AMBATOLAMPY 20 MW SOLAR PV

Document Prepared by Earthood Services Private Limited

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Summary:

The project activity involves the generation of electricity through a greenfield solar photovoltaic plant with a capacity of 20 MW in Ambatolampy, in the South-East of Vakinankaratra region, Madagascar. The solar plant consists of 73,008 photovoltaic modules that supply the generated electricity to RI-Tana grid operated by JIRAMA .

The project aims to reduce the dependency on fossil fuel powered power plants for electricity by substituting carbon intensive energy with solar energy. In the baseline scenario, electricity delivered to the grid by the project activity would have otherwise been generated by operation of grid-connected power plants and by addition of new generation sources. The baseline scenario is the same as the scenario existing prior to the implementation of the project activity.

The plant has estimated to result in emission reductions worth 34,957 tons CO_2eq per year and 244,699 tons CO_2eq during the entire crediting period of 7 years.

During the first verification conducted for this project alongside validation, actual emission reductions from the monitoring period 10/07/2018 to 30/04/2020 were calculated as 34,847 tCO_2.

Scope of validation and verification

GreenYellow Madagascar contracted ESPL to conduct the joint validation and verification of the project. The project is covered under sectoral scope 1- Energy Industries (renewable sources) based on the methodology ACM0002: Large-scale Consolidated Methodology: Grid-connected electricity generation from renewable sources, Version 20.0.

A total of 02 CLs and 01 CAR has been raised during the joint validation and verification process of the project activity and successfully closed.

Conclusion

ESPL has performed the validation and verification of the VCS project activity “Ambatolampy 20 MW solar PV”.

The VVB has confirmed that:

- the PA is in accordance with all relevant host country criteria (Madagascar) and VCS rules and requirements;

- the PA is in accordance with all conditions of the latest version of applied methodology ACM0002, Version 20.0: “Grid-connected renewable electricity generation from renewable sources”;
- the local stakeholders’ consultation has been performed in accordance with host country and VCS requirements;
- the environmental assessment is appropriate and sufficient;
- the monitoring plan is transparent and adequate;
- all information has been consistently applied in the VCS-PD;

The implementation of the project has been done as per description in the VCS-PD.

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1 INTRODUCTION

1.1 Objective

GreenYellow Madagascar contracted ESPL to conduct the joint validation and verification of project activity “Ambatolampy 20 MW solar PV” according to the requirements of the Verified Carbon Standard Version 4.0.

1.2 Scope and Criteria

The scope of the validation and verification is to establish/verify that:

- the latest available VCS- Joint PD and MR was used and correctly filled up;
- the project activity is in accordance with all relevant host country criteria (Madagascar);
- the project activity is in accordance with all relevant VCS rules and requirements;
- the project activity is in accordance with conditions of the applied methodology ACM0002: Large Consolidated methodology --- Version 20.0/4/.

The validation and verification of the of the project activity is based on the VCS- Joint PD and MR, estimated GHG emission reduction calculations and actual emission reductions calculations.

1.3 Level of Assurance

☐ Limited level of assurance

☒ Reasonable level of assurance

A draft joint validation and verification report that is prepared by assessment team is reviewed by an independent technical review team (one or more members) to confirm if the internal procedures established and implemented by Earthood are duly complied with and such opinion/conclusion is reached in an objective manner that complies with the applicable VCS requirements as appropriate. The technical review team is collectively required to possess the technical expertise of all the technical area/sectoral scope the project activity relates to. All team members of technical review team are independent of the validation and verification team. The report approved by Technical Manager is endorsed by Managing Director, who is overall responsible to ensure quality, before final release. The further details of applicable procedures and responsibilities about Earthood Quality Management System (QMS) are available on its website (www.earthood.in).

Earthood’s validation approach is based on the understanding of the risks associated with reporting of GHG emission data and the controls in place to mitigate these. Earthood planned and performed the validation by obtaining evidence and other information and explanations

that Earthood considers necessary to give reasonable level of assurance that reported estimated GHG emission reductions are fairly stated.

In our opinion the estimated and actual GHG emissions reductions were calculated correctly on the basis of the approved baseline and monitoring methodology ACM0002, Version 20.0, and the VCS standard, Version 4.0.

1.4 Summary Description of the Project

Ambatolampy 20 MW solar PV generates renewable solar electricity and supplies power to the RI-Tana grid operated by JIRAMA. The project activity is a 20 MW solar power plant with 73,008 solar panel modules installed in Ambatolampy, in the South-East of Vakinankaratra region, Madagascar. The power generated by the grid will be replacing an equivalent amount of electricity from the grid system of Madagascar which is majorly dependent on fossil-fuel based grid imports for its electricity. The project is based on sectoral scope 1: Energy Industries with ACM0002: Large-scale Consolidated methodology: Grid-connected electricity generation from renewable sources, Version 20.0.

As per the estimations made at the time of installation, the project will achieve a total of 34,957 MWh per year during the overall crediting period of 7 years from 10/07/2018 to 09/07/2025, resulting in **23,431 tons CO_2eq** of emission reductions per year on an average. The joint verification report also covers the first monitoring period from **10/07/2018 to 30/04/2020** resulting in a reduction of total of **37,847 tCO_2e** GHG emissions.

Year	Baseline emissions or removals (tCO_2e)	Project emissions or removals (tCO_2e)	Leakage emissions (tCO_2e)	Net GHG emission reductions or removals (tCO_2e)
2018	10,073	0	0	10,073
2019	21,421	0	0	21,421
2020	6,353	0	0	6,353
Total	37,847	0	0	37,847

2 VALIDATION AND VERIFICATION PROCESS

2.1 Method and Criteria

The joint Validation and Verification, from Contract Review to Verification Report & Opinion, was conducted using Earthood internal procedures. The Project was verified against the latest requirements (Version 4.0) /7/ and guidance set out in VCS and CDM Standards as applicable.

The validation and verification of project activity process is conducted as per internal CDM Quality Manual and in accordance with criteria laid down by VCS. It includes the following steps:

- contract with PP for the scope and appointment of validation, verification team and technical review team;
- completeness check of VCS-joint PD and MR;
- desk review of joint PD & MR and estimated as well as actual GHG emission reduction calculations;
- reporting and closure of findings (CARs/CLs/FARs) and preparation of draft joint validation and verification report;
- independent technical review of the draft report and final/revised documentation (e.g., VCS-Joint PD and MR, corresponding estimated ER calculations sheet and evidences);
- issuance of the final validation and verification report to contracted PP (or authorized representatives).

No sampling was required to be used since all data was directly verified through evidences and supporting documents provided by PP.

2.2 Document Review

The joint validation and verification is performed primarily as a document review of the documents submitted at various stages of assessments. The review is performed by assessment team using dedicated protocols. The assessment team cross checks the information provided in the documents (Joint Project Description & Monitoring Report/1/) and information from sources other than those used, if available, and also conducts independent background investigations. Earthood conducted a desk review as under;

a) A review of the data and information presented to verify their completeness;

b) A review of the monitoring plan, the monitoring methodology including applicable tool(s) and, where applicable, the applied standardized baseline, paying particular attention to the frequency of measurements, the quality of metering equipment including calibration requirements, and the quality assurance and quality control procedures;

c) An evaluation of data management and the quality assurance and quality control system in the context of their influence on the generation and reporting of emission reductions.

2.3 Interviews

No site visit was conducted for this validation and verification assessment due to the outbreak of global pandemic (caused by COVID-19) and increased risk of exposure and contraction due to travel. It was not possible for the VVB team to conduct personal interviews with the project management team on-site. Also, the international travel is restricted in the country of validation and verification team's residence/32/ which restricted the team from conducting the site visit physically.

However, alternate means were selected to discuss project implementation with the project management team.

All the relevant documents related to the Project Activity were collected via email beforehand and the information associated with the verification of Project Activity implementation were collected through a remote audit conducted on 18/09/2020 via Skype. The O&M personnel at the plant site were interviewed via video call to confirm information regarding the installed technology, data recording and storage procedures, plant maintenance and staff competency. The name plate details covering the provider and the serial numbers of all the installed technology were reviewed by the assessment team during the video call.

The details of the telephonic interview and video call inspection are as follows -

No.	Interviewee			Date	Topics
	Last name	First name	Affiliation		
1.	François	Vincent	Indian Ocean & Southern Africa- Solar Engineering and O&M Manager, GreenYellow	18/09/2020	Installed capacity and technological details of the plant, data recording and storage, monitoring management, and staff competency.
2.	Dunod	Alexandre	Director of Operations, AERA Group	18/09/2020	Monitoring management and data collection system
3.	Rivosoa	Ramanampamonjy	GreenYellow site manager	18/09/2020	Site operations and monitoring management

The assessment team was able to procure all the relevant information related to the Project Activity through the remote survey. The project activity is also registered under CDM. So, the validation report was also referred to corroborate certain assumptions. The representative present at the plant site guided the assessment team through installed solar modules, inverters, transformers, metering system and through the data processing procedures in the plant office. Through the cross-checking of the information obtained during the remote survey against the evidences provided the assessment team is able to give a reasonable level of assurance that the all the information related to the Project Activity is transparent and justified.

2.4 Site Inspections

Mandatory Site-Visit:

The site-visit for the current verification was not mandatory as VCS has launched travel guidance on 18/03/2020 (https://verra.org/covid-19-travel-guidance/) /30/ which does not mandate the provision to conduct on-site inspections. However, VVB is needed to demonstrate in the Joint validation and verification report on how a reasonable level of assurance is achieved without an in-person site visit.

Site-Visit:

The on-site inspection of the Project Activity could not be conducted due to outbreak of global pandemic Covid-19 and an increased risk of exposure and contraction due to travel. The decision to avoid on-site inspection was taken based on the WHO situation report as on 02/03/2020 which imposed restrictions on international travel to ensure health and safety.

In addition to that, World Health Organization (WHO) has released recommendations on cross-border movement across the COVID-19 affected countries. The link of the WHO recommendation is as follows-

https://www.who.int/news-room/articles-detail/updated-who-recommendations-for-international-traffic-in-relation-to-covid-19-outbreak

Verra has also launched travel guidance (https://verra.org/covid-19-travel-guidance/) which does not mandate the provision to conduct on-site inspections. However, VVB is needed to demonstrate in the Joint validation and verification report on how a reasonable level of assurance is achieved without an in-person site visit.

Issue with the postponement of Site-visit:

The site-visit for this verification could not be postponed as this would lead to delayed issuance of the CERs. The PP relies upon the CER revenue generated from the project as the working capital of the project.

Therefore, VVB had performed the Joint Validation and Verification of the Project Activity through the adoption of alternative means to reach a reasonable level of assurance:

Requirement	Information by PP	Alternative means of Validation and Verification
Project implementation and operation	Ambatolampy 20 MW solar PV ("the project") consists of the construction and operation of a greenfield 20 MW solar photovoltaic power plant by GreenYellow Madagascar ("GreenYellow") in Ambatolampy, in the South-East of Vakinankaratra region,	VVB has collected the Land lease document/10/, Yield Simulation Report/27/, ESPA/16/, Commercial Operation Date certificate/14/, EPC order for the installed technologies/25/, documents to verify the

	Madagascar. It involves the setting up of photovoltaic (PV) panels which will capture solar energy and convey such energy to the convertor station in order to produce electricity exported to the national grid.	project implementation and operation. These documents verify the compliance of the project implementation with the registered project design.
Technology installed	The PV modules installed are new and of make Eagle 60 from Jinko Solar. They are of high-efficiency, poly-crystalline silicon solar cells with high transmission and tempered glass, which results in module efficiency of up to 16.80%. According to the manufacturer's warranty, the average annual power output degradation of the module shall not exceed 0.5% per year, ending with 80.7% at the end of the 25th year, i.e. implying a life expectancy for at least this duration.[1] For the Balance of System components, including inverters, lifetime is also exceeding 25 years as per the extendable warranty.	PP has provided the General layout of the plant/13/, EPC contract for the installed technology/25/, manufacturer's specifications/17/ and photographs of the actual site/22,23/, to demonstrate the installation status of project technologies as per the monitoring plan /1,2/. In addition to that a remote survey was conducted on 18/09/2020 to further validate all the material information related to the Project Activity. From the remote survey and the evidences provided, it is verified that the project has been implemented as per the applied methodology and the registered monitoring plan /1,2/.
Monitoring systems and procedures	Electricity outputs is electronically recorded, stored and invoiced monthly to JIRAMA by GY Madagascar, based on main meter below (or back-up in case of main meter unavailability or default).	PP has provided the power invoices issued on a monthly basis to JIRAMA to demonstrate the compliance of monitoring

[1] see Eagle 60 260-280W specifications provided to the DOE

	The measurement devices of net electrical energy delivered to RI-Tana grid are both located before 20/63kV transformer at JIRAMA substation	activities with the registered monitoring plan. PP has also shared the photographs of the project site as a supportive document of monitoring activity. In addition to that a remote survey has been conducted on 18/09/2020 to further validate all the material information related to the Project Activity. The documents were checked by the VVB and it has been verified that the monitoring activities are following the registered monitoring plan.
Calibration	Cross check of measurement results with records for sold electricity. As per PPA §9.3, meters' testing, inspection, repairs, re-calibration or replacement will be ensured by the Parties according to best practices. Yet as per manufacturer's manual, meters are calibrated at the factory and do not require any further calibration during their entire service life. Calibration by customer is, therefore, not necessary.	The electricity meters are already calibrated at the time of manufacturing and as per the manufacturer's specifications/17/, the meters are not required to be calibrated thereafter. However, the assessment team concluded that the accuracies of the meters are within the standard through the meter receipt and initial meter testing documenting/24/.
Data and calculation	The monitoring period for which GHG emission reductions were achieved spans 10/07/2018 to 30/04/2020. Baseline emissions are calculated according to §4.1 methodological approach as the product of (i) the quantity of	VVB has checked the data, and calculations made for the emission reductions achieved during the monitoring period by means of desk review. This was further verified with the help of remote survey conducted

	net electricity generation that is produced and fed into the grid as a result of the implementation of the project activity in year y ($EG_{facility,y}$ = Exports – Imports, in MWh/yr) and (ii) the combined margin CO_2 emission factor for grid connected power generation in year y ($EF_{grid,CM,y}$):	by VVB team, on 18/09/2020 with PP representative. The above verification actions conclude that PP has implemented the data and calculations in line with the registered VCS PD /1/.

Therefore, it is concluded that the alternative means of verification applied are sufficient to perform the Joint Validation and Verification of the Project Activity.

2.5 Resolution of Findings

The findings ma be of the following types: CAR- Corrective Action Request, CL- Clarification Request and FAR- Forward Action Request.

During the present validation+verification, 02 CLs and 01 CAR was raised and successfully closed.

The list of findings and their resolution are presented in the Appendix IV of this verification report. The section also includes the response, if provided, by the project participants and an assessment by the verification team if it was closed our or otherwise.

2.5.1 Forward Action Requests

No Forward Action Requests (FARs) were raised during this verification.

3 VALIDATION FINDINGS

3.1 Project Details

The Project Activity "Ambatolampy 20 MW solar PV" consists the installation of 73,008 solar polycrystalline modules with a total capacity of 20 MW in Ambatolampy, in the South-East of Vakinankaratra region, Madagascar. The power generation is off-taken and distributed by the Madagascar public utility grid, JIRAMA, thereby replacing the dependency on the generation of electricity fossil fuels significantly. The project aims to achieve 34,957 MWh annually resulting in the emission reductions of 23,431 tons CO2eq per year on average.

The project proponent of the project activity is GreenYellow (Madagascar) and the other entity involved in the Project is AERA Group.

As per the desk review, remote survey observations, and collected evidences, it was possible to assess that, in general, the project activity has been implemented as described in the Joint VCS PD and MR sheet.

There is no material discrepancy between the monitoring plan set out in the project description/1,2/ and the applied methodology/4/.

Some of the characteristics of the PA are mentioned below:

- Project Proponent: GreenYellow (Madagascar) Ltd.
- Other entities involved: AERA Group
- Project Category: Project since the emission reductions are less than 300,000 tonnes of Co_2e per year.
- Estimated GHG reductions: 23,431 tCO_2 reductions on an average per year and 1,64,018 tCO_2 reductions during the entire crediting period of 7 years as checked from the ER sheet/5/. The calculations in the ER sheet were found to be accurate and appropriate.
- Start date: 10/07/2018, which is the which is the date of commissioning, synchronization and start of GHG emissions as confirmed from the Commercial Operation date issued by JIRAMA meters installation certificate/24/ and electricity generation data and power invoices/21/.
- Crediting period: The project crediting period starts on 10/07/2018 and lasts 7 years (fixed), until 09/07/2025.
- VERs Ownership: GreenYellow (Madagascar), as confirmed through the Power Purchase Agreement with JIRAMA, dated 30/11/2016/16/.
- Project Location: The project is situated in in in Ambatolampy, in the South-East of Vakinankaratra region, Madagascar. This was confirmed from the using Latlong coordinates application/28/.
- Conditions prior to project initiation: Electricity generation by fossil-fuel fired power plants/4,16/.
- Compliance with applicable laws, statutes and other regulatory frameworks: Ambatolampy 20 MW solar PV project has all necessary clearances in order to generate energy from Solar panels, in accordance with Madagascar legislation as confirmed through the EIA license/26/ and electricity generation license/14/ granted to the project.

- Emissions trading programs and other binding limits: GHG emission reductions generated by the project are not included in an emissions trading program or any other mechanism that includes GHG allowance trading as confirmed during remote site visit through interview with PP's representatives.

- Other forms of environmental credit sought or received and eligible to be sought or received: The project has not received nor sought any other form of environmental credit/18/.

- Participation under other GHG programs: The project activity is also registered under CDM (UNFCCC project number 10481) since 03/05/2019 but the project has not sought any carbon credits from CDM so far as confirmed from CDM project webpage https://cdm.unfccc.int/Projects/DB/RWTUV1556909746.23/view

- Rejection by other GHG programs: the project was not rejected under any other GHG programs/18/.

All information provided was verified from the remote survey and the supporting documents and evidences provided by the PP. Thus, VVB confirms that the description provided in project description is accurate, complete, and appropriately provides the understanding of the nature of the project. The project is found to be implemented in line with the project description/1,2/ and applied methodology/4/.

3.2 Participation under Other GHG Programs

The project activity is also registered under CDM (UNFCCC project number 10481) since 03/05/2019 /27/ but the project has not sought any carbon credits under CDM. It has been verified from the VCS registry and CDM webpage/27/ that no overlap concerning the dates for the current monitoring period has taken place. Furthermore, it was confirmed through interview with GreenYellow representatives to establish that "The project has been registered under another GHG program (CDM Project activity n°10481) but is not seeking any renewal or new registration under the same"/18/.

Furthermore, in accordance with Appendix II of VCS Standard Version 4/7/, it was confirmed that

ESPL was contracted for the registration of the Project Activity to VCS on 02/03/2020, therefore the gap validation of the Project Activity to VCS is considered valid and is eligible to be included under the scope of VCS Program (Version 3.0)

3.3 Safeguards

3.3.1 No Net Harm

The Environmental Impact Assessment Report of the Project Activity was issued on 19/09/2016 which includes key aspects like project background, Madagascar Legislation relevant to the project,

The IFC Environmental and Social Performance Standards, the key environmental and social sensitivities involved in the project area, assessment of potential environmental and social impacts and the environmental and social action plan. Both the impacts during construction and operation have been discussed in great detail in the report. The Project Activity takes into consideration the key IFC Performance Standards including the following:

- Assessment and Management of Environmental and Social Risks and Impacts,
- Labor and working conditions,
- Resource Efficiency and Pollution Prevention
- Community Health, Safety and Security
- Land Acquisition and Involuntary Resettlement
- Biodiversity Conservation and Sustainable Management of Living Natural Resource
- Cultural Heritage

The initial stage of assessment process covered the screening of all the potential impacts and the designing of mitigation efforts against each. The impact screening matrix for the project included the following points:

Construction phase	- Vegetataion clearance - Site levelling and grading - Equipment delivery to site - PV module mounting, underground cables and overhead line, substation construction, solar panel erection, Construction of service building - Water supply - Waste storage and disposal
Operational phase	- Solar panel operation - Site maintenances - Water supply - Accidental events (spill/uncontrolled release)
Decommissioning phase	- Removal of solar panels - Removal of underground cables - Accidental events - Site restoration and rehabilitation

The mitigation of all the impacts discussed have been further discussed in section 3.3.3. of the report.

3.3.2 Local Stakeholder Consultation

The local stakeholder consultation process has been described in detail, by the Project Developer, in the registered CDM PDD/2/. The project participant identified the relevant stakeholders and have

also sought clearance from several authorities for the development of the Project Activity. The Project Developer has consulted the following authorities to seek views and opinions about the Project:

- Ambohipihoanana mayor and treasure (Local authority)
- Vakinankaratra region officials (Regional authority)
- Power Regulation Authority (National authority)
- Ambohimena brick factory owner (Local economic stakeholder)
- JIRAMA (National economic stakeholder)
- Local communities
- Medical staff

All the stakeholders interacted directly with the concerned authorities and shared their concerns which were majorly related to project impacts, project cost, project execution, land availability, economic development, and access to electricity.

All the comments received during the Local Stakeholder Consultation were duly considered and addressed by the Project Developer during the Project's development and in the preparation of Environmental and Social Action Plan (ESAP). There is also an ongoing mechanism in place for recording any grievances related to the Project Activity. Thus, the validation team is of the opinion that the relevant stakeholders have been consulted appropriately and adequately.

3.3.3 Environmental Impact

The Project Activity designed an elaborate Environmental and social action plan wherein relevant actions were devised to overcome any environmental or social impacts related to the Project. Some of the mitigation measures against the potential Social and Environmental impacts are as follows:

1. Develop and maintain an ESMS for the project proportional and commensurate with the Project impacts and risks.
2. Develop emergency plans including an emergency response plan for spills and accidental events
3. Develop and implement a Stakeholder Engagement Plan
4. Prepare a decommissioning plan when appropriate, which includes recycling of the PV panels as far as possible
5. Develop and implement policies on the quality and management of accommodation provided to workers where applicable
6. Undertake routine inspection and maintenance of engines, vehicles and generators to minimise air emissions
7. Develop detailed waste management plan
8. Development and implementation a Road Traffic Management plan including strict implementation of speed limits on paved and unpaved roads
9. Provide appropriate training to workforce to raise awareness on culturally appropriate manners.

The impacts of project activity and mitigation measures taken by the project developer have been discussed extensively in the environment and social management plan/16/. The document was reviewed by the VVB and it was concluded that all environment and social impacts from different stages of this project activity (prior construction, construction, operation and dismantling) have been identified and reasonable steps have been taken to mitigate those impacts by the project developer. The project activity is therefore eliminated from an overall harm and has successfully implemented its aim of reducing harmful GHG emissions form the environment.

3.3.4 Public Comments

The project was open for public comments from 29/06/2020 to 29/07/2020/3/ during which no comments were received as confirmed from the project webpage/3/.

3.3.5 AFOLU-Specific Safeguards

Not Applicable.

3.4 Application of Methodology

3.4.1 Title and Reference

The Project Activity has applied the approved baseline and monitoring methodology ACM0002 version 20.0 - "Grid-connected electricity generation from renewable sources". Although the latest available version of this methodology is version 20.0, the current methodology version in use was found to be applicable until 24th July 2020 as confirmed form the UNFCCC website/27/.
The methodology has referred the following tools for the calculation of various parameters:

- "Determining the baseline efficiency of thermal or electric energy generation systems" version 2.0/11/
- "TOOL07: Tool to calculate the emission factor for an electricity system" version 7.0

3.4.2 Applicability

All applicability conditions of the valid version of the methodology (ACM0002 version 20.0) /4/ are met. Thus, the methodology is deemed fully applicable for the first crediting period and no request for deviation with regards to the applicability of the methodology is required. All applicability conditions are completely and correctly included in the VCS joint PD and MR/1,2/.

Criteria	Means of Verification	Conclusion
This methodology is applicable to grid-connected renewable energy power generation project activities that: a) Install a Greenfield power plant;	The project activity is a greenfield solar photovoltaic power plant substituting electricity produced on the grid by renewable energy.	Since the project is a grid connected/16/ greenfield power plant, criterion is fulfilled.

(b) Involve a capacity addition to (an) existing plant(s); (c) Involve a retrofit of (an) existing operating plants/units; (d) Involve a rehabilitation of (an) existing plant(s)/unit(s); or (e) Involve a replacement of (an) existing plant(s)/unit(s).	This has been confirmed from, land lease document/10/ and the Environment Impact Assessment Report /19/. The ESPA signed with JIRAMA/16/ confirmed that PA is grid connected.	
The project activity is the construction and operation, capacity addition, rehabilitation (or refurbishment), retrofit or replacement of a power plant/unit of one of the following types: hydro power plant/unit (with or without reservoir), wind power plant/unit, geothermal power plant/unit, solar power plant/unit, wave power plant/unit or tidal power plant/unit;	The project activity is the construction and operation of a solar photovoltaic power plant and hence the methodology is applicable. This has been checked against the ESPA/16/, power invoices/21/, and EIA report/19/	Since the PA is construction and operation of Solar PV power plant/25/,/16/, criterion is fulfilled
In the case of capacity additions, retrofits, rehabilitations or replacements (except for wind, solar, wave or tidal power capacity addition projects the existing plant/unit started commercial operation prior to the start of a minimum historical reference period of five years, used for the calculation of baseline emissions and defined in the baseline emission section, and no capacity expansion, retrofit, or rehabilitation of the plant/unit has been undertaken between the start of this minimum historical reference period and the implementation of the project activity.	The project activity does not involve any capacity additions, retrofits, rehabilitations, or replacements This has been checked against the ESPA agreement between the GreenYellow and JIRAMA/16/.	Since PA is a greenfield power plant/10/, criterion is not applicable.
In case of hydro power plants, one of the following conditions shall apply: (a) The project activity is implemented in existing single or multiple reservoirs, with no change in the volume of any of the reservoirs; or (b) The project activity is implemented in existing single or multiple reservoirs, where the volume of the reservoir(s) is increased and the power density	Not applicable as the proposed project activity involves a solar photovoltaic power plant. This has been checked against the ESPA provided to the VVB by the PP/16/.	Since PA is not a hydro power plant, criterion is not applicable

calculated using equation (3) of the methodology ACM0002, is greater than 4 W/m^2; or (c) The project activity results in new single or multiple reservoirs and the power density, calculated using equation (3) of the methodology ACM0002, is greater than 4 W/m^2; or (d) The project activity is an integrated hydro power project involving multiple reservoirs, where the power density for any of the reservoirs, calculated using equation (3) of the methodology ACM0002, is lower than or equal to 4 W/m^2, all of the following conditions shall apply: - The power density calculated using the total installed capacity of the integrated project, as per equation (4) of the methodology ACM0002, is greater than 4 W/m^2; - Water flow between reservoirs is not used by any other hydropower unit which is not a part of the project activity; - Installed capacity of the power plant(s) with power density lower than or equal to 4 W/m^2 shall be: a.) Lower than or equal to 15 MW; and b.) Less than 10 per cent of the total installed capacity of integrated hydro power project.		
In the case of integrated hydro power projects, project proponent shall: - Demonstrate that water flow from upstream power plants/units spill directly to the downstream reservoir and that collectively constitute to the generation capacity of the integrated hydro power project; or - Provide an analysis of the water balance covering the water fed to power units, with all possible combinations of reservoirs and without the construction of reservoirs. The purpose of water balance is to demonstrate the requirement of specific combination of reservoirs constructed under CDM project activity for the optimization of power output. This	Not applicable as the proposed project activity involves a solar photovoltaic power plant. This has been checked against the ESPA provided to the VVB by the PP/16/.	Since PA is not a hydro power plant, criterion is not applicable

demonstration has to be carried out in the specific scenario of water availability in different seasons to optimize the water flow at the inlet of power units. Therefore, this water balance will take into account seasonal flows from river, tributaries (if any), and rainfall for minimum five years prior to implementation of CDM project activity.		
The methodology is not applicable to: - Project activities that involve switching from fossil fuels to renewable energy sources at the site of the project activity, since in this case the baseline may be the continued use of fossil fuels at the site; - Biomass fired power plants/units.	The proposed project activity neither involves - switching from fossil fuels to renewable energy sources at the site of the project activity, since in this case the baseline may be the continued use of fossil fuels at the site, nor - biomass fired power plants/units This has been checked against the ESPA/16/ and the power invoices/21/.	Since project does not fall in either of the categories mentioned in this criterion, this criterion not applicable
In the case of retrofits, rehabilitations, replacements, or capacity additions, this methodology is only applicable if the most plausible baseline scenario, as a result of the identification of baseline scenario, is “the continuation of the current situation, that is to use the power generation equipment that was already in use prior to the implementation of the project activity and undertaking business as usual maintenance”.	The project activity does not involve capacity additions, retrofits, rehabilitations, or replacements This has been checked against the ESPA/16/ and the power invoices/21/ provided by the PP.	Since PA is a greenfield project, criterion is not applicable
In addition, the applicability conditions included in the tools referred to above apply.	Applicability of applied tools has been assessed by the VVB and found to be met	Since applicability conditions of included tools are met, criterion is fulfilled

Compliance with applicability conditions of “Tool to calculate emission factor for an electricity system”:

Criteria	Means of Verification	Conclusion
This tool may be applied to estimate the OM, BM and/or CM when calculating baseline emissions for a project activity that substitutes grid electricity that is where a project activity supplies electricity to a grid or a project activity that results in savings of electricity that would have been provided by the grid (e.g. demand-side energy efficiency projects).	The project activity substitutes grid electricity by supplying renewable power to grid. Hence the tool is applicable. This is verified thorough the ESPA signed with national grid/16/.	Since PA is grid connected/16/, criteria is met
Under this tool, the emission factor for the project electricity system can be calculated either for grid power plants only or, as an option, can include off - grid power plants. In the latter case, two sub-options under the step 2 of the tool are available to the project participants, i.e. option IIa and option IIb. If option IIa is chosen, the conditions specified in "Appendix 2: Procedures related to off-grid power generation" should be met. Namely, the total capacity of off-grid power plants (in MW) should be at least 10 per cent of the total capacity of grid power plants in the electricity system; or the total electricity generation by off-grid power plants (in MWh) should be at least 10 per cent of the total electricity generation by grid power plants in the electricity system; and that factors which negatively affect the reliability and stability of the grid are primarily due to constraints in generation and not to other aspects such as transmission capacity.	The emission factor for the project electricity system is calculated for grid power plants only.	Since the PA involves the calculation of emission factor for grid power plants only, the criterion is met.
In case of CDM projects the tool is not applicable if the project electricity system is located partially or totally in an Annex I country.	Since the project electricity system is not located partially or totally in an Annex I country, the tool is applicable	Since Madagascar is not an Annex I country, criteria met.

Under this tool, the value applied to the CO_2 emission factor of biofuels is zero.	No biofuels have been identified in the baseline grid emission factor determination	Since the PA only involves no biofuel usage, criteria met

3.4.3 Project Boundary

The project boundary is given by the applied methodology ACM0002, version 20.0/4/

"The spatial extent of the project boundary includes the project power plant and all power plants connected physically to the electricity system that the VCS project power plant is connected to."

The project activity consists of the installation of 73,008 solar polycrystalline photovoltaic modules. The total capacity of the project is 20 MW in which the power is off-taken and distributed to RI-Tana grid operated by JIRAMA. The project boundary includes the project activity site where the electricity is being produced and the grid that the power plant is connected to, which has been illustrated in the Section 1.12 of the Joint PD and MR Report/1,2/ and gives clear understanding of the project boundary; thus it is acceptable.

The consideration, by the PP, of only CO_2 gas for the baseline emissions is conservative and in line with the methodology. The exclusion of CH_4 & N_2O in the baseline scenario is appropriate. The project activity involves the generation of electricity using solar energy. Hence, there are no project emissions associated with this project activity. Therefore, the exclusion of CO_2, CH_4 & N_2O in the project scenario are appropriate. There are no other sources of project emissions. Hence, the project participant has considered the project emissions as zero for project activity; this is in line with the methodology.

The validation team is able to conclude that the project boundary and selected sources are applied as per the methodology /4/ and the applicable VCS criteria/7/.

3.4.4 Baseline Scenario

The project activity involves the installation of a newly built and grid-connected renewable power plant and supplying the generated electricity to RI-Tana grid operated by JIRAMA, hence, according to the applied ACM0002, version 20.0/4/, the baseline scenario is determined properly as:
"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, as reflected in the combined margin (CM) calculations described in the "Tool to calculate the emission factor for an electricity system."

The PP has provided the calculation for the same in the ER calculation sheet/5/ and it was validated by the validation and verification team. The baseline emission factor for the electricity system has been calculated on ex-ante basis and will remain fixed for the entire project crediting period.

The discussion on baseline is comprehensive in the VCS Joint PD and MR Report/1,2/ and it is in line with the applied baseline and monitoring methodology ACM0002, version 20.0/4/. Also, the identified baseline for the project activity is the most likely scenario of what would have occurred in the absence of the project activity. The project participant has included all sources and references used for baseline determination for the project activity in the Joint PD and MR Report /1,2/ and the identified baseline is justified appropriately by the project participant. The Baseline scenario and baseline emission calculations are found as per ACM0002, version 20.0/4/. The combined margin approach is the ex-ante approach as per tool to calculate the emission factor for an electricity system.

The validation team confirms that:

(a) All the assumptions and data used by the PP are listed in the VCS Joint PD and MR Report/1,2/, including their references and sources.

(b) All documentation used is relevant for establishing the baseline scenario and correctly quoted and interpreted in the Joint PD and MR sheet/1,2/.

(c) Assumptions and data used in the identification of the baseline scenario are justified appropriately, supported by evidence and can be deemed reasonable.

(d) Relevant national and/or sectoral policies and circumstances are considered and listed in the Joint PD and MR sheet.

(e)The approved baseline methodology has been correctly applied to identify the most reasonable baseline scenario and the identified baseline scenario reasonably represents what would occur in the absence of the proposed project activity.

3.4.5 Additionality

The information related to additionality has been mentioned under Section B.5 of the registered CDM PDD/2/. According to paragraph 28 of the applied methodology ACM0002: Large-scale Consolidated Methodology: Grid-connected electricity generation from renewable sources Version 20.0, a simplified procedure to demonstrate additionality is applicable to grid connected electricity generation Solar photovoltaic technology-based plant. A specific technology in the positive list is deemed automatically additional if the following conditions are met at the time of submission of PDD:

a) The percentage share of total installed capacity of the specific technology in the total installed grid connected power generation capacity in the host country is equal to or less than two per cent; or

b) The total installed capacity of the technology in the host country is less than or equal to 50 MW.

The Project Activity meets condition b) of the methodology.

The total installed capacity of solar PV in the host country i.e., Madagascar is 530 kW. This has been confirmed by the Validation team from Electricity Regulation Office statistics (ORE, 2016) operational power plants list as accessed from: http://www.ore.mg/DonneesTechniques/SynoptiqueParcProduction.xlsm

Since the total installed solar PV capacity in Madagascar lies far below the 50 MW threshold, the Validation team confirms that the Project is automatically additional.

3.4.6 Quantification of GHG Emission Reductions and Removals

The proposed activity has applied baseline methodology ACM0002, version 20.0 and as per the methodology:

"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, as reflected in the combined margin (CM) calculations described in the "Tool to calculate the emission factor for an electricity system."

The baseline emissions have been calculated as follows:

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

Where:

BE_y	Baseline emissions in year y (t CO_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 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" (t CO_2/MWh)

Calculation of $EG_{PJ,y}$:

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

$EG_{PJ,y}$	Quantity of net electricity generation that is produced and fed into the grid as a result of the implementation of the project activity in year y (MWh/yr)
$EG_{facility,y}$	Quantity of net electricity generation supplied by the project plant/unit to the grid in year y (MWh/yr)

Calculation of $EF_{grid,CM,y}$:

This parameter is calculated using the tool, ""Tool to calculate the emission factor for an electricity-system" (Version 07.0). Emission factor once calculated, shall remain fixed during the entire duration of the monitoring period. The tool provides procedure to determine the following parameters:

$EF_{grid,CM,y}$	Combined margin CO2 emission factor for the project electricity system in year y
$EF_{grid,BM,y}$	Build margin CO2 emission factor for the project electricity system in year y
$EF_{grid,OM,y}$	Operating margin CO2 emission factor for the project electricity system in year y

The tool highlights six steps for the calculation of combined margin (CM) emission factor:

Step 1: Identify the relevant electricity systems
In accordance with paragraph 17 of applied tool/12/ option 1, the National Electricity System (SEN) is defined as the relevant electric power system, which is considered appropriate since the system covers the whole country and defines the interconnected systems and spatial extent of the power plants. Therefore, the relevant electric power system is the national grid of Madagascar which is which is the RI-Tana Grid.

Step 2: Choose whether to include off-grid power plants in the project electricity system (optional):
In line with para 28 and 29 of applied tool/12/, project participant has chosen to include only grid-connected power plants in the calculations.

STEP 3: Select a method to determine the operating margin (OM) method
PP has selected option (a) in accordance with para 38 of applied tool/12/ i.e. Simple OM, based on the data requirement and important conditions set to be met in order to apply specific OM method, the choice of option (a) was found appropriate because low cost/ must run plants in the host country constitute greater than 50% of the total generation of the system in the last 5 years/6/ and Average load by LCMR is less than average LASL over three years. As demonstrated in PDD, a total share of all the low-cost/must run resources with a total share not exceeding 20.4% between 2015 and 2017.

The simple OM can be calculated from the two data vintages.

- Ex-ante option- the emission factor is calculated at the time of validation and doesn't need any monitoring and recalculate during the whole crediting period.
- Ex-post option- The emission factor is calculated annually during the monitoring period.

PP has selected the Ex-ante option for the calculation of the OM emission factor. In Madagascar and at the time of request for registration, there are 2 projects activities and 1 programme of activities registered under the CDM. Among these projects and programmes of activities, there are two power plants connected to the project electricity system: Small-Scale Hydropower Project Sahanivotry in Madagascar, and Tsiazompaniry Hydropower Project in Madagascar.

Therefore, the selection of option (a) was found to be the most appropriate.

STEP 4: Calculate the operating margin emission factor according to the selected method
According to the applied tool, simple OM emission factor ($EF_{OM,simple,y}$) can be calculated in two ways:
(a) Option A: Based on the net electricity generation and a CO_2 emission factor of each power unit; or

(b) Option B: Based on the total net electricity generation of all power plants serving the system and the fuel types and total fuel consumption of the project electricity system.

According to paragraph 47 (b) of the applied tool, option B can only be used if the necessary data for option A is unavailable, Only nuclear and renewable power generation are considered as low-cost/must-run power sources and the quantity of electricity supplied to the grid by these sources is known and if Off-grid power plants are not included in the calculation (i.e. if Option I has been chosen in Step 2). Since all of the conditions have been met, PP has chosen Option B to calculate simple OM emission factor.
In line with para 49 (b) of tool 07/12/, the formula used in revised PDD/1,2/ for calculation of operating margin emission factor was found to be appropriate, as given below:

$EF_{EL,m,y} = EF_{co2,m,i,y} \times 3.6 \ / \ \eta m,y$

Where:

$EF_{EL,m,y}$	CO2 emission factor of power unit m in year y (t CO2/MWh)
$EF_{CO2,m,i,y}$	Average CO2 emission factor of fuel type i used in power unit m in year y (t CO2/GJ)
$\eta m,_y$	Average net energy conversion efficiency of power unit m in year y (ratio)
m	All power units serving the grid in year y except low-cost/must-run power units
y	The relevant year as per the data vintage chosen in Step 3 3.6 = Conversion factor (GJ/MWh)

For the determination of EGm,y, JIRAMA national power utility data as shared publicly through the Power Regulation Authority website's statistics has been used. The result of the calculation for the most recent 3 years average returns an Operating Margin of 0.668 CO2/MWh.

STEP 5: Calculate the build margin (BM) emission factor

To calculate build margin emission factor, tool 07/12/ provisions two options for selection of vintage of data used. Since either of the choices do not require any pre-condition to be met before being selected, option 1 has been chosen by the PP. In the project electricity system, there is no capacity addition from retrofits of power plants
Project participant has applied option 1 from para 72 of Tool 07, which says that build margin emission factor shall be updated based on the most recent information available on units already built. The most recent consolidated data published available was confirmed to be of 2017/2/.

PP has applied the steps defined in procedure for selection of power units in operation at the time of submission (defined in the Para 75 of Tool 07/12/), which has been checked and found to be valid for the calculation of BM emission factor.

The 5 power units considered for BM calculation, which have been appropriately selected as per the guidance in the para 75 of tool 7/12/, generate 20% of the system's energy, and the calculated build margin is the generation-weighted average emission factor (tCO2/MWh) of all power units m during the most recent year y for which power generation data is available.
The methodological choices and calculations were found to be appropriate and acceptable by the assessment team.

The electricity generation data used for calculation of build margin emission factor was found to be the latest data available at the time of submission of PDD to the validating DOE.
The build margin emissions factor for which electricity generation data is available (2017 in present case), calculated as follows:

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

$EF_{grid,BM,y}$	Build margin CO2 emission factor in year y (t CO2/MWh)
$EG_{m,y}$	Net quantity of electricity generated and delivered to the grid by power unit m in year y (MWh)
$EF_{EL,m,y}$	CO2 emission factor of power unit m in year y (t CO2/MWh)
m	Power units included in the build margin
y	Most recent historical year for which electricity generation data is available

Based on the obtained data and the final calculations reviewed from Emission Factor calculation sheet, the calculated BM is 0.677 tCO2/MWh.

Step 6: Calculate the combined margin emission factor
The combined margin emissions factor is calculated as follows:

$$EFgrid, CM,y = EFgrid,OM,y \times wOM + EFgrid,BM,y \times wBM$$

$EF_{grid,BM,y}$	Build margin CO2 emission factor in year y (t CO2/MWh)
$EF_{grid,OM,y}$	Operating margin CO2 emission factor in year y (tCO2/MWh)
wOM	Weighting of operating margin emissions factor (%); and
wBM	Weighting of build margin emissions factor (%).

The default values of wOM (0.75) and wBM (0.25) have been used and based on the obtained data and the final calculations reviewed from Emission Factor calculation sheet, the calculated CM is 0.6703 tCO2 MWh.

3.4.7 Methodology Deviations

No deviation from methodology and tools was requested during the validation process.

3.4.8 Monitoring Plan

According to the applied methodology: ACM0002/3/, the only parameter to be monitored is the "Quantity of net electricity generation supplied by the project plant/unit to the grid in year y"

This parameter will be calculated as difference between

(a) The quantity of electricity supplied by the project plant/unit to the grid; and

(b) The quantity of electricity received by the project plant/unit from the grid.

These will be monitored using bi-directional energy meter (main and check meters) calibrated and cross-checked with power invoices as per monitoring reconciliation practices with JIRAMA.

Conclusion:

The monitoring methodology applies consistently the choice of the option selected for monitoring of baseline emissions. The monitoring plan provide procedures for the collection and archiving of all relevant data necessary for estimation or measuring the emission reductions within the project boundary during the crediting period.

According the signed ESPA, meters' testing, inspection, repairs, re-calibration or replacement will be ensured by the Parties according to best practices. But as per the manufacturer's specifications, meters are calibrated at the factory and do not require any further calibration during their entire service life. The CDM PD and VCS MR/1,2/ has been reviewed to check that the procedure for data uncertainty, emergency preparedness, roles and responsibility, operational and management structure are mentioned in the PD. The monitoring plan completely describes all measures to be implemented for monitoring all parameters required. The validation team confirms that:

1. The monitoring plan included in the CDM PD/2/ and VCS MR/1/ is based on the baseline methodology ACM0002 version 20.0/4/ which has been applied to the proposed VCS project activity

2. The monitoring arrangements described in the monitoring plan are feasible within the project design.

3.5 Non-Permanence Risk Analysis

No non-permanence risk has been identified.

4 VERIFICATION FINDINGS

4.1 Accuracy of GHG Emission Reduction and Removal Calculations

The project monitoring has been carried in accordance with the registered CDM PD/2/ and VCS MR sheet/1/. The assessment team has verified the information flow (from data generation, aggregation, to recording, calculation and reporting for these parameters including the values) in the MR/1,2/.
The emission reductions are based on the fuel savings by the project activity.

- The emission reduction calculation is accurate from the point of data collection, transfer and the formulas applied are in accordance with the applied methodology/4/ and registered PD/1,2/.
- The emission reduction calculations have been followed in accordance with the registered CDM PD/2/ and applied methodology/4/.
- The default values applied for calculations were consistent to the registered CDM PD and MR sheet/1,2/.

The data transfer from data generation sheets to final emission reduction calculation sheet/5/ has been transparently described and followed. The final values are reproducible, and all the calculation are linked and clearly presented in the emission reduction calculation sheet/5/.

The assessment team is in a position to conclude that the monitoring for the concerned period has been done in accordance with the procedures laid in the registered documents and the resulting emission reductions are measurable and conservative.

4.1.1. Parameter(s) available at the time of Validation

The table given below describe how the ex-ante parameter $EF_{grid,CM,y}$, which is to be measured according to the monitoring plan, has been verified to confirm that the actual monitoring complies with the monitoring plan, monitoring data has been thoroughly assessed and that the sampling requirement are met.

Ex-Ante Parameter	Assessment
$EF_{grid,CM,y}$ 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"	PP has applied a value of 0.6703 tCO_2/MWh as per Tool 7: "Tool to calculate the emission factor for an electricity system"/12/. The calculation related to the parameter has been described in detail under Section 3.4.6 of the report. The value is consistent with the Joint PD and MR sheet/1,2/ and the ER sheet/5/.
$EF_{grid,OM,y}$ Operating Margin CO2 emission factor for grid connected power generation in year y	PP has applied a value of 0.668 tCO_2/MWh as per Tool 7: "Tool to calculate the emission factor for an electricity system"/12/.

calculated using the latest version of the "Tool to calculate the emission factor for an electricity system"	The calculation related to the parameter has been described in detail under Section 3.4.6 of the report. The value is consistent with the Joint PD and MR sheet/1,2/ and the ER sheet/5/.
$EF_{grid,BM,y}$ Build Margin CO2 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"	PP has applied a value of 0.677 tCO_2/MWh as per Tool 7: "Tool to calculate the emission factor for an electricity system"/12/. The calculation related to the parameter has been described in detail under Section 3.4.6 of the report. The value is consistent with the Joint PD and MR sheet/1,2/ and the ER sheet/5/.
The percentage share of total installed capacity of the solar PV in the total installed grid connected power generation capacity in the host country.	PP has applied a value of 0.1% and the value can be accessed from: https://www.get-invest.eu/market-information/madagascar/energy-sector/
The total installed capacity of solar PV	PP has applied a value of 0.53 MW. The value has been sourced from Electricity Regulation Office statistics (ORE, 2016)/29/.

4.1.2. Monitored Parameter(s)

Parameter	$EG_{facility,y}$ Quantity of net electricity generation supplied by the project plant/unit to the grid in year y
Means of verification	

Criteria/Requirements	**Assessment/Observation**
Measuring /Reading /Recording frequency	The parameter is monitored continuously for the estimation of Voluntary Emission Reductions. The PP is required to monitor the parameter at least monthly. The parameter here is being monitored

		continuously through the Electricity meter(s) present at the project site.
	Is measuring and reporting frequency in accordance with the monitoring plan and monitoring methodology? (Yes / No)	Yes, measuring and reporting frequency is in accordance with monitoring plan /1,2/ and methodology/4/.
	Monitoring equipment	Electricity outputs are recorded by bidirectional electricity meters at the project site of make Landis+Gyr Dialog and type ZMD402CT and ZMD402CT/23,17/. The precision of the meters is 0.2s as checked from the meter specifications provided by the PP/17/.
	Is accuracy of the monitoring equipment as stated in the monitoring plan? If the monitoring plan does not specify the accuracy of the monitoring equipment, does the accuracy of the monitoring equipment comply with local/national standards, or as per the manufacturer's specification?	As per the monitoring plan/1,2/, the accuracy of the electricity meters is 0.2S. The same has been confirmed from the meter's manufacturer's specification/17/ and through the calibration certificates document provided by PP/24/.
	Is the accuracy valid for the entire measuring range or do different accuracy levels apply to different measuring ranges?	As per the monitoring plan/1,2/ and the manufacturer's specifications/17/, the accuracy of 0.2S is valid for the entire measuring range.
	Calibration frequency /interval:	The electricity meters are already calibrated at the time of manufacturing and as per the manufacturer's specifications/17/, the meters are not required to be calibrated thereafter.

		However, the assessment team has been able to conclude that the accuracies of the meters are within the standard. Through the initial meter receipt and testing document issued by JIRAMA/24/.
	Is the calibration interval in line with the monitoring plan and/or methodology? If the monitoring plan does not specify the frequency of calibration, is the selected frequency in accordance with the local/national standards, pending until the findings are closed or as per the manufacturer's specifications?	The electricity meters are already calibrated at the time of manufacturing and as per the manufacturer's specifications/17/, the meters are not required to be calibrated thereafter. However, the assessment team has been able to conclude that the accuracies of the meters are within the standard. Through the initial meter receipt and testing document issued by JIRAMA/24/.
	Is(are) calibration(s) valid for the whole reporting period?	Although no calibration of the meters is required to be done, an initial meter receipt and testing document issued by JIRAMA/24/ has been submitted by PP.
	How were the values in the monitoring report verified?	The final value calculated for $EG_{facility,y}$ are as follows: **Year** | **2018** | **2019** | **2020** | **Total** Value | 15,029 MWh | 31,958 MWh | 9,478 MWh | 56,3465 MWh The following monitored values were checked against the power invoices/21/ and the ER sheet provided by the PP to the verification team.
	Does the data management ensure correct transfer of data and reporting of emission reductions and are necessary	Yes, QA/QC procedures were found to be in place. Since the electricity meters are already calibrated at the time of manufacturing and as per the manufacturer's

	QA/QC processes in place?	specifications/17/, the meters are not required to be calibrated thereafter. However, the assessment team has been able to conclude that the accuracies of the meters are within the standard. Through the initial meter receipt and testing document issued by JIRAMA/24/. Monthly invoices/21/ issued provides the value of $EG_{Facility,y}$ that is used for emission reduction calculations.
	In case project participants have temporarily not monitored the parameter, has either i) a deviation been approved by the CDM EB or ii) has the parameter been estimated as stipulated by Appendix 1 to the CDM Project Standard?	No such issue
Findings	No findings were raised.	
Conclusion	The parameter has been monitored appropriately, in accordance with the registered monitoring plan (as per measurement methods and procedures to be applied) and applied methodology. The monitoring results were recorded consistently as per the approved frequency in the monitoring plan. The verification team is able to confirm that the project is implemented as per the registered PD and there is no discrepancy observed between the actual monitoring system and the monitoring plan set out in the project description and the applied methodology outlined in the registered VCS PD/1,2/. Monthly values of electricity generated inserted in the ER sheet was verified with the import and export invoices provided by the project proponent/21/. Since 100% data was verified, the team can ascertain that the values taken for emission reduction calculation are free from material errors.	

4.2 Quality of Evidence to Determine GHG Emission Reductions and Removals

The emission reductions calculations for this verification were verified against many evidences: Electricity generation invoices raised to JIRAMA- signed by both PP and JIRAMA representatives/21/, initial meter testing document/24/. The evidences checked were found to be

appropriate and reliable sources of information. The evidences used were approved by third parties and therefore, found to be non-biased and appropriate. The information was also cross checked through received documents and interviews conducted and observations made during the remote survey conducted by the verification team.
The data was found to be appropriately stored (achieved for at least two years) and easily retrievable if required.

Verification of meters: The electricity meters are already calibrated at the time of manufacturing and as per the manufacturer's specifications/17/, the meters are not required to be calibrated thereafter. However, the assessment team has been able to conclude that the accuracies of the meters are within the standard. Through the initial meter receipt and testing document issued by JIRAMA/24/.

The baseline emissions were calculated in line to the applied methodology ACM0002: Large-scale Consolidated Methodology: Grid-connected electricity generation from renewable sources, Version 20.0. Baseline emissions are calculated as the product of the quantity of net electricity generation that is produced and fed into the grid as a result of the implementation of the project activity in year y ($EG_{facility,y}$ = Exports – Imports, in MWh/yr) and the combined margin CO_2 emission factor for grid connected power generation in year y ($EF_{grid,CM,y}$):

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

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

Where:

BE_y	Baseline emissions in year y (t CO_2/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" (t CO_2/MWh)
$EG_{facility,y}$	Quantity of net electricity generation supplied by the project plant/unit to the grid in year y (MWh/yr)

Therefore,

BE_y = 56,465.8 * 0.6703

= 37,849 tCO2

The verification team confirms that appropriate methods and formulae for calculating baseline emissions have been followed. The assumptions, emission factors and default values that were applied in the calculations are justified.

All the data were made available and have been monitored as per required monitoring frequency. The means of verification for the values of parameters, used for baseline emission calculation, is described above in previous sections.

5 VALIDATION AND VERIFICATION CONCLUSION

Earthood Services Private Limited (Earthood), contracted by Green Yellow Madagascar., has performed the joint verification and validation of the emission reductions for the VCS project activity Ref number 2307 "**Ambatolampy 20 MW solar PV**" in Madagascar for the crediting period **10/07/2018 to 09/07/2025** and monitoring period **10/07/2018 to 30/04/2020** as reported in the Joint VCS PD and MR version 1.2 dated 15/07/2020. The company, Green Yellow (Madagascar) is responsible for the collection of data in accordance with the monitoring plan and the reporting of GHG emissions reductions from the project activity. It is our responsibility to express an independent validation and verification statement on the reported GHG emission reductions from the project activity.

Earthood commenced the validation and verification based on the baseline and monitoring methodology ACM0002 version 20.0, the monitoring plan contained in the Joint MR and PD Version 1.2 dated 15/07/2020 and VCS guidelines version 4.0, as per the process described under Section 2 of this report.

Earthood's validation and verification approach is based on the understanding of the risks associated with reporting of GHG emission data and the controls in place to mitigate these. Earthood planned and performed the validation and verification by obtaining evidence and other information and explanations that Earthood considered necessary to give reasonable assurance that reported GHG emission reductions are fairly stated.

In our opinion the GHG emissions reductions reported for the project activity for the period 10/07/2018 to 30/04/2020 are fairly stated in the Joint Project Description and Monitoring Report Version 1.2 dated 15/07/2020. The GHG emission reductions were calculated correctly based on the approved baseline and monitoring methodology ACM0002 version 20.0, and the VCS standard.

Verification period: From 10/07/2018 to 30/04/2020

Verified GHG emission reductions and removals in the above verification period:

Year	Baseline emissions or removals (tCO2e)	Project emissions or removals (tCO2e)	Leakage emissions (tCO2e)	Net GHG emission reductions or removals (tCO2e)
2018	10,073	-	-	10,073

2019	21,421	-	-	21,421
2020	6,353	-	-	6,353
Total	37,847	-	-	37,847

Approved by

Dr. Kaviraj Singh

Managing Director

Earthood Services Privated Limited

Date:01/10/2020

Place: Gurgaon, Haryana

APPENDIX I: <REFERENCES>

No.	Title	References
1.	VCS-Joint Project Description and Monitoring Report	Version 1.2 Dated: 15/07/2020
2.	CDM Registered PDD	Version 1.4 Dated: 05/07/2019
3.	https://registry.verra.org/app/projectDetail/VCS/2307	-
4.	Methodology: ACM0002: Large-scale Consolidated Methodology: Grid-connected electricity generation from renewable sources	Version 20.0
5.	Ex-ante and Ex-post ER Spreadsheet – final	Corresponding to final version of Joint PD and MR
6.	Grid Emission factor calculation sheet	Corresponding to final version of CDM PDD
7.	VCS Standard	Version 4.0
8.	VCS Validation and Verification Manual	Version 3.2

9.	Shareholders Agreement	-
10.	Land lease agreement	-
11.	Tool 09: Determining the baseline efficiency of thermal or electric energy generation systems	Version 2.0
12.	Tool 07: Tool to calculate the emission factor for an electricity system	Version 07.0
13.	General Plant Layout	-
14.	Commercial Operation Certificate	Dated: 10/07/2018
15.	Equipment receipts for the installed technology	Various
16.	GY JIRAMA ESPA	30/11/2016
17.	Manufacturer's and technical specification of the installed technology	Various
18.	Undertaking for non-participation in any other Environmental Credit Program except for CDM	04/09/2020
19.	ESIA Report	19/09/2016
20.	LSC Report	July'16
21.	Monthly power import/export invoices	Various
22.	Photographic evidences from the project site	-
23.	Photographic evidence for the installed technology	-
24.	Meter receipt and initial meter testing (JIRAMA)	10/07/2018
25.	EPC Invoice	-
26.	EIA License	-
27	PA 10481 https://cdm.unfccc.int/Projects/DB/RWTUV1556909746.23/view	-
27	Yield Simulation report	07/11/2017
28	https://www.latlong.net/c/?lat=-18.766947&long=46.869106	-
29	Electricity Regulation Office statistics (ORE, 2016) http://www.ore.mg/DonneesTechniques/SynoptiqueParcProduction.xlsm	
30	https://verra.org/covid-19-travel-guidance/	18/03/2020
31	Remote survey video recording	18/09/2020

32	International Travel Ban- India https://boi.gov.in/content/advisory-travel-and-visa-restrictions-related-covid-19-1#:~:text=1.,flights%20especially%20approved%20by%20DGCA.	24/05/2020

APPENDIX II: <ABBREVIATIONS>

Abbreviations	Full texts
BE	Baseline Emission
CA	Corrective Action / Clarification Action
CAR	Corrective Action Request
CDM	Clean Development Mechanism
CO_2	Carbon dioxide
CO_2e	Carbon dioxide equivalent
CL	Clarification Request
VVB	Validation and Verification Body
ER	Emission Reduction
ESPL	Earthood Services Private Limited
ERPA	Emission Reductions Purchase Agreement
FAR	Forward Action Request
GHG	Greenhouse gas(es)
MP	Monitoring Plan
MR	Monitoring Report
PA	Project Activity
PE	Project Emission
PP	Project Participant
QA/QC	Quality Assurance / Quality Control

UNFCCC	United Nations Framework Convention on Climate Change
VCS	Verified Carbon Standard
VCS-PD	VCS – Project Description
VCU	Verified Carbon Unit
XLS	Emission Reduction Calculation Spread Sheet
SLD	Single Line Diagram
JMR	Joint Meter Reading
PPA	Power Purchase Agreement
ESIA	Environment and Social Impact Assessment
ESMP	Environment and Social Management Plan

APPENDIX III: COMPETENCE OF TEAM MEMBERS AND TECHNICAL REVIEWERS

Competence Statement			
Name	Deepika Mahala		
Country	India		
Education	M. Sc. (Environmental Management), GGSIP University B.Sc. Hons. (Chemistry), Sri Venkateshwar College, DU		
Experience	3 Years +		
Field	Climate Change		
Approved Roles			
Team Leader	YES		
Validator	YES		
Verifier	YES		
Methodology Expert	ACM0002, AMS.I.D., AMS.I.A, AMS.III.AV, AMS.II.G		
Local expert	YES (India)		
Financial Expert	NO		
Technical Reviewer	YES		
TA Expert	YES (TA 1.2 & TA 3.1)		
Reviewed by	Shreya Garg	**Date**	14/09/2018

Approved by	Anshika Gupta	**Date**	14/09/2018

Competence Statement			
Name	Shreya Garg		
Country	India		
Education	M.Sc. (Climate Science & Policy), TERI University		
Experience	6 Years +		
Field	Climate Change		
Approved Roles			
Team Leader	YES		
Validator	YES		
Verifier	YES		
Methodology Expert	AMS.I.A., AMS.I.C., AMS.I.D., AMS.I.F., AMS.II.D., AMS.II.G., AMS.II.J., AMS.III.AV., ACM0002, ACM0012		
Local expert	YES (India)		
Financial Expert	NO		
Technical Reviewer	YES		
TA Expert	YES (TA 1.2, TA 3.1)		
Reviewed by	Abhishek Mahawar	**Date**	01/03/2018
Approved by	Ashok Gautam	**Date**	01/03/2018

Competence Statement			
Name	Rahi Sahni		
Education	M.Sc Environment Science and Technology, Bharati Vidyapeeth University, Pune		
Experience	6 months		
Field	Climate Change and Environment		
Approved Roles			
Team Leader	NO		
Validator	Yes		
Verifier	Yes		
Methodology Expert	NO		
Local expert	NO		
Financial Expert	NO		
Technical Reviewer	NO		
TA Expert	NO		
Reviewed by	Shreya Garg	**Date**	09/04/2020
Approved by	Anshika Gupta	**Date**	09/04/2020

APPENDIX IV: FINDINGS

Table 1. CL from this verification

CL ID	01	**Section no.**	4.2	**Date :** 01/07/2020
Description of CL				
1. The annual estimated ERs in the registered CDM PDD version 1.4 is 23,244 tCO2. However, annual estimated ERs in the VCS Joint PD and MR provided is 23,431 tCO2. PP shall justify the difference in the two values since all the parameters and assumptions related to registration are the same for both CDM and VCS. 2. Section 1.8 of the Joint PD and MR states "12-July-2018, as the date of commissioning, synchronization and start of GHG emission reductions". However, the commissioning certificate submitted has been dated as 21/06/2018				
Project participant response				**Date :** 17/07/2020
1. only difference is that registered CDM PDD included ERs from the expected CDM registration date (from may 19) while VCS ex-ante calculations relied on the actual COD (from 12-July-2018) 2. Mistake, 12/07 was the date of signature of JIRAMA meters receipt letter but the same document indeed feature 10/07 as the actual install date when production started and was first accounted - as confirmed by JIRAMA cf. JIRAMA meters install 2018071				
Documentation provided by project participant				
Revised MR/PD				
DOE assessment				**Date:** 05/09/2020
1. The assessment team has confirmed from the project webpage that the expected start date for CDM is 03/05/2019 and the start date for VCS registration is the actual installation date i.e., 10/07/2018. The difference in the ERs between CDM and VCS is because of the slight difference in the start date of both the programs. The finding is thus closed. 2. PP has now revised the start date to 10/07/2018 which is the actual installation date as confirmed from the document JIRAMA cf. JIRAMA meters install 2018071. The finding is now closed.				

CL ID	02	**Section no.**	3.2	**Date :** 02/07/2020
Description of CL				
1. Appendix 2 of VCS standard version 4.0. states: "Projects registered under an approved GHG program shall only be eligible to complete a gap validation and/or transfer to the VCS Program where the project has applied for registration with the VCS Program on or before 9 March 2020, unless evidence of contracting for a VCS gap validation prior to 9 March 2020 is provided". PP shall clarify how this condition has been met. 2. The start date of the project as mentioned in the VCS Joint PD and MR is 12/07/2018. However, para 3.7.1 of the VCS standard states "Non-AFOLU projects shall complete validation within two years of the project start date. Additional time is granted for non-AFOLU projects to complete validation where they are applying a new VCS methodology". PP shall clarify how this condition has been met.				
Project participant response				**Date :** 17/07/2020

1. This is only for "project activities that were eligible under *VCS Version 3*, but are now excluded from the scope of the VCS Program (Section 2.1)" yet Madagascar = LDC therefore not concerned 2. not relevant because of prior CDM registration and gap/transition to VCS only - see https://registry.verra.org/app/projectDetail/VCS/1319 : validated for VCS in 2014, while started operation in 2008 (and registered to CDM in 2010: https://cdm.unfccc.int/Projects/DB/TUEV-SUED1269612670.69/view)
Documentation provided by project participant
-

DOE assessment	**Date:** 05/09/2020
1. Appendix 2 of Validation and Verification Requirements Version 4 states "Projects registered under an approved GHG program shall only be eligible to complete a gap validation and/or transfer to the VCS Program where the project has applied for registration with the VCS Program approved GHG program on or before 9 March 2020 31 December 2019, unless evidence of contracting for a VCS gap validation prior to 9 March 2020 is provided. It has now been confirmed that ESPL was contracted for the registration of the project activity on 02/03/2020. Therefore, the registration of the program to VCS is valid. 2. It has now been confirmed from the CDM project webpage that the project was indeed registered on 03/05/2019 and the project is now being considered for gap validation under VCS. A similar project which was validated for VCS in 2014 but started operations in 2008 was considered by Verra too. Please see: https://registry.verra.org/app/projectDetail/VCS/1319 Therefore, the justification provided by the PP is found acceptable and the finding is therefore closed. CL#02 is now closed.	

Table 2. CAR from this verification

CAR ID	03	**Section no.**	4.2	**Date :** 01/07/2020
Description of CAR				
The calculation for ""EGPJ,y (MWh)" has been done incorrectly in ER sheet "ex-ante ER" cell: C29. Please see the commented ER sheet.				
Project participant response				**Date :** 17/07/2020
ER sheet corrected				
Documentation provided by project participant				
Revised ER sheet				
DOE assessment				**Date:** 05/09/2020
PP has now provided the revised ER sheet wherein the calculation has been done appropriately. The finding is now closed.				

Table 3. FAR from this verification

FAR ID		**Section No.**		**Date :** DD/MM/YYYY
Description of FAR				
XX				
Project participant response				**Date :** DD/MM/YYYY
XX				
Documentation provided by project participant				
XX				
DOE assessment				**Date:** DD/MM/YYYY
XX				