Gold Standard
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TEMPLATE

MONITORING REPORT

PUBLICATION DATE **14.10.2020**

VERSION **v. 1.1**

RELATED SUPPORT **- TEMPLATE GUIDE Monitoring Report v. 1.1**

This document contains the following Sections

KEY PROJECT INFORMATION

Key Project Information

GS ID (s) of Project (s)	GS3556
Title of the project (s) covered by monitoring report	Panasolar Photovoltaic Project
Version number of the PDD/VPA-DD (s) applicable to this monitoring report	4
Version number of the monitoring report	1.9
Completion date of the monitoring report	18/08/2025
Date of project design certification	04/11/2019
Date of Last Annual Report	NA
Monitoring period number	1
Duration of this monitoring period	04/11/2019 to 30/11/2023 (Both days included)[1]
Project Representative	Panasolar Generation S.A.
Host Country	Panama
Activity Requirements applied	☐ Community Services Activities ☒ Renewable Energy Activities ☐ Land Use and Forestry Activities/Risks & Capacities ☐ N/A
Methodology (ies) applied and version number	AMS-I.D. Grid connected renewable electricity generation Ver. 18
Product Requirements applied	☒ GHG Emissions Reduction & Sequestration ☐ Renewable Energy Label ☐ N/A

Table 1 - Sustainable Development Contributions Achieved

Sustainable Development Goals Targeted	SDG Impact	Amount Achieved	Units/ Products
SDG7 7 - Ensure access to affordable, reliable, sustainable and modern energy for all	MWh of renewable energy generated	60,016.69	MWh
SDG 13 Climate Action	Emissions Reductions	26,600	VERs
SDG 8 Decent work and Economic Growth	Total Employees: Total Trainings: Operation of tank:	12 10 In operation	Employees Trainings Photo Evidence

Table 2 – Product Vintages

Start Dates	End Dates	VERs	MWh
04/11/2019	31/12/2019	1,180	2,260.62
01/01/2020	31/12/2020	6,852	14,104.84
01/01/2021	31/12/2021	6,352	14,796.43
01/01/2022	31/12/2022	5,910	14,122.27
01/01/2023	30/11/2023	6,306	14,732.52

SECTION A. DESCRIPTION OF PROJECT

A.1. General description of project

>>The project consists of the construction, installation, operation, and maintenance of photovoltaic panels for the production of electricity through solar energy. This energy is captured by photovoltaic modules, with an installed capacity of 9.9 MW AC and 12.09 MW DC. These panels are placed on fixed structures anchored to the ground. The project activity will connect to the 34.5 KV substation in Llano Sanchez, via a mix (underground and aerial) transmission line that it does not require for trees to be cut or trimmed where the lines pass. Once the line reaches the substation, it connects to the national electrical grid, known as Empresa de Trasmisión Eléctrica, S.A. (ETESA). The project has an expected lifetime of 25 years.

The estimated annual energy generation will be 19,192 MWh with a plant load factor of 22.33%% that will generate an annual average of 10,322 reductions of tCO2e per year, which means a total emission reduction of 72,254 tCO2e for the first crediting period. Prior to the project activity, no activity related to the generation of electricity took place in the project area. The baseline scenario is, as per the provisions of the methodology AMS-I.D., "that the electricity delivered to the grid by the project activity would have otherwise been generated by the operation of grid-connected power plants and by the addition of new generation sources into the grid."

The baseline scenario is therefore the same as the scenario existing prior the implementation of the project activity.

The proposed photovoltaic power project will contribute to the sustainable development through improvement of family income due to jobs created during construction and operation of the plant, strengthen commercial and institutional conditions and also promote the sustainable development of the surrounding area through the generation of renewable energy, which will expand the available power in Panamanian grid to meet increasing energy demand through clean and renewable sources and have positive impacts on the balance of trade, as Panama´s coal and oil imports used to fuel national thermals plants will be replaced by the use of renewable indigenous energy sources.

The energy generation for this monitoring period was 60,016.69 MWh which means a total emission reduction of 26,600 tCO2e for this monitoring period.

The Project Proponent notified the DNA and relevant regulatory bodies at least two months before Registration regarding the voluntary activity and the issuance of voluntary activity emissions reductions. No objections or comments were raised by the authorities.

The PP also confirms that no double counting is occurring with respect to the emissions reductions associated with this project. All necessary steps have been taken to ensure that the reductions are accurately accounted for, and no overlap exists with other registered projects or activities. The project has been thoroughly reviewed to prevent any duplication of emissions reductions, in compliance with relevant standards and regulations.

A.2. Location of project

>> City of Aguadulce, borough of El Roble, Coclé State, Republic of Panama

The project activity can be located with the following coordinates:

Latitude: + 8.217139

Longitude: - 80.692833

A.3. Reference of applied methodology

>>

Title: Grid connected renewable electricity generation

Reference: The project activity meets the eligibility criteria to use the simplified modalities and procedure for small-scale CDM project activities as set out in paragraph 6 (c) of decision 17/CP.7.

Details of methodology for baseline calculations for CDM projects of capacity less than 15 MW are available in the "Appendix B of the simplified modalities and procedure for small scale CDM project activities".

Methodology: AMS-I.D Grid Connected Renewable Electricity Generation (Version 18). Type I : Renewable Energy Project (Small Scale) Category : I. "D", Grid Connected Renewable Electricity Generation

Reference has been taken from indicative simplified baseline and monitoring methodologies for selected small scale (CDM projects less than 15 MW) project activity categories.
Tools referred with above methodology are:
Tool to calculate the emission factor for an electricity system - Version 07.0
Please click following link for more information about the methodology and tool: http://cdm.unfccc.int/methodologies/SSCmethodologies/approved

A.4. Crediting period of project

>> 04/11/2019 - 03/11/2026

7 years twice renewable. The Project will be renewed every 7 years counting from the date of its registration.

SECTION B. IMPLEMENTATION OF PROJECT

B.1. Description of implemented project

>>

Project status is operational (producing electricity and exporting to the national grid).

Although the energy production has operated below the expectations of the project owner, once the project began operation, there have been only a few technical issues with operation.

Below is information regarding key development milestones and operational issues during the monitoring period:

The start date of the project, marked by its connection to the national system, is 11/05/2019.

The land purchase was not considered as the earliest date because the land could be sold, and the project could be reversible. That's why the initial date considered is the Order of Equipment, because the investment is much more, and the project will not be reversible.

The purchase of equipment and the beginning of the construction was purchase by own money while the financial closure was done.

Failures in the plant:

- 23/12/2019: Disconnection of the plant from the System due to a thermal failure on the the Substation ETESA de Llano Sánchez. The solution of this failure was done on 28/12/2019.
- 01/05/2020: Skid A, B, transformer power cable is replaced.
- 30/05/2021: The line 1 motor is deactivated due to overheating.
- 11/05/2022: Phase A of Line 2 cable replacement due to over current which also causes a trip of the 3LA12 switch at the Llano Sánchez.
- 30/03/2023: replacement of the line on phase C due to the tripping of the main switch of the 3LE12 plant and of the 3LA12 switch at the Llano Sánchez Substation.

The project consists in installing in the Republic of Panama a PV Plant of up to 9.9 MW of installed power with an estimated annual energy generation will be 15,270 MWh with a plant load factor of 17.61% and an operational lifetime of 25 years.

Below some more detailed technical information:

PV Panel model: JKM 330Wp manufactured by JINKO SOLAR

- Length x width x thickness(mm): 1.650 x 992 x 40
- Weight (kg): 18.5

Max. Power output (Wp): 250 ±3%
Open Circuit tension (V): 37.6
Short Circuit Current (A): 8.8
Max. System Tension (V): 1,000.00
Max. Power output Tension (V): 30.4
Max. Power output Current (A): 8.23
Number inverter modules per series: 20
Number of parallel strings: 2,240

Geographic coordinates have been modified from the registered PDD in order to reflect the correct location of the project activity.

B.1.1 Forward Action Requests

>>Transition Annex will be required. When transition annex is approved, it will be included here any FAR raised by the GS4GG, if any.

According to the Performance Review from GS, FAR#1: The verifying VVB shall verify and assess the grievance mechanism at the time of first verification.

To facilitate community feedback, the (PD) has installed a grievance mailbox at the local church. In addition, community members have direct access to the Plant Administrator for communication. The mailbox is checked weekly by the Plant Administrator, specifically every Monday. If a grievance is submitted, the PD will review the matter and provide a response as soon as possible. No grievances or comments were received during the current monitoring period of the project activity.

B.2. Post-Design Certification changes

>>

B.2.1. Temporary deviations from the approved Monitoring & Reporting Plan, methodology or standardized baseline

>> Deviation request DEV_795 was approved by GS on 27/10/2024. The deviation request that was approved pertains to the Principles & Requirements, Version 1.2, specifically section 5. Project Cycle, subsection (c) Verification & Performance Review (PERFORMANCE CERTIFICATION).

Deviation request DEVRQ-170 was conditionally approved by GS on 31/17/2025. The deviation request that was approved pertains to the Applicability of Minimum site visit requirement by VVB, Version 2.1, paragraph number 2.2.2. First site visit and 2.2.4. The verification and performance review for the approved monitoring period is from 04/11/2019 to 30/11/2023.

5.1.29 Verification must occur at least once during
the five-year Certification cycle with the first Verification completed within two years of project Implementation Date or Design Certification, whichever is later. The Project implementation date is defined as the date at which physical activity first becomes operational, for example, the commencement of energy generation or start of distribution of household technology.

B.2.2. Corrections

>> The coordinates have been corrected during current MP. Already updated in GS Platform.

B.2.3. Changes to start date of crediting period

>>The start date of the project, marked by its connection to the national system, is 11/05/2019. The design certification date, however, precedes this on 04/11/2019.

According to Section 3.3.1(c), Table 1 ("Up to one year") of the "Design Change Request Requirements and Procedures," a modification to the start date of the Design Certified Crediting Period is eligible when the difference between these dates is up to one year.

B.2.4. Permanent changes from the Design Certified monitoring plan, applied methodology or applied standardized baseline
>>No permanent changes from the Design Certified monitoring plan, applied methodology or applied standardized baseline.

B.2.5. Changes to project design of approved project
>>NA

SECTION C. DESCRIPTION OF MONITORING SYSTEM APPLIED BY THE PROJECT

>>

Anaconda Carbon S.A. has developed a Management Plan, which is applied during verification activities to assure correctness of data management.

Monitoring consists of metering the electricity generated by the renewable technology.

Emissions Factor Calculation: Emissions Factor for the electricity grid is calculated ex post and will be done so prior to each verification.

Management Structure and Responsibilities
Overall responsibility for daily monitoring and reporting lies with the project owner. The manager of the proposed project is responsible for review the monthly reported results/data and checks the calibration certificates.

Data Collection: The electricity supplied by the project activity to the grid is measured by calibrated electricity meters. The parameter is monitored at the control room and crosschecked with review of the receipts of electricity sales.

Data is measured continuously and recorded at least hourly as required by the applicable methodology.

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

Meter Calibration: All measurements are conducted with calibrated measurement equipment according to relevant industry or national standards named "Reglamento de Operacion", published by the “Centro Nacional de Despacho” in February 2018. The frequency of calibration is annual.

Data Report: Data recorded, and the receipts will be consolidated on a monthly basis and will be checked for quality control purposes with official reports or statistics. If there are discrepancies in the data, the source of the variation will be identified. The

data report will be concluded monthly and will be verified by the Project Developer's Head Office.

Data Archives: The data recording, the data report and the invoices are archived, together with this monitoring plan. All data collected as part of monitoring are archived electronically and be kept at least for 2 years after the end of the last crediting period or the last issuance of VERs, whichever is later.

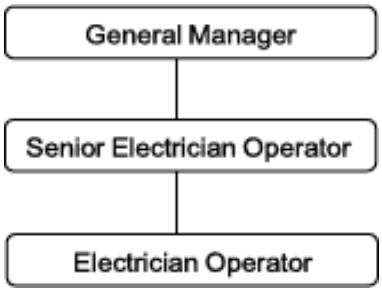
Data Quality Control: An internal procedure to secure the correctness of data is regularly carried out. Data and reports are checked internally to secure correctness of data. In case of mistakes, the source of the variation will be identified, whether it is the primary meter or the backup meter. The data report is concluded monthly and verified by the Project Developer's Head Office. Corrective actions will be applied to avoid future similar mistakes wherever appropriate.

Training and Monitoring Personnel: All people that participate in the monitoring process are suitably qualified and trained in the operation and maintenance of the plant. They will also receive instructions of the monitoring plan.

Verification and Monitoring Results: The monitoring report is prepared by the monitoring personnel and/or the designed consulting company, in this case Anaconda Carbon S.A. It contains the data report, the emission factor calculation, and the results of the emissions reductions of the project for a certain period.

Leakage monitoring: No energy generating equipment is transferred from another activity to this project and there is no existing equipment to be transferred to another activity. The project activity involves electricity generation from solar radiation. The employed solar energy generator can only convert solar radiation 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. The project owner can adjust and modify the monitoring plan accordingly in order to meet operational requirements. These changes need to be approved by the verifier during the periodic verifications.

The relevant company personnel involved in the monitoring activities are:



The responsibilities of each function are as follows:

General Manager

• Signs off on the written statement for each month.
• Designates the representative for precision testing and calibration.
• Attaches seals to the meters or designates the appropriate person for this function.

Senior Electrician Operator

• Drafts the written statement for each month to be delivered to the General Manager for signature.
• Verifies the readings carried out by the Electrician Operator.
• Maintains communication with the energy buyer.

Electrician Operator

• Carries out readings from meters.
• Stores readings in electronic database.
• Sends meter readings to Senior Electrician Operator for the monthly written statement.

Below is a table with key dates for project development:

Phase	Start
Land Purchase	24/06/2014
Financial Closure	21/12/2017
Order of Equipment	12/07/2016
Construction Begins	01/08/2017
Connection to the National System	11/05/2019

SECTION D. DATA AND PARAMETERS

D.1. Data and parameters fixed ex ante or at renewal of crediting period

>>NA

D.2 Data and parameters monitored

>>

Relevant SDG Indicator/Safeguarding Principle	**Goal 7: Affordable and Clean Energy:** Ensure access to affordable, reliable, sustainable and modern energy for all 7.2 - By 2030, increase substantially the share of renewable energy in the global energy mix 7.2.1 - Renewable energy share in the total final energy consumption
Data / Parameter	$EG_{facility,,y}$
Unit	MWh
Description	Quantity of net electricity supplied by the project activity to the grid
Source of data	Electricity meter. The primary meter Primary meter: Sensor Link model SEL 735 / Serial number 3190140043 / 0.1S accuracy class Secondary meter: model SEL 735 / Serial number 3190140044 / 0.1S accuracy class Calibration dates: 17/05/2019, 21/08/2020, 11/03/2022, 24/03/2023 Due to missing calibration certificate for periods: 16/05/2020 – 21/08/2020, 20/08/2021 – 11/03/2022, 10/03/2023 – 24/03/2023 Maximal error of the measurement equipment was applied. According to the technical sheet, the maximal error is 0.025%.

Value(s) applied	04/11/2019 - 31/12/2019: 2,260.62 MWh 01/01/2020 - 31/12/2020: 14,104.84 MWh 01/01/2021 - 31/12/2021: 14,796.43MWh 01/01/2022 - 31/12/2022: 14,122.27MWh 01/01/2023 - 30/11/2023: 14,732.52MWh
Measurement methods and procedures	This parameter will be monitored using bi-directional energy meters for the primary (meter #1), and secondary (meter #2) installed on an hourly basis. The total annual electricity of the proposed project activity supplied to SIN in the crediting period shall be obtained by the SCADA system installed at the project site. Furthermore, two redundantly set-up energy meters, as established in the commercial measuring system regulations, have been installed in the substation.
Monitoring frequency	Continuous monitoring, hourly measurement, and at least monthly recording.
QA/QC procedures	Equipment will be annually calibrated by the CND in Panama as per Panama law and manufacturer specification. The electricity supplied to the grid will be acquired from the SCADA System. The meters will conform to the accuracy class of 0.1S The electricity supplied by the project activity to the grid is measured by calibrated electricity meters. The parameter is monitored at the control room and crosschecked with review of the receipts of electricity sales.
Purpose of data	Baseline emissions.
Additional comment	This parameter will be used ex-post during each verification.

Relevant SDG Indicator/Safeguarding Principle	Safeguarding Principle: 4.1.1 Emissions
Data / Parameter	$EF_{grid,CM,y}$

Unit	tCO_2
Description	Combined margin CO2 emission factor for the electricity system in year y
Source of data	Calculated ex-post and during each verification. The plant is connected to the Llano Sanchez Substation owned by ETESA (Empresa de Transmision Electrica S.A) which is the State-owned owner of the Transmission grid. The method to be used to calculate the Operating Margin emissions factor is Simple Adjusted OM
Value(s) applied	Calculated ex-post. Grid Emission factor: $EFgrid_{,CM,2019}$= 0.5221 tCO_2/MWh $EFgrid_{,CM,2020}$= 0.4858 tCO_2/MWh $EFgrid_{,CM,2021}$= 0.4293 tCO_2/MWh $EFgrid_{,CM,2022}$= 0.4185 tCO_2/MWh $EFgrid_{,CM,2023}$= 0.4281 tCO_2/MWh
Measurement methods and procedures	$EF_{grid,CM,y} = EF_{grid,OM,y} \times w_{OM} + EF_{grid,BM,y} \times w_{BM}$ Where: Where: $EF_{grid,BM,y}$= Build margin CO_2 emission factor in year y (tCO_2/MWh) $EF_{grid,OM,y}$= Operating margin CO2 emission factor in year y (tCO2/MWh) w_{OM}= Weighting of operating margin emissions factor (%) w_{BM} = Weighting of build margin emissions factor (%)As the project activities is a solar power generation, the default values used are: w_{OM} = 0.75 and w_{BM} = 0.25 (owing to their intermittent and non-dispatchable nature)
Monitoring frequency	Yearly
QA/QC procedures	N/A

Purpose of data	To calculate baseline emissions
Additional comment	To be calculated ex-post and during each verification.

Relevant SDG Indicator	**SDG 8 – Decent work and Economic Growth:** Promote inclusive and sustainable economic growth, employment, and decent work for all
Data/parameter:	Quantitative employment and income generation
Unit	Number of contracts
Description	The project activity has created jobs for local people who did not have such job opportunities prior to the implementation of the project activity. These jobs, as well as maintenance and security services which are sub-contracted enjoy salaries that are above the national minimum salaries.
Source of data	Number of direct employees
Value(s) applied	12 direct employees 100% of the employees a locally.
Measurement methods and procedures	Number of employees per year.
Monitoring frequency	Yearly
QA/QC procedures	Not applicable
Purpose of data	To measure the job creation impact of the project activity(SDG8)
Additional comment	Not applicable

Relevant SDG Indicator	**SDG 8 – Decent work and Economic Growth:** Promote inclusive and sustainable economic growth, employment, and decent work for all
Data/parameter:	Quality of employment
Unit	Training of staff events
Description	Payroll information of employees and how it compares to minimum wage in Panama that is $3.14 per hour. Number of events that have training of staff regarding safe and healthy working conditions or other technical project implementation aspects. Provision of adequate personal protective equipment (PPE) will also be monitored.

Source of data	Trainings per year
Value(s) applied	Trainings: 2019: 2 trainings (Maintenance and Operation of Medium and Low Voltage Equipment – Technical project implementation aspects and Socio-environmental and Occupational Safety Talk-Safe and Healthy working conditions) 2020: 2 trainings (Maintenance and Operation of Medium and Low Voltage Equipment – Technical project implementation aspects and Socio-environmental and Occupational Safety Talk-Safe and Healthy working conditions) 2021: 2 trainings (Maintenance and Operation of Medium and Low Voltage Equipment – Technical project implementation aspects and Socio-environmental and Occupational Safety Talk-Safe and Healthy working conditions) 2022: 2 trainings (Maintenance and Operation of Medium and Low Voltage Equipment – Technical project implementation aspects and Socio-environmental and Occupational Safety Talk-Safe and Healthy working conditions) 2023: 2 trainings (Maintenance and Operation of Medium and Low Voltage Equipment – Technical project implementation aspects and Socio-environmental and Occupational Safety Talk-Safe and Healthy working conditions)
Measurement methods and procedures	Number of trainings per year.
Monitoring frequency	Yearly
QA/QC procedures	Not applicable

Purpose of data	To measure the skills training impact of the project activity(SDG8)
Additional comment	Not applicable

Relevant SDG Indicator	**SDG 8 – Decent work and Economic Growth:** Promote inclusive and sustainable economic growth, employment, and decent work for all
Data/parameter:	Human and institutional capacity
Unit	Number of direct employees and training of staff events
Description	Number of contracts with employees and number of trainings session annually as well as the % of employees that are local.
Source of data	Number of direct employees and Trainings per year
Value(s) applied	2 trainings per year. One every 6 months Technical project implementation aspects: Maintenance and Operation of Medium and Low Voltage Equipment Safe and Healthy working conditions: Socio-environmental and Occupational Safety Talk-
Measurement methods and procedures	Number of trainings per year.
Monitoring frequency	Yearly
QA/QC procedures	Not applicable
Purpose of data	To measure the skills training impact of the project activity(SDG8)
Additional comment	Not applicable

Relevant SDG Indicator	**SDG 8 – Decent work and Economic Growth:** Promote inclusive and sustainable economic growth, employment, and decent work for all
Data/parameter:	Livelihood of the poor
Unit	Usage rate
Description	Operation of water tank in the local community
Source of data	Availability and use of water tank for the community.
Value(s) applied	Pictures and users' interviews

Measurement methods and procedures	Confirmation of use and availability of water tank by the local community.
Monitoring frequency	Monthly
QA/QC procedures	Not applicable
Purpose of data	To measure the economic and well-being impact that the project activity has on the community
Additional comment	Not applicable

D.3. Comparison of monitored parameters with last monitoring period

Data/Parameter	Value obtained in this monitoring period	Value obtained last monitoring period
SDG 7Net Generation	60,016.69 MWh	Not applicable for non-Community Service Activities
SDG 13 Emission Reduction	26,600 VERs	Not applicable for non-Community Service Activities
SDG 8 Decent work and Economic Growth	12 employees 10 Trainings Approximately 80 houses connected to the Tank	Not applicable for non-Community Service Activities

D.4. Implementation of sampling plan

>>There is no sampling plan involved in the project activity.

SECTION E. CALCULATION OF SDG IMPACTS

E.1. Calculation of baseline value or estimation of baseline situation of each SDG Impact

>>

SDG13

According to methodology AMS-I.D, the baseline is the power generation in MWh produced by the renewable generating unit multiplied by the Combined Margin emission factor (measured in tCO_2e/MWh).

The emission factor was calculated with the latest available data at the time of start of validation and will serve as an example of the calculation that is to take place ex post. According to the Tool to calculate de emission factor for an electricity system, for the purpose of determining the operating margin and the build margin emission factors, a project electricity system is defined by the spatial extent of the power plants that can be dispatched without significant transmission constraints. Similarly, a connected electricity system is defined as an electricity system that is connected by transmission lines to the project electricity system and in which power plants can be dispatched without significant transmission constraints.

Baseline Emissions (BE):

Baseline emissions include only CO_2 emissions from electricity generation in fossil fuel fired power plants that are displaced due to the project activity. The methodology assumes that all project electricity generation above baseline levels would have been generated by existing grid-connected power plants and the addition of new grid-connected power plants. The baseline emissions are to be calculated as follows:

$$BEy = EG_{facility,y} * EF_{grid,CM,y} \quad (1)$$

Where:

BEy = Baseline Emissions in year y (t CO_2)

$EG_{facility,y}$ = Quantity of net electricity supplied to the grid as a result of the implementation of the CDM project activity in year y (MWh)

$EF_{grid,CM,y}$ = CO_2 emission factor of the grid in year y (t CO_2/MWh)

Project emissions (PE):

For most renewable energy project activities, PEy= 0. However, for the following categories of project activities, project emissions have to be considered following the procedure described in the most recent version of AMS ID

• Emissions related to the operation of geothermal power plants (e.g. non-condensable gases, electricity/fossil fuel consumption)

• Emissions from water reservoirs of hydro power plants

Since the project activity is solar power project so there is no emission due to the project activity and hence, PE = 0

Leakage (LE):

As the energy generating equipment is not transferred from another activity or the existing equipment is transferred to another activity, hence leakage is not to be considered.

Emission reductions (ER)

Emission reductions are calculated as follows: Emission reduction, ER = BE – PE – LE

But here:

PE= 0, LE=0

So ER= BE

The grid emission factor will be calculated ex post according with the "Tool to calculate the emission factor for an electricity system" version 7, to calculate the Combined margin CO_2 emission factor for grid connected power generation in year y.

The Tool 07 was used for the calculations of the emission factor. The steps followed to calculate the EF is showed below:

STEP 1. Identify the relevant electric power system.

STEP 2. Choose whether to include off-grid power plants in the project electricity system. Option II was selected.

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

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

Used generation data from CND Panama for 2017, 2018, 2019, 2021, 2022 and 2023 in the sheet GEN. Lambda factor was calculated to express the percentage of time when low-cost/must-run power units are on the margin in year. Emissions for thermal plants was calculated based in a specific EF (tCO_{2e}/Mwh) based on the Heat rate (Btu/Kwh) and fuel type, average for the whole year in each power unit.

$$EF_{grid,OM-adj,y} = (1-\lambda_y) * \frac{\sum_m EG_{m,y} \times EF_{EL,m,y}}{\sum_m EG_{m,y}} + \lambda_y * \frac{\sum_k EG_{k,y} \times EF_{EL,k,y}}{\sum_k EG_{k,y}}$$

$$EF_{grid,OM-adj,2017} = (1-0.0742) * \frac{2{,}838{,}045.80 \times 0.6797}{2{,}838{,}045.80} + 0.0742 * \frac{7{,}722{,}700.80 \times 0}{7{,}722{,}700.80}$$

$$EF_{grid,OM-adj,2017} = 0.6293 tCO_2/MWh$$

$$EF_{grid,OM-adj,2018} = (1-0.0742) * \frac{2{,}210{,}634.90 \times 0.6617}{2{,}210{,}634.90} + 0.0742 * \frac{8{,}466{,}240.60 \times 0}{8{,}466{,}240.60}$$

$$EF_{grid,OM-adj,2018} = 0.6126 tCO_2/MWh$$

$$EF_{grid,OM-adj,2019} = (1-0.1805) * \frac{4{,}664{,}626.20 \times 0.5502}{4{,}664{,}626.20} + 0.1805 * \frac{6{,}053{,}154.30 \times 0}{6{,}053{,}154.30}$$

$$EF_{grid,OM-adj,2019} = 0.4509 tCO_2/MWh$$

$$EF_{grid,OM-adj,2020} = (1-0.0007) * \frac{2{,}168{,}733.70 \times 0.5221}{2{,}168{,}733.70} + 0.0007 * \frac{8{,}188{,}915.40 \times 0}{8{,}188{,}915.40}$$

$$EF_{grid,OM-adj,2020} = 0.5218 tCO_2/MWh$$

$$EF_{grid,OM-adj,2021} = (1-0.0742) * \frac{1{,}943{,}377.70 \times 0.4395}{1{,}943{,}377.70} + 0.0742 * \frac{9{,}166{,}255.60 \times 0}{9{,}166{,}255.60}$$

$$EF_{grid,OM-adj,2021} = 0.4069 tCO_2/MWh$$

$$EF_{grid,OM-adj,2022} = (1-0.1805) * \frac{2{,}217{,}364.90 \times 0.4987}{2{,}217{,}364.90} + 0.1805 * \frac{9{,}331{,}792.70 \times 0}{9{,}331{,}792.70}$$

$$EF_{grid,OM-adj,2022} = 0.4087\ tCO_2/MWh$$

$$EF_{grid,OM-adj,2023} = (1 - 0.0007) * \frac{,349,671.60 \times 0.5003}{4,349,671.60} + 0.0007 * \frac{7,880,675.90 \times 0}{7,880,675.90}$$

$$EF_{grid,OM-adj,2023} = 0.4999 tCO_2/MWh$$

Where:

$EF_{grid,OM\text{-}adj,y}$ = Simple adjusted operating margin CO_2 emission factor in year y (tCO_2/MWh)

λ_y = Factor expressing the percentage of time when low-cost/must-run power units are on the margin in year y

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

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

$EF_{EL,m,y}$ = CO_2 emission factor of power unit m in year y (tCO_2/MWh)

$EF_{EL,k,y}$ = CO_2 emission factor of power unit k in year y (tCO_2/MWh)

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

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

y = The relevant year as per the data vintage chosen in Step 3

The parameter $EF_{EL,m,y}$ and $EF_{EL,k,y}$ is defined as follows:

$$\mathrm{EF}_{\mathrm{EL,m,y}} = \frac{\sum_i FC_{i,m,y} * NCV_{i,y} * EF_{CO2,i,y}}{EG_{m,y}}$$

$$\mathrm{EF}_{\mathrm{EL,m,2017}} = \frac{1{,}929{,}139.829}{2{,}838{,}045.80} = 0.6797$$

$$\mathrm{EF}_{\mathrm{EL,m,2018}} = \frac{1{,}462{,}677.576}{2{,}210{,}634.90} = 0.6617$$

$$\mathrm{EF}_{\mathrm{EL,m,2019}} = \frac{2{,}566{,}288.780}{4{,}664{,}626.20} = 0.5502$$

$$\mathrm{EF}_{\mathrm{EL,m,2020}} = \frac{1{,}132{,}326.412}{2{,}168{,}733.70} = 0.5221$$

$$\mathrm{EF}_{\mathrm{EL,m,2021}} = \frac{854{,}141.820}{1{,}943{,}377.70} = 0.4395$$

$$\mathrm{EF}_{\mathrm{EL,m,2022}} = \frac{1{,}105{,}909.331}{2{,}217{,}364.90} = 0.4987$$

$$\mathrm{EF}_{\mathrm{EL,m,2023}} = \frac{2{,}176{,}006.816}{4{,}349{,}671.60} = 0.5003$$

$$\mathrm{EF}_{\mathrm{EL,k,y}} = \frac{\sum_i FC_{i,k,y} * NCV_{i,y} * EF_{CO2,i,y}}{EG_{k,y}}$$

$$\mathrm{EF}_{\mathrm{EL,k,2017}} = 0\ \mathrm{tCO_2}/\mathrm{MWh}$$

$$\mathrm{EF}_{\mathrm{EL,k,2018}} = 0\ \mathrm{tCO_2}/\mathrm{MWh}$$

$$\mathrm{EF}_{\mathrm{EL,k,2019}} = 0\ \mathrm{tCO_2}/\mathrm{MWh}$$

$$\mathrm{EF}_{\mathrm{EL,k,2020}} = 0\ \mathrm{tCO_2}/\mathrm{MWh}$$

$$EF_{EL,k,2021} = 0\ tCO_2/MWh$$
$$EF_{EL,k,2022} = 0\ tCO_2/MWh$$
$$EF_{EL,k,2023} = 0\ tCO_2/MWh$$

Where:

$EF_{EL,m,y}$ = CO_2 emission factor of power unit m in year y (tCO_2/MWh)

$FC_{i,m,y}$ = Amount of fossil fuel type i consumed by power unit m in year y (Mass or volume unit) $NCV_{i,y}$ = Net calorific value (energy content) of fossil fuel type i in year y (GJ/mass or volume unit) $EF_{CO2,i,y}$ = CO_2 emission factor of fossil fuel type i in year y (tCO_2/GJ)

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

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

i = All fossil fuel types combusted in power unit m in year y

y = The relevant year as per the data vintage chosen in Step 3

The parameter λy is defined as follows:

$$\lambda_y(\%) = \frac{Number\ of\ hours\ low\text{-}cost\ /\ run\ sources\ are\ on\ the\ margin\ in\ year\ y}{8760\ hours\ per\ year}$$

$$\lambda_{2017}(\%) = 1 - \frac{8110}{8760} = 0.0742$$
$$\lambda_{2018}(\%) = 1 - \frac{8110}{8760} = 0.0742$$
$$\lambda_{2019}(\%) = 1 - \frac{7179}{8760} = 0.1805$$
$$\lambda_{2020}(\%) = 1 - \frac{8754}{8760} = 0.0007$$
$$\lambda_{2021}(\%) = 1 - \frac{8110}{8760} = 0.0742$$
$$\lambda_{2022}(\%) = 1 - \frac{7179}{8760} = 0.1805$$
$$\lambda_{2023}(\%) = 1 - \frac{8754}{8760} = 0.0007$$

STEP 5. Calculate the build margin emission factor. Used the 2023 generation of the most recently power plants and which represent the 20% of the total generation.

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

$$EF_{grid,BM,2019} = \frac{1{,}165{,}385}{2{,}937{,}422.10} = 0.3967 \ tCO_2/MWh$$

$$EF_{grid,BM,2020} = \frac{561{,}441}{1{,}567{,}939.40} = 0.3580 \ tCO_2/MWh$$

$$EF_{grid,BM,2021} = \frac{658{,}606\ 0}{1{,}927{,}504.20} = 03416 \ tCO_2/MWh$$

$$EF_{grid,BM,2022} = \frac{643{,}748\ 0}{1{,}874{,}483.30} = 0.34340 \ tCO_2/MWh$$

$$EF_{grid,BM,2023} = \frac{1{,}392{,}915}{3{,}553{,}706.70} = 0.3919 \ tCO_2/MWh$$

Where:

$EF_{grid,BM,y}$ = Build margin CO_2 emission factor in year y (tCO_2/MWh)

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

$EF_{EL,m,y}$ = CO_2 emission factor of power unit m in year y (tCO_2/MWh)

m= Power units included in the build margin

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

STEP 6. Calculate the combined margin (CM) emissions factor. The CM calculate is based on the previous calculated data: yearly generation, yearly OM, OM simple adjusted and the BM 2023.

STEP 6. Calculate the combined margin emissions factor

$$EF_{grid,CM,y} = EF_{grid,OM,y} \times w_{OM} + EF_{grid,BM,y} \times w_{BM}$$

$$EF_{grid,CM,2019} = 0.5639 \times 0.75 + 0.3967 \times 0.25$$

$$EF_{grid,CM,2019} = 0.5221 \ tCO_2/MWh$$

$$EF_{grid,CM,2020} = 0.5284 \times 0.75 + 0.3580 \times 0.25$$

$$EF_{grid,CM,2020} = 0.4858 \ tCO_2/MWh$$

$$EF_{grid,CM,2021} = 0.4585 \times 0.75 + 0.3416 \times 0.25$$

$$EF_{grid,CM,2021} = 0.4293 \text{ tCO}_2/\text{MWh}$$

$$EF_{grid,CM,2022} = 0.4436 \times 0.75 + 0.3434 \times 0.25$$

$$EF_{grid,CM,2022} = 0.4185 \text{ tCO}_2/\text{MWh}$$

$$EF_{grid,CM,2023} = 0.4401 \times 0.75 + 0.3919 \times 0.25$$

$$EF_{grid,CM,2023} = 0.4281 \text{ tCO}_2/\text{MWh}$$

Where:

$EF_{grid,BM,y}$ = Build margin CO_2 emission factor in year y (tCO_2/MWh

$EF_{grid,OM,y}$ = Operating margin CO_2 emission factor in year y (tCO_2/MWh)

w_{OM} =Weighting of operating margin emissions factor (%)

w_{BM} = Weighting of build margin emissions factor (%)

The following default values were used for w_{OM} and w_{BM}:

• Wind and solar power generation project activities: w_{OM} = 0.75 and w_{BM} = 0.25 (owing to their intermittent and non-dispatchable nature) for the first crediting period and for subsequent crediting periods.

SDG7

The calculation of project impact is based on the electricity generation of the project in this Monitoring Period.

	SDG7 Actual value during monitoring period
MWh 2019	2,260.62
MWh 2020	14,104.84
MWh 2021	14,796.43
MWh 2022	14,122.27
MWh 2023	14,732.52
Total MWh:	**60,016.69**

SDG8

The calculation of project impact is the number of full-time local employees generated by the project on a yearly basis. For this monitoring period 12 local employees were hired with a full-time job.

Also, for the SDG8 the calculation of project impact is the number of training employees. For this monitoring period a total of 5 training courses in Technical Project implementation aspect and 5 in Safe and Healthy working conditions

E.2. Calculation of project value or estimation of project situation of each SDG Impact

>>

Total $ERs_{,y}$= Total Net Generation (MWh) * Emission Factor

Total ERs_{2019}= 2,260.62*0.5221= 1,180 VERs

Total ERs_{2020}= 14,104.84*0.4858= 6,852 VERs

Total ERs_{2021}= 14,796.43*0.4293= 6,352 VERs

Total ERs_{2022}= 14,122.27*0.4185= 5,910 VERs

Total ERs_{2023}= 14,732.52*0.4281= 6,306 VERs

Total ERs = 26,600 VERs

E.3. Calculation of leakage

>> No leakage is accounted, as no technology will be transferred from other activities.

E.4. Calculation of net benefits or direct calculation for each SDG Impact

SDG	SDG Impact	Baseline estimate	Project estimate	Net benefit
7	Net quantity of electricity produced by the Project and supplied to the Grid	**0**	**60,016.69 MWh**	**60,016.69**
13	VERs	0	**26,600 tCO2e**	**26,600 tCO2e -**
8	Employees	0	**12**	**12**
8	Trainings	0	**10**	**10**

E.5. Comparison of actual SDG Impacts with estimates in approved PDD

Values estimated in ex ante calculation of approved PDD for this monitoring period	Actual values[2] achieved during this monitoring period
04/11/2019 to 31/12/2019: 1,640VERs 01/01/2020 to 31/12/2020: 10,322 VERs 01/01/2021 to 31/12/2021: 10,322 VERs 01/01/2022 to 31/12/2022: 10,322 VERs 01/01/2023 to 30/11/2023: 9,445 VERs **Total= 42,051 VERs**	04/11/201904/11/2019 to 31/12/2019: 1,180VERs 01/01/2020 to 31/12/2020: 6,852 VERs 01/01/2021 to 31/12/2021: 6,352 VERs 01/01/2022 to 31/12/2022: 5,910 VERs 01/01/2023 to 30/11/2023: 6,306 VERs **Total= 26,600 VERs**
04/11/2019 to 31/12/2019: 3,124.21 MWh 01/01/2020 to 31/12/2020: 19,661.00 MWh 01/01/2021 to 31/12/2021: 19,661.00 MWh 01/01/2022 to 31/12/2022: 19,661.00 MWh 01/01/2023 to 30/11/2023: 17,991.16 MWh **Total= 80,098.38 MWh**	04/11/2019 to 31/12/2019: 2,260.62 MWh 01/01/2020 to 31/12/2020: 14,104.84 MWh 01/01/2021 to 31/12/2021: 14,796.43 MWh 01/01/2022 to 31/12/2022: 14,122.27 MWh 01/01/2023 to 30/11/2023: 14,732.52 MWh **Total MWh= 60,016.69 MWh**
7 Employees 10 Trainings per year	12 local employees (100% local employees) 10 (2 per years)

E.5.1. Explanation of calculation of value estimated ex ante calculation of approved PDD for this monitoring period

>>

Yearly generation as per feasibility study: 19,661 MWh/year

Grid emission factor: 0.525 tCO2/MWh (ex ante estimated value)

Yearly emission reduction: 10,322 VERs.

[2] Whenever emission reductions are capped, both the original and capped values used for calculations must be transparently reported. Use brackets to denote original values.

The calculation of the ex ante estimated value for this monitoring is specified in document "Panasolar Photovoltaic Project ER sheet V9-30042025". The following table shows the results of the values ex ante:

Monitoring Period:			CALCULATION EX ANTE FOR THE MONITORING PERIOD	
		DAYS	MWh/Year	VERs
04-Nov-2019	31-Dec-2019	58	**3,124.21**	**1,640**
1-Jan-2020	31-Dec-2020	366	**19,661.00**	**10,322**
1-Jan-2021	31-Dec-2021	365	**19,661.00**	**10,322**
1-Jan-2022	31-Dec-2022	365	**19,661.00**	**10,322**
1-Jan-2023	30-Nov-2023	334	**17,991.16**	**9,445**
		TOTAL	**80,098.38**	**42,051**

E.6. Remarks on increase in achieved SDG Impacts from estimated value in approved PDD

>> Does not apply, as the emissions reductions achieved are below the expectations described in the registered PD.

The reasons why there was a generation lower than the ex-ante values were:

1. The actual radiation is lower than had been estimated
2. There were technical problems with one of the plant's transformers.

SECTION F. SAFEGUARDS REPORTING

>>

The project has shown records of employees that demonstrate that they are of an adequate age and that all of them are local hires. As can be seen in section D

The following training events took place, which cover the safeguarding principles that we consider most relevant (employee work environment, health and safety)

Employees Trainings:

Training	Date
Technical project implementation aspects: Maintenance and Operation of Medium and Low Voltage Equipment -	08/05/2019 16/12/2019 13/07/2020 28/01/2021

	03/12/2021 17/12/2021 20/01/2022 09/09/2022 26/03/2023 15/10/2023
Safe and Healthy working conditions: Socio-environmental and Occupational Safety Talk	02/05/2019 31/10/2019 08/04/2020 22/09/2020 10/03/2021 22/09/2021 09/03/2022 13/10/2022 06/04/2023 12/10/2023

The other Safeguards Principles remains the same.

SECTION G. STAKEHOLDER INPUTS AND LEGAL DISPUTES

G.1. List all Inputs and Grievances which have been received via the Continuous Input and Grievance Mechanism together with their respective responses/mitigations.

>>There have been no grievances nor complaints presented to the project activity by the local communities of by government figures.

G.2. Report on any stakeholder mitigations that were agreed to be monitored.

>>There are no stakeholder mitigations that are agreed upon to be mitigated and monitored between the project activity and the surrounding communities nor the local government.

G.3. Provide details of any legal contest that has arisen with the project during the monitoring period

>>There have been no grievances nor complaints presented to the project activity by the local communities of by government figures

Revision History

Version	Date	Remarks
1.1	14 October 2020	Hyperlinked section summary to enable quick access to key sections Improved clarity on Key Project Information Section for POA monitoring Forward action request section Improved Clarity on SDG contribution/SDG Impact term used throughout Clarity on safeguard reporting Clarity on design changes Leakage section added for VER/CER projects Addition of Comparison of monitored parameters with last monitoring period Provision of an accompanying Guide to help the user understand detailed rules and requirements
1.0	10 July 2017	Initial adoption