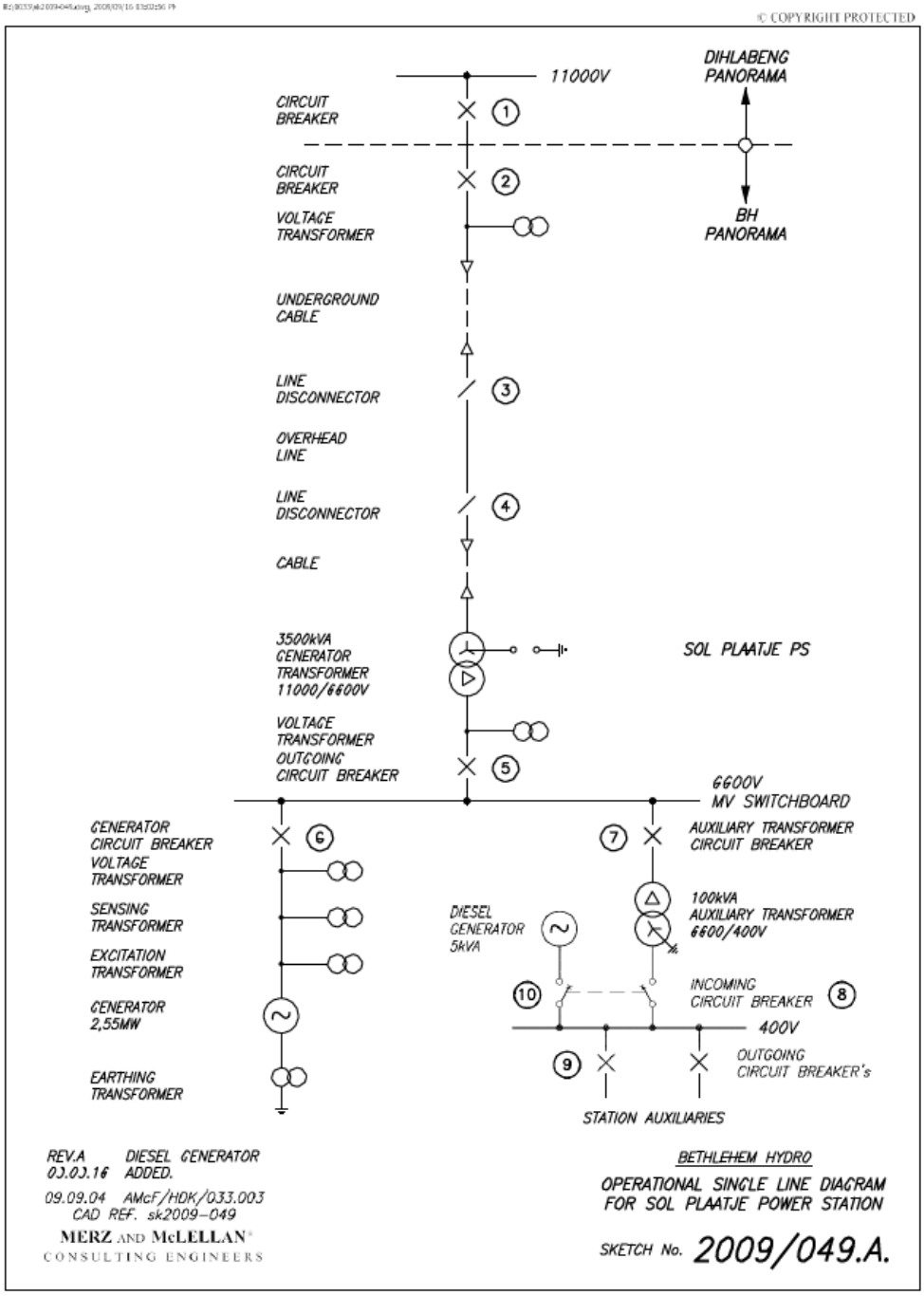
The electricity meters at the Sol Plaatje facility, during the monitoring period, are described in section D.2. During the monitoring period, the meters were replaced once: the old Iskra meters were replaced with new Landis+Gyr meters on 17 October 2019.

The electricity meters at the Merino facility, during the monitoring period, are described in Section D.2. During the monitoring period, the meters were replaced once: the old Elster meters were replaced with new Elster meters on 5 February 2018.

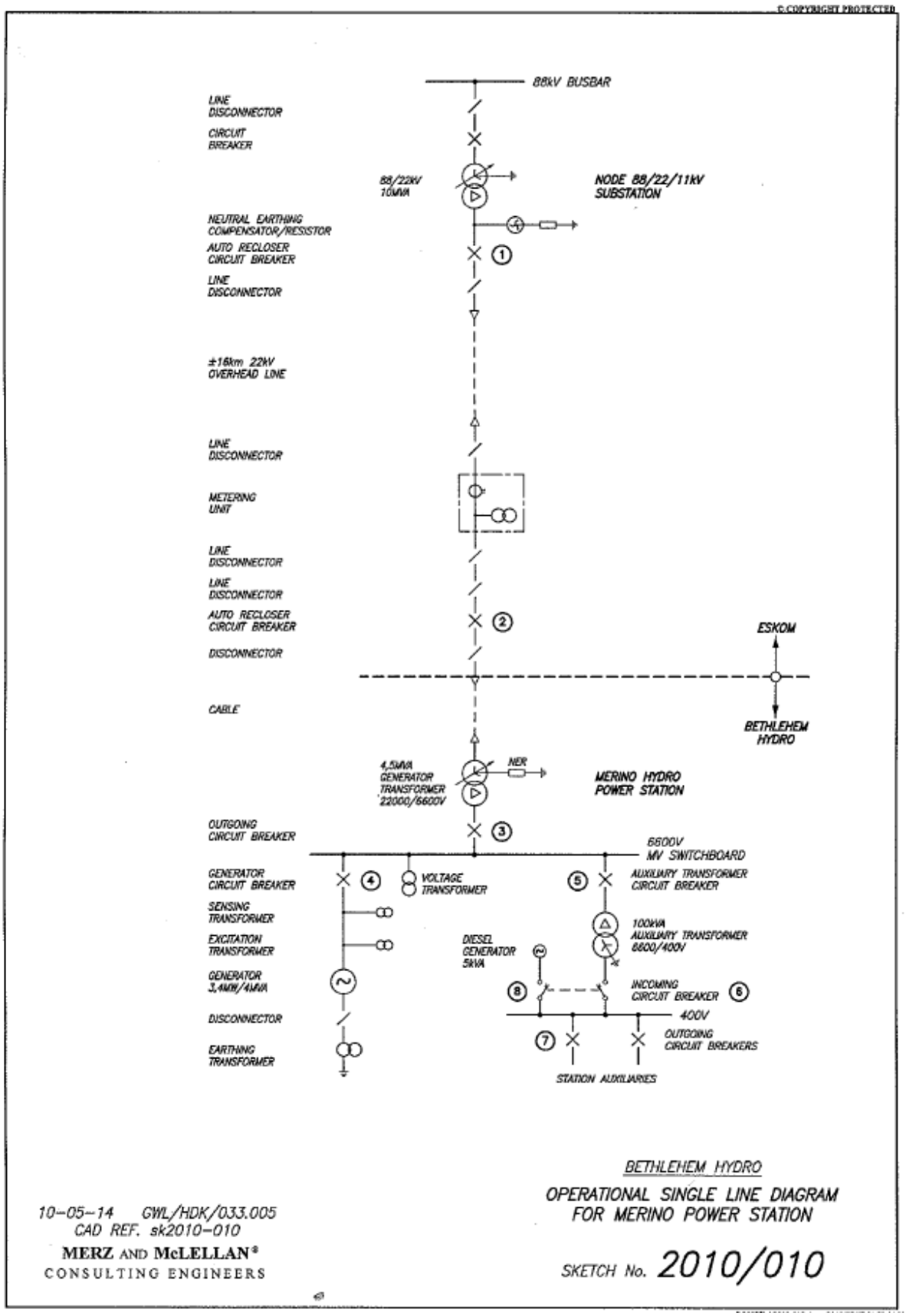
Monitoring equipment installation

The electricity production of the Sol Plaatje unit is measured by a bi-directional electricity meter at the Panorama substation. There is a check meter installed at the same location.

Power produced by the Sol Plaatje unit is transmitted to the Panorama substation by a dedicated 11kV power line. The line diagram is shown below as per the registered PDD.



The Merino meter setup is identical to Sol Plaatje with both a main and check bi-directional electricity meter. The unit feeds power directly into the Eskom line through a dedicated 22kV line without a substation. The single line diagram is shown below.



Monitoring data adjustment procedures

Data is collected on a daily and consolidated on a monthly basis where the data is cross checked against records for quality control purposes. The meters are calibrated.

Data and reports review procedures

Data is reviewed by the Operational Manager and signed off by the Managing director on a monthly basis against predicted and historical values.

Project performance review
Data and project performance are reviewed by the Managing Director and the Operational Manager on a monthly basis against predicted and historical values.

Procedures for improving quality of project monitoring
The main procedure for improving the accuracy of the monitoring is the quality control procedures described in the Monitoring Plan. The data collection and reporting formats are checked on a monthly basis for accuracy and the monitoring procedures are adjusted as required for improved integration with plant operations.

SECTION D. Data and parameters

D.1. Data and parameters fixed ex ante

(Copy this table for each data or parameter.)

Data/Parameter	**$EF_{grid,y}$**
Unit	tCO_2/MWh
Description	Southern African standardised baseline grid emissions factor, ASB0001, applicable to all project activities other than wind and solar for the second or third crediting period
Source of data	ASB0001 “Standardized baseline: Grid emission factor for the Southern African power pool” (Version 01.0)
Value(s) applied	0.9488
Choice of data or measurement methods and procedures	No direct measurements are required. The combined margin emission factor “applicable to all project activities other than wind and solar for the second or third crediting period” from the ASB0001 “Standardized baseline: Grid emission factor for the Southern African power pool” (Version 01.0) has been used for the entire monitoring period in accordance with par 263 of the CDM Project Standard for Project Activities (Version 02.0).
Purpose of data/parameter	Used in the calculation of the baseline emissions.
Additional comments	This project activity meets the applicability criteria of the ASB0001 standardised baseline, in that it is situated in South Africa and is connected to the project electricity system. The grid emission factor is calculated ex-ante

D.2. Data and parameters monitored

(Copy this table for each data or parameter.)

Data/Parameter	**$EG_{PJ,facility,y}$**
Unit	MWh
Description	Quantity of net electricity generation supplied by the project plant/unit to the grid in year y (MWh)
Measured/calculated/ default	Measured
Source of data	Electricity meters installed at both the generating unit’s connection point (Sol Plaatje and Merino sites).

	Year	$EG_{facility\ Merino,y}$ (MWh/year)	$EG_{facility\ Sol\ Plaatje,y}$ (MWh/year)	Total MWh
Value(s) of monitored parameter	2016	6,234	4,034	**10,277**
	2017	27,535	17,183	**44,719**
	2018	27,998	17,758	**45,756**
	2019	20,334	13,367	**33,701**
	2020	21,036	14,565	**35,600**
	Total	**103,145**	**66,908**	**170,053**

Monitoring equipment

METERS AT THE SOL PLAATJE POWER PLANT

The meters at Sol Plaatje were replaced during the monitoring period. The **old** Iskra meter details for the Sol Plaatje Power Plant are as below:

Iskra Electricity Meters	Main Meter	Check Meter
Meter Type	Iskra MT860s	Iskra MT831
Accuracy	Class 0.2s	Class 0.5s
Serial Number	41506004	35597712
1st Calibration	29/03/2016	29/03/2016
1st Calibration Validity	28/03/2019	28/03/2019
Last Calibration	19/03/2021	08/03/2021
Meter Functionality	Bidirectional	Bidirectional

The electricity data sets used in the emission reduction calculations were recorded by the Main Iskra meter up to 1 December 2019. The Iskra meter readings were used up to this date, even though **new** Landis+Gyr meters were installed on 17 October 2019. The Iskra meter readings were used in the emission reduction calculations up to 1 December 2019, as the new Landis+Gyr meter only started recording data on 2 December 2019. Only electricity consumption was recorded as the plant was not generating power. The plant did not generate power because the water suppliers, the Lesotho Drylands Water Project, had a planned water shutdown event. Delayed calibration procedures were applied on the Iskra meter readings, as described further in the Additional Comments field of this table.

The **new** Landis+Gyr meter details for the Sol Plaatje Power Plant are as below. The electricity data sets used in the emission reduction calculations were recorded by the Main Landis+Gyr meter. The factory calibration of the meters was undertaken on 22 October 2018. The meters were however only installed on 17 October 2019 during a maintenance period where there was no electricity generation.

Landis+Gyr Meters	Main Meter	Check Meter
Meter Type	Landis+Gyr ZMD402 CT	Landis+Gyr ZMD402 CT
Accuracy	Class 0.5s	Class 0.5s
Serial Number	43474373	43474371
Factory Calibration	22/10/2018	22/10/2018
Calibration Validity	21/10/2021	21/10/2021
Meter Functionality	Bidirectional	Bidirectional

METERS AT THE MERINO POWER PLANT

The registered PDD provides for the recording of electricity data sets by the Eskom-owned, Elster meters located at the Merino Power Plant. The Elster meters were replaced with new Elster meters during the monitoring period:

Old Eskom Meters	Main Meter	Check Meter
Meter Type	ELSTER A1700	ELSTER A1700
Accuracy	Class 0.5s	Class 0.5s
Serial Number	41101303	41101301
Last Calibration	10/07/2015	10/07/2015
Calibration Validity	09/07/2018	09/07/2018
Meter Functionality	Bidirectional	Bidirectional

The old meters were replaced with new Elster meters on 5 February 2018. These meters are described below:

New Eskom Meters	Main Meter	Check Meter
Meter Type	ELSTER A1700	ELSTER A1700
Accuracy	Class 0.5s	Class 0.5s
Serial Number	3514211183055	3514211183063
1st Calibration	05/02/2018	05/02/2018
Calibration Validity	04/02/2021	04/02/2021
Meter Functionality	Bidirectional	Bidirectional

No delayed calibration procedures were required on the Merino data.

Measuring/reading/recording frequency	Continuous real time monitoring, with a daily download of data and monthly recording thereof.
Calculation method (if applicable)	The quantity of net electricity supplied by the project is calculated by the difference between: (a) The quantity of electricity supplied by the project plant to the grid; and (b) The quantity of the electricity delivered to the project plant from the grid.
QA/QC procedures	According to the National Standard for Metering (NRS-057), the meters need to be at least of Class 1. Meters' calibration to be checked by accredited calibration authority every 3 (three) years. All the electricity meters installed at the sites have accuracy classes which are below this threshold and consequently meet the NRS-057 standards.
Purpose of data/parameter	Used in the calculation of the project emission reductions
Additional comments	As stated above, the electricity meters at both sites were replaced during the monitoring period. Delayed calibration was however applied only in the case of Sol Plaatje. The calibration validity of the Sol Plaatje Iskra meters expired on 28 March 2019. The Landis+Gyr replacement meters began recording consumption data on 2 December 2019. Hence, to be conservative, delayed calibration was applied to the full months in this period, i.e. from 1 March 2019 to 31 December 2019. The maximum permissible error applied in the delayed calibration was 0.2%. A conservative approach was taken in the employment of delayed calibration and the maximum permissible error of the meters was applied to the electricity generation and consumption figures for the period of the delayed calibration. This is as per the "CDM validation and verification standard", Version 09.0, paragraph 395(a). As noted above, there was no Power Purchase Agreement in place with an electricity off-taker for the power generated by the Sol Plaatje Plant for the period from 28 November 2019 to 1 June 2020. The plant remained in operation and generated electricity at times during this period, which was fed into the electricity grid. However, as no Power Purchase Agreement existed for the electricity, no power generation invoices were generated during this period, although electricity was still being supplied into the grid at times. During the period where there was no signed Power Purchase Agreement, Eskom provided records of electricity generated by Sol Plaatje, which was fed into the national grid, for the period 1 March 2020 – 31 May 2020. The source of these data generation records was the Eskom-meter that measured electricity data at the Sol Plaatje plant. Hence, these records of generation from Eskom prove that electricity was generated in this period and fed into the grid. Hence emission reductions are claimed for the periods 1 March 2020 – 31 May 2020 but not for the period 1 December 2019 – 29 February 2020. Project emissions from the consumption of electricity were however still accounted for during the full months of December 2019 - February 2020.

D.3. Implementation of sampling plan

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A sampling plan does not form part of this project activity. This section is not applicable.

SECTION E. Calculation of emission reductions or net anthropogenic removals

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

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According to the methodology AMS-I.D, version 18.0, the baseline emissions are calculated as the product of quantity of net electricity generation that is produced and fed into the grid as a result of the implementation of the project activity multiplied by the grid emission factor (equation (1) of the

methodology).

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

BE_y = Baseline emissions in year y (t CO_2)
$EG_{PJ,y}$ = 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)
$EF_{grid,y}$ = 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" (t CO_2/MWh)

The sample calculation for the year 2019 follows:

$$BE_y = 33{,}701\ MWh \times 0.9488\ \frac{tCO_2}{MWh} = 31{,}976\ tCO_2$$

As per the applied Southern African power pool standardized baseline, ASB0001, version 01.0:

$EF_{grid,y}$ = 0.9488 t CO_2/MWh

The calculation of $EG_{PJ,y}$ for greenfield power plants are calculated according to equation (2) of the methodology as:

$$EG_{PJ,y} = EG_{pj,facility,y}$$

Where:

$EG_{PJ,facility,y}$ = Quantity of net electricity generation supplied by the project plant/unit to the grid in year y (MWh)

A sample calculation for the year 2019 follows:

$$EG_{PJ,y} = EG_{pj,facility,y} = 20{,}334\ MWh_{Merino} + 13{,}367\ MWh_{Sol\ Plaatje} = 33{,}701\ MWh$$

The values of $EF_{grid,y}$ are as per the applied Southern African power pool standardized baseline, ASB0001, version 01.0.

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

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According to the AMS-I.D. methodology (version 18.0) project emissions (PE_y) for most renewable energy project activities are equal to zero.

However, for the following categories of project activities, project emissions have to be considered following the procedure described in the most recent version of "ACM0002: Grid-connected electricity generation from renewable sources" (Version 16.0):

a. Emissions related to the operation of geothermal power plants (e.g. non-condensable gases, electricity/fossil fuel consumption);
b. Emissions from water reservoirs of hydro power plants.

Point a) does not apply to this project activity as it is not a geothermal power plant. Point b) does apply to this project activity as there is an existing water reservoir, the Sol Plaatje Dam, at the one turbine. However, the existing reservoir is not used as a storage facility for dispatch production of energy. Instead, the facility only utilises the water as and when the water flows out the dam, and thus the facility does not affect the water volumes of the dam.

According to ACM0002, version 16.0 the emissions from water reservoirs of hydro power plants ($PE_{HP,y}$) are calculated depending on the value of the power density (PD) of the project activity, which is calculated according to equation (3) of the methodology as follows:

$$PD = \frac{Cap_{PJ} - Cap_{BL}}{A_{PJ} - A_{BL}}$$

PD = Power density of the project activity (W/m^2)
Cap_{pj} = Installed capacity of the hydro power plant after the implementation of the project activity (W)
Cap_{BL} = Installed capacity of the hydro power plant before the implementation of the project activity (W). For new hydro power plants, this value is zero
A_{PJ} = Area of the single or multiple reservoirs measured in the surface of the water, after the implementation of the project activity, when the reservoir is full (m^2)
A_{BL} = Area of the single or multiple reservoirs measured in the surface of the water, before the implementation of the project activity, when the reservoir is full (m2). For new reservoirs, this value is zero.

In this project activity the difference between $A_{PJ} – A_{BL}$ is zero as the project activity has not changed the water volume of the dam. The volume of water in the dam is not affected by the project activity but only by the water requirements of the town where the water is being delivered. The project activity is only able to produce power as and when the water is transported to the town for consumption. The facility does not use the reservoir as a storage facility for dispatch energy production.

With power density (PD) equation being divide by zero it results in a PD = ∞, infinity. According to paragraph 45 of the large scale methodology ACM0002, version 16.0, if PD > 10 W/m^2 then $PE_{HP,y}$ = 0, equation (6) of the methodology.

In addition, according to methodology AMS-I.D version 18.0, CO_2 emissions from on-site consumption of fossil fuels due to the project activity shall be calculated using the latest version of the “Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion”. However, the project activity does not consume any diesel on site. Thus, there are no project emissions related to fossil fuel consumption.

As such project emission for this project activity are equal to zero, $PE_y = 0$.

E.3. Calculation of leakage emissions

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According to methodology AMS-I.D, version 18.0, leakage emissions only apply to biomass project activities. Thus, leakage emissions are zero for this project activity.

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

	Baseline GHG emissions or baseline net GHG removals (t CO_2e)	Project GHG emissions or actual net GHG removals (t CO_2e)	Leakage GHG emissions (t CO_2e)	GHG emission reductions or net anthropogenic GHG removals (t CO_2e)			
				Before 01/01/ 2013	From 01/01/ 2013 until 31/12/ 2020	From 01/01/ 2021	Total amount
2016	9,751	0	0	0	9,751	0	9,751
2017	42,429	0	0	0	42,429	0	42,429
2018	43,413	0	0	0	43,413	0	43,413
2019	31,976	0	0	0	31,976	0	31,976
2020	33,778	0	0	0	33,778	0	33,778
Total	161,346	0	0	0	161,346	0	161,346

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

Amount achieved during this monitoring period (t CO_2e)	Amount estimated ex ante for this monitoring period in the PDD (t CO_2e)
161,346	136,671

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

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For the period, 8 October 2016 to 31 December 2020, the values reported in section B.6.4 of the PDD were summed as provided. This yields a total of 136,671 tCO_2e.

E.6. Remarks on increase in achieved emission reductions

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The actual emission reductions achieved in the monitoring period are 18% higher than the estimated ex ante emission reductions. The increase is due to higher generation resulting from the higher plant availability. This is related to an increase in water flow during the monitoring period. The availability is calculated by summing the hours the plant is generating electricity (i.e the uptime) and taking it as a percentage of the total amount of hours in a year. This was checked by summing the hours of downtime in the year and expressing it as a percentage of the year. The two percentages add up to 100% thus accounting for the entire year.

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

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Not applicable.

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Document information

Version	*Date*	*Description*
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.
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).

Version	Date	Description
01.0	28 May 2010	EB 54, Annex 34. Initial adoption.

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