Monitoring report form
(Version 05.1)

MONITORING REPORT		
Title of the project activity	La Ferme – Bambous 15 MW solar power farm	
UNFCCC reference number of the project activity	10317	
Version number of the monitoring report	1.1	
Completion date of the monitoring report	06/02/2017	
Monitoring period number and duration of this monitoring period	Monitoring period No. 01 Duration: 01/10/2016 – 31/12/2016	
Project participant(s)	SARAKO PVP Co. Ltd	
Host Party	Mauritius	
Sectoral scope(s)	Sectoral Scope 1: Energy Industries (renewable / non-renewable sources)	
Selected methodology(ies)	ACM0002 version 16.0	
Selected standardized baseline(s)	ASB0019 version 01.0	
Estimated amount of GHG emission reductions or net GHG removals by sinks for this monitoring period in the registered PDD	5,703 tCO_2e	
Total amount of GHG emission reductions or net GHG removals by sinks achieved in this monitoring period	GHG emission reductions or net GHG removals by sinks reported up to 31 December 2012	GHG emission reductions or net GHG removals by sinks reported from 1 January 2013 onwards
	-	5,522 tCO_{2e}

SECTION A. Description of project activity

A.1. Purpose and general description of project activity

La Ferme - Bambous Solar Photovoltaic Power Plant ("the project") is a greenfield 15.2 MW solar photovoltaic power plant in Eau Bonne, Bambous (Mauritius). The project activity undertaken by project promoter SARAKO PVP Co. Ltd ("SARAKO") therefore substitutes Mauritius grid's fossil-intensive electricity by clean and renewable energy, and cut down GHG emissions. Apart from emission reductions, the benefits of the project comprise, among others, improvement of energy self-sufficiency of the country, as well as creation of local employment.

***Figure 1**:* La Ferme - Bambous Solar Photovoltaic Power Plant, aerial view

The project is the first large-scale solar PV power plants on the island. During this first CDM monitoring period starting on 01/10/2016 and ending on 31/12/2016, the project generated 5,522 tCO_2e emission reductions.

Relevant implementation dates and events during implementation and operation are described in the table below.

Table 1: Summary of relevant dates for the project activity

Event	Date
Start of the construction of the plant	01/08/2013
Commissioning Date	18/02/2014
Pre-CDM VCS monitoring period	18/02/2014 – 30/09/2016

A.2. Location of project activity

The project is located on a 337,668 m^2 plot of land forming part of the State Land Saint Pierre and the State Land La Ferme at Eau Bonne, Bambous, Mauritius. The project geo-coordinates are: latitude 20°15'37.57 S, longitude 57°25'36.50" E.

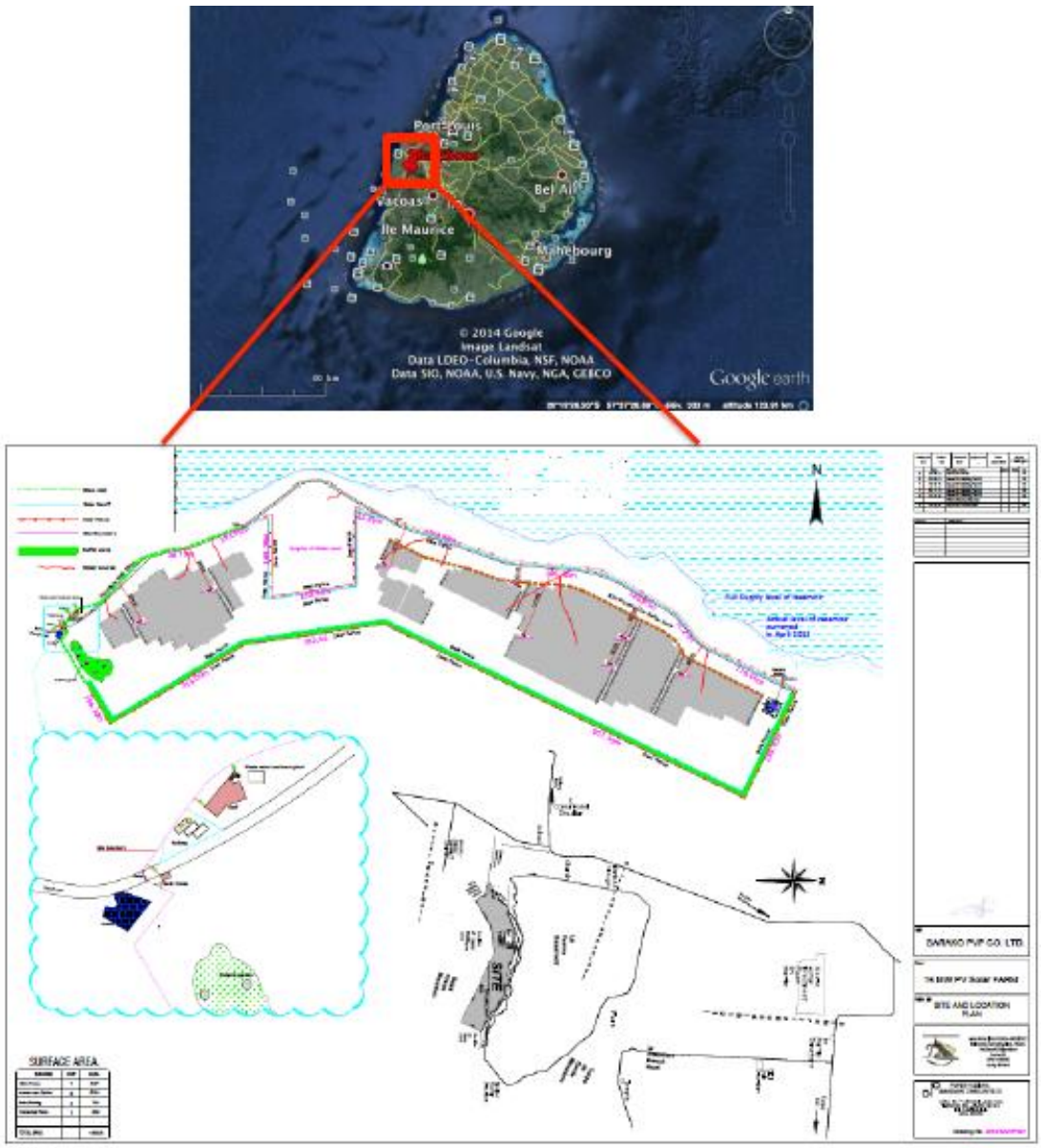

Figure 2 : Project location and layout

A.3. Parties and project participant(s)

Party involved ((host) indicates a host Party)	Private and/or public entity(ies) project participants (as applicable)	Indicate whether the Party involved wishes to be considered as project participant (yes/no)
Mauritius (host)	SARAKO PVP Co. Ltd.	No

A.4. Reference of applied methodology and standardized baseline

The approved baseline and monitoring methodology applied in the proposed project activity is ACM0002 (Version 16.0) – Large-Scale Consolidated Methodology for "grid-connected electricity generation from renewable sources".

In line with the application of ACM0002 methodology, the project refers to the following tools:

- Tool to calculate the emission factor for an electricity system (Version 5.0)
- "Assessment of the validity of the original/current baseline and update of the baseline at the renewal of the crediting period"

A.5. Crediting period of project activity

The project crediting period started on 01/10/2016. It lasts 10 years (i.e. 120 months) and is not renewable.

A.6. Contact information of responsible persons/entities

The persons/entities responsible for completing the CDM-MR-FORM are:

AERA Group (Carbon credit consultant)
Mr. Alexandre DUNOD, Advisory Manager
Email: a.dunod@aera-group.fr

SECTION B. Implementation of project activity

B.1. Description of implemented registered project activity

The PV modules installed are of make TW250P660 from Tianwei New Energy Holdings Co., Ltd. (TWNE), an affiliate of China South Industries Group Corporation (CSGC). They are of high-efficiency, poly-crystalline silicon solar cells with high transmission and tempered glass, which results in module efficiency of up to 15.4%. According to the manufacturer's warranty, the average annual power output degradation of the module does not exceed 0.7% in the following 23 years, ending with 83% at the end of the 25th year[1]. For the Balance of System components, including inverters, average lifetime is estimated at 10-15 years.[2]

In the solar photovoltaic power plant, 25 modules are connected to form a string having an output power of 6.25 kWp. There are 2,432 strings in the facility. Up to a maximum of 21 strings are collected together to form an array and there are 114 arrays in the facility.

Table 2: Characteristics of Solar PV Modules[3]

[1] A warranty of 10 years is provided on workmanship and material.
[2] cf. Mason et al. 2006: Energy Pay-Back and Life Cycle CO_2 Emissions of the BOS in an Optimized 3.5 MW PV Installation in: Progress in Photovoltaics Research and Applications, 14:179-190.
[3] http://www.dreamenergies.com/wp-content/uploads/2014/07/TWxxxP6601.pdf

Electrical Characteristics		Mechanical specifications	
Maximum Power (Pmax)	250 W	Dimensions	1,640×992×40 mm
Maximum Power Voltage (Vmp)	30.5	Weight	19.5 kg
Maximum Power Current (Imp)	8.2	Max. static load, front (snow & wind)	5,400 Pa
Open Circuit Voltage (Voc)	37.8	Max. static load, back (wind)	2,400 Pa
Short Circuit Current (Isc)	8.85	Max. hailstone impact (diameter/velocity)	25 mm / 23 m/s
Encapsulated Cell Efficiency (%)	17.3		
Module Efficiency (%)	15.4		
Power Tolerance (W)	0~5		
Maximum Series Fuse Rating (A)	15		
Maximum System Voltage (TUV)	DC 1000 V		
Normal Operating Cell Temperature (°C)	45±3		

The solar facility consists of 17 Inverter Units, 6 units of 630 kVA, 2 units of 750 kVA and 9 units of 1,000 kVA, of make ABB AG. Moreover, 13 transformers of 400/22 kV are installed in the inverter substations. All 22 kV output from the inverter substations are connected through underground cables to the Seller's Substation whereby the power is stepped up to 66 kV through a power transformer. The auxiliary power is supplied from the 22 kV bar at the seller's substation. The stepped power at 66 kV is then exported to CEB's La Chaumiere's Substation through approximately 4.5 km of overhead transmission line.

The engineering, procurement and construction contractor for the project was Germany's Conecon GmbH. All installed technologies, systems and equipment are new. Additionnally, PowerLogic® ION8600 meters are installed within Sarako solar farm premises for internal use and cross-check.

Table 3: Relevant implementation dates

Milestones	***Date***
Measurements and planning	Mar-Apr. 2013
Local stakeholders consultations	Apr-Jun. 2013
Site preparation (civil works)	August 2013
EIA license	19/08/2013
Building and Land Use Permit	15/11/2013
Drilling and mounting of the panels	Nov-Dec. 2013
Commissioning Date	18/02/2014

B.2. Post-registration changes

B.2.1. Temporary deviations from registered monitoring plan, applied methodology or applied standardized baseline

N/a

B.2.2. Corrections

N/a

B.2.3. Changes to start date of crediting period

N/a

B.2.4. Inclusion of a monitoring plan to the registered PDD that was not included at registration.

N/a

B.2.5. Permanent changes from registered monitoring plan, applied methodology or applied standardized baseline

N/a

B.2.6. Changes to project design of registered project activity

N/a

B.2.7. Types of changes specific to afforestation or reforestation project activity

N/a

SECTION C. Description of monitoring system

The project monitoring complies with the monitoring methodology ACM0002 Version 16.0 "Consolidated baseline methodology for grid-connected electricity generation from renewable sources", whereby it is stated that:

"All data collected as part of monitoring should be archived electronically and be kept at least for 2 years after the end of the last crediting period. 100% of the data should be monitored if not indicated otherwise in the tables [in B.7.1.]. All measurements should be conducted with calibrated measurement equipment according to relevant industry standards".

Therefore, the quantity of net electricity generation supplied by the project plant to the grid has been reliably monitored through calibrated electricity meters and cross-checked with monthly sales invoices to the power purchaser, the Central Electricity Board.

Organization Structure

The Country Manager of SARAKO PVP Co. Ltd coordinates and endorses the overall responsibility for all CDM monitoring of the project, including:

- Develop, approve, execute, and improve the CDM Monitoring/Reporting Procedures;
- Organize in-house seminar to inform and train the company staff to the monitoring procedures;
- Ensure that instrumentations and devices are available and properly suited to efficiently perform the monitoring;
- Communicate and coordinate the monitoring work of all business units;
- Validate and electronically archive all monitoring data on a monthly basis throughout the crediting period (and conserve it at least for 2 further years);
- Calculate and report the emission reductions; and
- Coordinate the DOE work during the verification audit.

The Country Manager might appoint a CDM coordinator to delegate him the above specific tasks of monitoring supervision.

The Technical/Engineering/Maintenance Department consisting of plant technicians will undertake the technical actions required by the monitoring plan, under the Country Manager's authority, to collect and record related data.

The Accounting/Sales Department (Chief Financial Officer) will crosscheck, reconcile or

consolidate data with multiple sources whenever possible. At minimum, data obtained from the electricity meters is to be crosschecked with the electricity sales receipts. This kind of reconciliation activity will be recorded properly as DOE may request for such information during the verification.

Monitoring procedures

The Meter Laboratory (ML) of CEB is solely responsible for the selection, installation, calibration, servicing, testing and repairing of all energy meters. The ML has recently acquired a sophisticated test bench to enable testing of electronic meters which have been put in service for registering the electricity consumption of maximum demand customers. Moreover, the SARAKO PVP Co. Ltd's back up meters shall be sealed by CEB in the presence of both parties and break only by CEB when required.

Data collection, consolidation and results analysis is undertaken by a dedicated team adequately trained, well aware of CDM requirements.

Internal auditing performance

The quantity of net electricity generation supplied by the project plant/unit to the grid every year is measured continuously and recorded at least once a month. The equipment used to ensure the measurement is a three-phase electronic electricity meters at CEB substation.

SECTION D. Data and parameters

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

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	As per ASB0019 Version 01.0
Value(s) applied	0.966
Choice of data or Measurement methods and procedures	As per ASB0019 Version 01.0
Purpose of data	Calculation of baseline emissions
Additional comment	-

Data / Parameter	$EF_{grid,OM,y}$
Unit	tCO2/MWh
Description	Operating 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	As per ASB0019 Version 01.0
Value(s) applied	1.017
Choice of data or Measurement methods and procedures	As per ASB0019 Version 01.0
Purpose of data	Calculation of baseline emissions
Additional comment	-

Data / Parameter	$EF_{grid,BM,y}$
Unit	tCO_2/MWh
Description	Build 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	As per ASB0019 Version 01.0
Value(s) applied	0.813
Choice of data or Measurement methods and procedures	As per ASB0019 Version 01.0
Purpose of data	Calculation of baseline emissions
Additional comment	-

Data / Parameter	The percentage share of total installed capacity of solar PV
Unit	%
Description	The percentage share of total installed capacity of the solar PV in the total installed grid connected power generation capacity in the host country.
Source of data	Statistics Mauritius (2014): Digest of Water and Energy Statistics - 2013, Port Louis.
Value(s) applied	0.3
Choice of data or Measurement methods and procedures	-
Purpose of data	Additionality demonstration
Additional comment	-

Data / Parameter	The total installed capacity of solar PV
Unit	MW
Description	The total installed capacity of the solar PV in the host country.
Source of data	Statistics Mauritius (2014): Digest of Water and Energy Statistics - 2013, Port Louis.
Value(s) applied	2.46
Choice of data or Measurement methods and procedures	-
Purpose of data	Additionality demonstration
Additional comment	-

D.2. Data and parameters monitored

Data / Parameter:	$EG_{facility,y}$
Unit:	MWh/yr
Description:	Quantity of net electricity generation supplied by the project plant/unit to the grid in year y
Measured/calculated/ default:	Measured

Source of data:	Electricity meter(s) at CEB sub-station.
Value(s) of monitored parameter:	5,716
Monitoring equipment:	Three-phase electronic electricity meters at CEB substation. The CEB Meters measure the net electrical energy delivered to CEB by SARAKO PVP Co. Ltd with the following specifications: ▪ Make: EDMI Model: MK6E V= 3x57-259V ▪ I: 1(6)A (50/60Hz) ▪ Accuracy class: 0.2S (±0.02%) LED Impulse: 0.1 imp/kWh Country of origin: Singapore ▪ SN: # 14502802 (main) & # 14502803 (back-up) ▪ CT ratio: 200/1 PT ratio: 66kV/110V
Measuring/reading/recording frequency:	Continuous measurement and at least monthly recording
Calculation method (if applicable):	n/a
QA/QC procedures:	Cross check of measurement results with records for sold electricity. Meter Laboratory (ML) of CEB is solely responsible for the selection, installation, calibration, servicing, testing and repairing of all energy meters. As per PPA §12.1.4, *CEB shall inspect each CEB Meter upon installation and at least once every year thereafter. CEB shall check the certification of CEB Meters through an accuracy test at least once every 4 (four) years thereafter or at any time the readings of Net Energy from the CEB Meter and Seller Back-up Meter differ by an amount greater than 0.5%.* Sarako's internal meter is a Schneider Electric PowerLogic® ION8600, accuracy class 0.2S (SN: MT-1309A052-01). ION meters are digital and do not require calibration, only verification of their accuracy, as per manufacturer's specifications.
Purpose of data:	Calculation of baseline emissions
Additional comment:	-

D.3. Implementation of sampling plan

This project activity does not require the implementation of sampling approaches.

SECTION E. Calculation of emission reductions or GHG removals by sinks

E.1. Calculation of baseline emissions or baseline net GHG removals by sinks

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:

$$\mathrm{BE_y} = \mathrm{EG_{pj,y}} \times \mathrm{EF_{grid,CM,y}}$$

Where:

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

$EG_{PJ,y}$ = 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 latest version of the "*Tool to calculate the emission*

factor for an electricity system" (tCO_2/MWh)

In this first CDM monitoring period (01/10/2016 to 31/12/2016), the GHG baseline emissions were **5,522 tCO2e** such as detailed in table below.

	***EGy* (MWh)**	***EFy* (tCO_2e/MWh)**	***BEy* *(tCO2e)***
2016	5,716	0.966	5,522
TOTAL	**5,716**		**5,522**

E.2. Calculation of project emissions or actual net GHG removals by sinks

The only fossil CO_2 emissions from the project activity come from the 10 kVA diesel emergency unit installed at the plant. This unit is relied on only for backup power of the servers and security lighting. Yet according to ACM0002 §37, for all renewable energy power generation project activities, emissions due to the use of fossil fuels for the backup generator can be neglected, therefore, $PE_y = 0$.

E.3. Calculation of leakage

As newly built solar power plant, there is no energy generating equipment transferred from another activity and no existing equipment transferred to another activity. The emissions potentially arising due to activities such as power plant construction and upstream emissions from fossil fuel use (e.g. extraction, processing, transport etc.) are neglected. Therefore according to methodology ACM0002 there is no need to consider leakage for the proposed project, thus $L_y = 0$.

E.4. Summary of calculation of emission reductions or net GHG removals by sinks

Item	**Baseline emissions or baseline net GHG removals by sinks ($t CO_2e$)**	**Project emissions or actual net GHG removals by sinks ($t CO_2e$)**	**Leakage ($t CO_2e$)**	**GHG emission reductions or net GHG removals by sinks ($t CO_2e$) achieved in the monitoring period**		
				Up to 31/12/2012	**From 01/01/2013**	**Total amount**
Total	5,522	0	0	0	5,522	5,522

E.5. Comparison of actual emission reductions or net GHG removals by sinks with estimates in registered PDD

Item	**Values estimated in ex ante calculation of registered PDD**	**Actual values achieved during this monitoring period**
Emission reductions or GHG removals by sinks ($t CO_2e$)	5,703 tCO2e	5,522 tCO2e

E.6. Remarks on difference from estimated value in registered PDD

The actual value achieved during this first CDM monitoring period is lower than in the estimate in the registered PDD due to lower electricity production than expected.

Appendix 1. Contact information of project participants and responsible persons/entities

Project participant and/or responsible person/ entity	☒ Project participant ☐ Person/entity responsible for completing the CDM-MR-FORM
Organization name	SARAKO PVP Co. Ltd.
Street/P.O. Box	-
Building	BPML Cyber Tower 1 Ground Floor
City	Ebene
State/region	-
Postcode	72201
Country	Mauritius
Telephone	+230 4681401
Fax	+230 4677914
E-mail	info@sarako.mu
Website	www.sarako.mu
Contact person	Mr Rajeev Bundhoo
Title	COO
Salutation	Mr
Last name	Bundhoo
Middle name	-
First name	Rajeev
Department	-
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Project participant and/or responsible person/ entity	☐ Project participant ☒ Person/entity responsible for completing the CDM-MR-FORM
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Building	
City	Paris
State/region	
Postcode	75008
Country	France
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E-mail	contact@aera-group.fr
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Contact person	Mr. Alexandre DUNOD
Title	Advisory Manager
Salutation	Mr
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