



**Verified Carbon
Standard**

15 MW NAM HINBOUN DOWNSTREAM HYDROPOWER PROJECT



Document Prepared by 4K Earth Science Private Limited

Project Title	15 MW Nam Hinboun Downstream Hydropower Project
Report Title	15 MW Nam Hinboun Downstream Hydropower Project
Version	2.0
Report ID	3662-VCS
Verification Period	01-February-2021 to 31-July-2022
Client	Rasita Power Co. Ltd.
Pages	70
Date of Issue	28-March-2023
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Summary:

'Kosher Climate India Private Limited' has commissioned "4K Earth Science Private Limited" to carry out the Joint Validation and Verification of the project "15 MW Nam Hinboun Downstream Hydropower Project", with regard to the relevant requirements of VCS Standard Version 4.3. The monitoring period verified is from 01/02/2021 to 31/07/2022 (including both the days).

The project activity is developed by Rasita Power Co., Ltd. which involves the installation and operation of a 15 MW hydro power plant in the Songhong village, Hinboun District, Khammouane province, Lao PDR. The project activity consists of two bulb turbines with the unit capacity of 7.5MW each.

This is a Green-field project activity. The electricity generated by the project activity will be delivered to the grid, under a long-term power purchase agreement (PPA) /22/ signed between Rasita Power Co., Ltd. and Electricite Du Laos.

The technical details of the project is verified from the technical specifications /17/, signed PPA /22/, photos /21/ and during on-site audit and found consistent.

In the absence of the project activity, electricity would have been generated by the operation of grid connected power plants, which are predominantly fossil fuel based. Therefore, "15 MW Nam Hinboun Downstream Hydropower Project" #3662 displaces carbon dioxide that would have been produced in the absence of the project activity by the grid connected power plants.

It has been estimated that approximately 79,740 MWh of electricity will be generated annually by the project, displacing approximately 44,192 tonnes of carbon dioxide (tCO₂) per annum and over 309,343 tCO₂ over the 7-years crediting period.

Validation and Verification is a requirement for all VCS projects and is seen as necessary to provide assurance to stakeholders of the quality of the project and its intended generation of estimated verified emission reductions (VERs).

A risk-based approach has been followed to perform this joint validation and verification. In the course of the joint validation and verification, 13 Corrective Action Requests (CAR) and 07 Clarification Requests (CL) were raised and successfully closed out. 00 Forward action request (FARs) was raised.

The joint validation and verification is based on the Joint PD & MR, additional documents related to baseline and monitoring methodology, ER calculation sheet, the subsequent background investigation, follow-up interviews and supporting documents made available to the validation and verification team by project proponent.

The objective of this validation activity is to have an independent third party for the assessment of the project design, estimated ER sheet and to ensure a thorough assessment of the proposed project activity against the applicable CDM and VCS requirements. As a result of the validation, the validation team confirms that:

- The project fulfils criteria of VCS Standard Version 4.3.
- The project is in line with all relevant VCS requirements.
- The project additionality is sufficiently justified in the Joint PD & MR.

- The monitoring plan is transparent, adequate and in line with applied baseline and monitoring methodology AMS I.D version 18.0.
- The calculation of the Baseline emission reductions is carried out in a transparent and conservative manner, so that the calculated emission reductions of 309,343 tCO₂e is most likely to be achieved within the 7 years of crediting period.
- The projects compliance with the requirements of Article 12 of the Kyoto Protocol, the CDM Modalities and Procedures as agreed in the Marrakech Accords under decision 3/CMP.1, the annexes to this decision, subsequent decisions and guidance made by COP/MOP & CDM Executive Board and other relevant rules, including the Host Country legislation and sustainability criteria.

No restrictions or uncertainties were identified related to the joint validation and verification.

The management of the 'Rasita Power Co. Ltd.' responsible for the preparation of the GHG emissions data and the reported GHG emissions reductions on the basis set out within the project final JOINT PROJECT DESCRIPTION & MONITORING REPORT Version 04 dated 20/03/2023. The calculation and determination of GHG emission reductions from the project is the responsibility of the management of 'Kosher Climate India Private Limited'. The development and maintenance of records and reporting procedures are in accordance with the JOINT PROJECT DESCRIPTION & MONITORING REPORT Version 04 dated 20/03/2023.

It is our responsibility to express an independent GHG verification opinion on the GHG emissions and on the calculation of GHG emission reductions from the project for the period 01/02/2021 to 31/01/2022 based on the reported emission reductions in the final JOINT PROJECT DESCRIPTION & MONITORING REPORT Version 04 dated 20/03/2023 for the same period.

Further during this monitoring period (01-February-2021 to 31-July-2022), the project has produced a net total of 103,365 MWh electricity and a total amount of 57,284 tCO₂ of emission reduction. The monitoring period subject to this monitoring report is inclusive of first and last day of period.

Based on an understanding of the risks associated with reporting GHG emissions data and the controls in place to mitigate these, 4KES planned and performed our work to obtain the information and explanations that we considered necessary to provide sufficient evidence for us to give reasonable assurance that this reported amount of GHG emission reductions for the period is fairly stated.

4KES confirms the following;

Reporting period: 01/02/2021 to 31/07/2022

Year	Baseline emissions or removals (tCO ₂ e)	Project emissions or removals (tCO ₂ e)	Leakage emissions (tCO ₂ e)	Net GHG emission reductions or removals (tCO ₂ e)
2021 (01/02/2021	34,143	0	0	34,143

to 31/12/2021)				
2022 (01/01/2022 to 31/07/2022)	23,141	0	0	23,141
Total	57,284	0	0	57,284

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1 INTRODUCTION

1.1 Objective

4KES has been contracted by 'Kosher Climate India Private Limited' to undertake the Joint validation and verification of the project titled "15 MW Nam Hinboun Downstream Hydropower Project" (VCS ID 3662). The monitoring period verified is from 01/02/2021 to 31/07/2022 (including both the days).

The purpose of this joint validation and verification is to have an independent third-party assessment of whether the project activity conforms to the qualification criteria set out in the VCS standard Version 4.3 /09/ to attain real, measurable, additional and permanent emission reductions.

The validation statement/opinion is a written assurance that:

- The project complies with all the applicable VCS requirements and has the ability to generate the emission reductions stated over the project's crediting period.
- The validation followed the requirements of the current version of the VCS Standard Version 4.3 /09/ and VCS program guide 4.2 /08/ to ensure the quality and consistency of the validation work and the report.

The objectives of the verification exercise are, by review of objective evidence, to establish that:

- The project activity has been implemented and operated as per the Joint Project Description and Monitoring Report (JPD & MR) and that all physical features (technology, project equipment, and monitoring and metering equipment) of the project are in place;
- Monitoring report and other supporting documents are complete;
- The data is recorded and stored as per the monitoring methodology and approved monitoring plan.
- To confirm that the monitoring system is implemented and fully functional to generate Voluntary Emission Reductions (VERs/VCUs) without any double counting, and
- To establish that the data reported are accurate, complete, consistent, transparent and free of material error or omission by checking the monitoring records and the emissions reduction calculation.

1.2 Scope and Criteria

The validation scope is given as an independent and objective review of the project design and monitoring plan which is included in the Joint PD & MR and other relevant supporting documents.

The scope of work covered in the validation is described below:

- To validate whether the project activity meets the requirements of VCS Standard Version 4.3 /09/ and VCS program guide 4.2/08/ including additionality and compliance with local laws.
- To evaluate whether the baseline and monitoring plan are in conformance with the applied methodology from the VCS approved GHG program.
- To confirm that the information presented are completed, consistent, transparent and free of omission or material error.
- Background investigation and follow up interviews.

The information in the Joint PD & MR is reviewed against the criteria of VCS Standard 4.3 /09/, VCS program guide 4.2 /08/ and the approved baseline and monitoring CDM methodology AMS I.D. version 18.0.

4KES has performed validation based on a risk-based approach focusing mainly on the significant risks to meet the qualification criteria and the ability to generate Verified Carbon Units (VCUs).

The scope of verification is to assess the claims and assumptions made in the Joint PD & MR against the VCS criteria, including but not limited to, VCS standard, applied methodology and other relevant rules and requirements established for VCS project activities.

The validation and verification are not meant to provide any consulting towards the client. However, stated request for clarifications and/or corrective actions may provide input for improvement of the project design.

1.3 Reasonableness of Assumptions and Level of Assurance

The Joint validation & verification report is based on Joint PD & MR /02/, Monitoring plan, supporting documents made available to the validator and information collected through performing interviews during the on-site audit. Based on the process and procedures conducted, 4KES states with a reasonable level of assurance that information in the Joint PD & MR:

- is materially correct and is a fair representation of the actual project details, and
- is prepared in accordance with VCS requirements and the applied CDM methodology for information pertaining to additionality, GHG qualification, monitoring and reporting

The validation & verification work is carried out as per this requirement and the validation & verification opinion is assured provided the credibility of all above. Details are presented in the Validation & Verification statement in section 4 below.

The verification team verified the complete monitoring data /20/ and /21/ for the monitoring parameter of the monitoring plan against the Joint PD & MR /02/, ER Calculation sheet /04/ and IRR Sheet /05/ and confirms that the reported emission reductions are free from any type of material errors. On-site audit was also conducted to verify the implementation and monitoring plan of the project activity. The implementation of the project activity (i.e., major equipment and the metering arrangement) was verified during the interview and found in accordance with the Joint PD & MR /02/. Verification team has also verified the technical details of the project equipment and metering arrangement with the supportive documents and found correct. Therefore, 4KES confirms that the validation & verification is conducted with reasonable level of assurance.

1.4 Summary Description of the Project

The project activity is a run-of-river hydro project which involves the installation and operation of a 15 MW hydro power plant, developed by Rasita Power Co., Ltd. in Songhong village, Hinboun District, Khammouane province, Lao PDR. The project activity consists of two bulb turbines with the unit capacity of 7.5MW each.

The project was commissioned on 01/02/2021 and the same has been verified with the commissioning certificate and found consistent. The technical details of the project are verified from technical specification document /17/, signed PPA /22/, photos /21/ and during on-site audit and found consistent.

The project is designed to generate electricity and the generated electricity is supplied to the grid, under a long-term power purchase agreement/26/ between Electricite Du Laos and Rasita Power Company Limited.

In the absence of the project activity, electricity would have been generated by the operation of grid connected power plants, which are predominantly fossil fuel based. Therefore, '15 MW Nam Hinboun Downstream Hydropower Project' #3662 displaces carbon dioxide that would have been produced in the absence of the project activity by the grid connected power plants.

It has been estimated that approximately 79,740 MWh of electricity will be generated annually by the project, displacing approximately 44,192 tonnes of carbon dioxide (tCO₂) per annum and over 309,343 tCO₂ over the 7-years crediting period.

The important timeline of the project has been given below:

15 December 2015	PPA signature
24 August 2016	Approval from Ministry of Mine and Energy
27 August 2017	Public Stakeholders Meeting
01 February 2021	Commissioning date

The project participants involved in the project are as per below tables.

Project participant:

Organization name	Rasita Power Co. Ltd.
Contact person	Mr. Outdone Somphone
Title	General Manager
Address	Songhong Village, Hinboun District, Khammouane Province, Lao PDR
Telephone	+856 20 55511731
Email	rasita@live.cn

Other Entities Involved in the Project:

Organization name	Kosher Climate India Private Limited
Role in the project	Project Representative
Contact person	Vamsi Krishna M
Title	Director
Address	Zee Plaza, No.1678, 27th Main Rd, Near KLM Mall, Sector 2, HSR Layout, Bengaluru, Karnataka 560102, India
Telephone	+91 99453 43475
Email	vamsi@kosherclimate.com narendra@kosherclimate.com

2 VALIDATION AND VERIFICATION PROCESS

2.1 Method and Criteria

The validation and verification process involves the following:

- The desk review of documents and evidences submitted by the project proponent in context of the reference VCS rules and guidelines,
- Undertaking on-site audit, interview or interactions with the representative of the project proponent,
- Reporting audit findings with respect to clarifications and non-conformities and the closure of the findings, as appropriate and
- Preparing a draft validation and verification report
- Resolution of outstanding issues and the issuance of final validation and verification report and opinion
- The prepared validation & verification report and other supporting documents then undergo an internal quality control before being submitted to the Verra Secretariat for registration & issuance of credits as per VCS standard version 4

In order to ensure transparency, a validation & verification protocol was prepared for the project according to the VVS for PAs version 03.0 validation & verification requirements and VCS Standard version 4.3 /09/. The Clarification Requests (CL) were issued where additional information was needed to clarify issues, and Forward Action Requests (FAR) for issues relating to project implementation that required review during the next verification of the project activity.

4KES assessed and determined whether the proposed implementation and operation of the project activity, and the steps taken to report emission reductions comply with the criteria and relevant guidance provided by the VCS Board.

Duration of Validation:

Validation & Verification Contract	14/11/2022
Remote audit	22/12/2022
On-site audit	26/12/2022
Draft Validation and Verification Report	02/01/2023
Final Validation and Verification Report	28/03/2023

2.2 Document Review

The validation & verification has been conducted using the VCS Standard and the applied methodology AMS I.D. version 18.0 as the reference criteria. The validation team had done the completeness check of Joint PD & MR submitted by the PP as per the VCS standard Version 4.3 /09/ requirements. Furthermore, a desk review was also carried out to assess the following:

- Information of project details in compliance with VCS PD template
- Appropriateness of methodology AMS I.D. version 18.0 applied to the project activity
- Compliance with relevant laws and regulations
- Correctness of application of baseline and monitoring methodology
- Demonstration of additionality
- Monitoring plan described in the VCS PD
- Stakeholder consultation
- Proof of listing of project under pipeline
- Calculation of grid emission factor, etc. where applicable.

The Joint PD & MR version 02 dated 10/10/2022 /01/ was initially reviewed and the PP was requested to submit the revised documents along with the supporting information and documents. The revised documents and additional supporting documents were further assessed by the validation & verification team during desk review. During the validation and verification process, the revised Joint PD & MR (version 04, dated 20/03/2023) /02/ and the supporting documents were assessed to confirm the actions taken by the PP to the CARs and CLs issued.

The validation team has reviewed the final version of the Joint PD & MR (i.e., Version 04 dated 20/03/2023) to confirm that all changes agreed have been incorporated adequately.

Further, prior to the on-site audit, it was verified by the validation team that the project was listed in the VCS pipeline in line with the requirements (Section 3, Registration and Issuance process, version 4.1 /10/) Ref: <https://registry.verra.org/app/projectDetail/VCS/3662>

The documents that were considered during the validation and verification process are given in Appendix of this report.

The assessment is performed by a verification team using a protocol. The cross checks between information provided in the Joint PD & MR and information from sources other than those used, if available, the team's sectoral or local expertise and, if necessary, independent background investigations.

2.3 Interviews

As a part of joint validation & verification, the on-site assessment was performed by assessment team on 26th December 2022. During site visit, the verification team interviewed representative of PP and O&M team who is responsible for monitoring of the project activity. Kindly find below names of the persons interviewed:

No.	Interview			Date	Subject	Team member
	Last name	First name	Affiliation			
1.	Oudone	Somphone	Managing Director, Rasita	26/12/2022	- Project Implementation status - Project Boundary - Methodology Eligibility criteria - Host country Requirements - Monitoring Plan - Project activity start date and Crediting period - Roles and responsibilities of the project owner - Local Stake holder consultation - Baseline assumptions - Additionality - Training to the Monitoring personnel	M.P. Kanal Phoutkham Singphachon
2	Bountai	Pakaiysit	Plant Manager, Rasita	26/12/2022		
3	Vilaisack	Kor	Assistant plant manager, Rasita	26/12/2022		
4	Neephanit	Daosy	Chief Engineer, Rasita	26/12/2022		
5	V	Anil Kumar	Kosher Climate	26/12/2022	- PD filling - Editorial in PD - Additionality - ER calculation - Actual ER calculation	M.P. Kanal Phoutkham Singphachon
6	K	Vidya	Kosher Climate	26/12/2022		

2.4 Site Visits

As a part of joint validation & verification, the on-site assessment was performed by assessment team on 26th December 2022. No sampling procedures were adopted in document verification and all the document were cross checked to ensure conservative estimation of emission reduction. The details of the site visit are given below

Duration of on-site inspection: 26/12/2022				
No	Activity performed on-site	Site location	Date	Team member
1.	Opening Meeting	Songhong and Samakhixai Villages, Hinboun District, Khammouane in Lao PDR.	26/12/2022	M.P. Kanal Phoutkham Singphachon
2	Visit to hydro power plant			
3	Document Review & Closing Meeting			

2.5 Resolution of Findings

As an outcome of the validation and verification process, the team can raise different types of findings:

A Clarification Request (CL) is raised if information is insufficient or not clear enough to determine whether the applicable VCS requirements have been met

Where a non-conformance arises the team leader shall raise a Corrective Action Request (CAR). A CAR is issued, where:

- The project participants have made mistakes that will influence the ability of the project activity to achieve real, measurable additional emission reductions;
- The VCS requirements have not been met;
- There is a risk that emission reductions cannot be monitored or calculated.
- The validation and verification process may be halted until this information has been made available to the team leader's satisfaction. Failure to address a CL may result in a CAR. Information or clarifications provided as a result of a CL may also lead to a CAR.

During the validation and verification process, total 13 CAR and 07 CL were raised and resolved satisfactorily. The list of CARs/CLs/FARs raised and the response provided, the mean of validation and verification, reasons for their closure and references to correction in the relevant documents are provided in Appendix of this report.

2.5.1 Forward Action Requests

No FAR is raised during the validation & verification.

3 VALIDATION FINDINGS

3.1 Project Details

The project activity is a run-of-river hydro project which involves the installation and operation of a 15 MW hydro power plant, developed by Rasita Power Co., Ltd. in Songhong village, Hinboun District, Khammouane province, Lao PDR. The project activity consists of two bulb turbines with the unit capacity of 7.5MW each.

The project was commissioned on 01/02/2021 and the same has been verified with the commissioning certificate and found consistent. The technical details of the project are verified from technical specification document /17/, signed PPA /22/, photos /21/ and during on-site audit and found consistent.

The project is designed to generate electricity and the generated electricity is supplied to the grid, under a long-term power purchase agreement/26/ between Electricite Du Laos and Rasita Power Company Limited.

In the absence of the project activity, electricity would have been generated by the operation of grid connected power plants, which are predominantly fossil fuel based. Therefore, '15 MW Nam Hinboun Downstream Hydropower Project' #3662 displaces carbon dioxide that would have been produced in the absence of the project activity by the grid connected power plants.

It has been estimated that approximately 79,740 MWh of electricity will be generated annually by the project, displacing approximately 44,192 tonnes of carbon dioxide (tCO₂) per annum and over 309,343 tCO₂ over the 7-years crediting period.

15 December 2015	PPA signature
24 August 2016	Approval from Ministry of Mine and Energy
27 August 2017	Public Stakeholders Meeting
01 February 2021	Commissioning date

Project comes under Sectoral scopes: Energy industries (renewable - / non-renewable sources) (Sectoral Scope 1). VVB has this sectoral scope to validate this project.

As the project is a Grid-connected electricity generation using hydro power plant and located in Lao People's Democratic Republic which is a Least Developed Country (as designated by United nations <https://unfccc.int/topics/resilience/workstreams/national-adaptation-programmes-of-action/ldc-country-information>), it is eligible under the VCS in accordance with table 1 of the VCS Standard, v4.3 /09/.

Project is not a group project activity as confirmed from section 1.4 of the VCS Joint Project Description and Monitoring Report /02/ and during the on-site interview.

Validation team has done the on-site audit on 26/12/2022 to confirm the project description mentioned in the VCS- Joint Project Description and Monitoring Report /02/.

The project neither has been rejected nor included in an ETs or other compliance or voluntary mechanism. This is confirmed from the declaration/25/ provided by the project participant.

The project participants involved in the project are as per below tables.

Project participant:

Organization name	Rasita Power Co. Ltd.
Contact person	Mr. Outdone Somphone
Title	General Manager
Address	Songhong Village, Hinboun District, Khammouane Province, Lao PDR
Telephone	+856 20 55511731
Email	rasita@live.cn

Other Entities Involved in the Project:

Organization name	Kosher Climate India Private Limited
Role in the project	Project Representative
Contact person	Vamsi Krishna M
Title	Director
Address	Zee Plaza, No.1678, 27th Main Rd, Near KLM Mall, Sector 2, HSR Layout, Bengaluru, Karnataka 560102, India
Telephone	+91 99453 43475
Email	vamsi@kosherclimate.com narendra@kosherclimate.com

Rasita Power Co. Ltd. has gained project ownership through a power purchase agreement /22/ with Electricite Du Laos.

The start date of the project is 01-February-2021 (the date of commissioning of the project activity). Validation team has checked the commissioning certificate /16/ to confirm and found the start date in compliance with section 3.7 of the VCS standard Version 4.3 /09/. Also, as per

section 3.7.1 of the VCS standard version 4.3 /09/, projects shall complete validation within two years of the project start date which is also fulfilled.

The first crediting period of project activity starts from 01-February-2021 until 31-January-2028 (7 years renewable crediting period) in accordance with section 3.8.1 of the VCS Standard Version 4.3 /09/.

Project come under the scale “Project” as the estimated GHG emissions reductions per years are less than 300,000 tonnes of CO₂e per year in accordance with section 3.9.1 of the VCS Standard Version 4.3 /09/.

The project is located in the Hinboun District, Khammouane province, Lao PDR. The details of the same has been provided in the below table:

Project Location	Latitude	Longitude
Songhong and Samakhixai Villages, Hinboun District, Khammouane, Lao PDR	17° 43'38" N	104° 34'19" E

The project activity is in compliance with the Local Laws and regulations as given below:

Laws & Regulation	Project Compliance
Law on Electricity (amended version) No. 03/NA, dated 20/12/2011;	Approval received from Ministry of Mine and Energy/19/ is verified and confirmed that the project compliance with these Laws & Regulation. The PPA with Electricite du Laos, a state-owned enterprise/22/ is verified which confirms the approval for electricity connection with the grid.
Decree on Sustainable Hydropower Development of the Lao PDR No. 03/GoL., dated 12/01/2015;	
Law on Environmental Protection (EPL), No. 02-99/NA, dated 3/4/99;	The Environmental clearance from Water Resources and Environment Agency (WREA) and IEE report/27/ is verified and confirmed that the project compliance with these laws & regulation.
National Policy on Environmental and Social Sustainability of the Hydropower Sector in Lao PDR	

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The project neither has nor intended to generate any other form of GHG related environmental credit for the GHG emission reduction or removal claimed under the VCS programme.

Declaration /25/ for double counting has been checked and found OK.

No commercially sensitive information has been excluded from the public version of the project description as verified during the on-site audit. Validation team confirms that the description in

the project description is accurate, complete, and provides an understanding of the nature of the project and the project has been implemented as described in the project description.

Sustainable development contributions from the project activity have been mentioned under section 1.17 of the VCS Joint PD & MR/02/ and found OK. It is further verified from the supportive document and interview with stakeholder. Project contribute positively in the sustainable development of the area.

3.2 Participation under Other GHG Programs

The project is not registered under any other GHG programs. The project is seeking registration only in VCS program.

3.3 Safeguards

3.3.1 No Net Harm

Being a renewable project activity, there is no negative impacts from the project activity. Hydro energy systems do not produce air pollution or greenhouse gases. In general, using hydro energy has a positive, indirect effect on the environment when hydro energy replaces or reduces the use of other energy sources that have larger effects on the environment, i.e., there is not net harm.

The project is a run of river project, there is no considerable change in the water storage area and hence no negative impact due to the project. The same is confirmed from site visit and interview with the project proponent. The same is reconfirmed from the satellite maps of before and after the project implementation. PP has clarified that there is no potential environment or socio-economic impacts is expected from the project as explained under section 2.1 of the VCS Joint PD & MR /02/ which is found OK. The Project activity meets all local laws and regulation of Laos PDR.

Further socio-economic impacts are rather indirect but positively related to the project activity. There are no negative socio-economic impacts from the project which is also discussed during the stakeholder interview.

Validation team has interviewed the local stakeholder and confirmed that project has positive impact on the environment and proper compensation was given to people.

3.3.2 Local Stakeholder Consultation

Local Stakeholders Consultation took place on 12 July 2017 at Khamkeo village, meeting room, Hinboun district, Kanmouane province, Lao PDR.

The technique used was interview surveys which ensured an in-depth and detailed exploration of the questions asked.

The local stakeholder meeting was conducted prior to the start of validation activities with VVB.

The comments by local stakeholders are invited in an open and transparent manner. A summary of the comments received has provided to the validation team along with the report indicating how due account was taken to the comments received. The same has been detailed in 'Table 3: Stakeholder Comments' under section 2.2 of Joint PD & MR/02/.

The local stakeholder consultation process is mentioned in detail under section 2.2 of the Joint PD & MR /02/ which is checked by the validation team and found OK.

Validation team has checked the supportive document /28/ to confirm the stakeholder consultation and confirm that people were supportive to the project activity and expressed no potential negative comments on the project activity. As part of the validation, 4KES confirmed through document review that the stakeholders were invited in a transparent manner.

Since the comments of the stakeholders did not question any detail of the design of the project activity, no updates have been made with regard to the design of the project.

Further Validation team has checked the on-going communication with local stakeholders. PP has provided communication channels (grievance register, phone number & email ID) for any reporting any grievances which is found to be adequate.

Further the stakeholders available to the validation team for interview confirmed that there were no adverse comments about the project and this project will lead to employment generation and better environmental conditions.

4KES team considers the local stakeholder consultation carried out adequately and can confirm that the process is credible.

3.3.3 Environmental Impact

The project activity has no significant impact on the environment.

3.3.4 Public Comments

In accordance with the requirement in clause 3.17.6 of the VCS standard version 4.3 "All VCS projects are subject to a 30-day public comment period. The date on which the project is listed on the project pipeline marks the beginning of the project's 30-day public comment period".

The PP listed their project activity in the VCS pipeline for 30 days from 24/11/2022 to 24/12/20221 (<https://registry.verra.org/app/projectDetail/VCS/3662>) for public comments.

No comments received during the commenting period, as evident from the VCS pipeline in the web interface.

3.3.5 AFOLU-Specific Safeguards

Not Applicable.

3.4 Application of Methodology

3.4.1 Title and Reference

The validation and verification team confirm that selected baseline and monitoring methodology is approved methodology and PP has correctly used it. All the applied methodology and tools are still valid.

- AMS I.D version 18.0 - “Grid-connected renewable electricity generation”

Other guidelines and tools referenced in this methodology are:

TOOL07: “Tool to calculate the emission factor for an electricity system”, version 7.0

TOOL21: “Demonstration of additionality of small-scale project activities”, version 13.1

TOOL27: “Investment analysis”, version 12

3.4.2 Applicability

Applicable criteria for the selected baseline methodology AMS I.D version 18.0 is assessed by the validation and verification team by means of document review & on-site audit. The project applicability was confirmed against each condition in the approved methodology by the following methods.

- AMS I.D. version 18.0 - “Grid-connected renewable electricity generation”

AMS I.D. version 18.0 applicability conditions	Project activity applicability	Validation Remarks
This methodology is applicable to project activities that: a) Install a Greenfield plant; b) Involve a capacity addition in (an) existing plant(s); c) Involve a retrofit of (an) existing operating plant(s)/unit(s); d) Involve a rehabilitation of (an) existing plant(s)/unit(s); or e) Involve a replacement of (an) existing plant(s)/unit(s).	The project activity is a greenfield hydro power plant substituting electricity produced on the grid. Hence, this is applicable.	The project activity consists in the installation of a new grid connected renewable power plants at a site where no renewable power plant was operated prior to the implementation of the project activity (Greenfield power plant). Hence point (a) is applicable. Commissioning certificate /16/, Monthly electricity invoices /20/, Photos/ video of site /21/, Signed PPA /22/ etc. have been checked to confirm the same.

		Project is supplying electricity to Electricite Du Laos. PPA /22/ has already signed between PP and Electricite Du Laos which has been verified by the validation team. Hence the project is in compliance with latest version of the methodology AMS I.D Version 18.0.
Hydro power plants with reservoirs that satisfy at least one of the following conditions are eligible to apply this methodology: a) The project activity is implemented in an existing reservoir, with no change in the volume of reservoir; b) The project activity is implemented in an existing reservoir, where the volume of reservoir is increased and the power density of the project activity, as per definitions given in the project emissions section, is greater than 4 W/m²; c) The project activity results in new reservoirs and the power density of the power plant, as per definitions given in the project emissions section, is greater than 4 W/m².	As the project activity is a run-off river type hydro power plant, this criterion is not relevant for the project activity.	The project activity is the 15MW run-off river type hydro power plant. Therefore, this criterion is not applicable. Hence the project is in compliance with latest version of the methodology AMS I.D. Version 18.0.

If the new unit has both renewable and non-renewable components (e.g. a wind/diesel unit), the eligibility limit of 15 MW for a small-scale CDM project activity applies only to the renewable component. If the new unit co-fires fossil fuel, the capacity of the entire unit shall not exceed the limit of 15 MW.	The proposed project activity doesn't have provision for co-firing fossil fuel. Hence this is not applicable.	It is a renewable energy project with no provision for co-firing fossil-fuel. The project activity is the installation of a new hydro power plant. Hence this para is not applicable. Hence the project is in compliance with latest version of the methodology AMS I.D. Version 18.0.
Combined heat and power (co-generation) systems are not eligible under this category.	The project activity does not involve with co-generation. Hence it is not applicable.	The project activity is the installation of a new hydro power plant and doesn't involve any co-generation. Hence this para is not applicable. Hence the project is in compliance with latest version of the methodology AMS I.D. Version 18.0.
In the case of project activities that involve the capacity addition of renewable energy generation units at an existing renewable power generation facility, the added capacity of the units added by the project should be lower than 15 MW and should be physically distinct¹ from the existing units.	The project activity does not involve capacity additions. Hence, this is not applicable.	The project activity is the installation of a new hydro power plant. Hence this para is not applicable. Hence the project is in compliance with latest version of the methodology AMS I.D. Version 18.0.
In the case of retrofit, rehabilitation or replacement, to qualify as a small-scale	The project activity does not involve retrofit, rehabilitation	The project activity is the installation of a new hydro power plant and doesn't

project, the total output of the retrofitted, rehabilitated or replacement power plant/unit shall not exceed the limit of 15 MW.	or replacement. Hence, this is not applicable.	involve any retrofit, rehabilitation measures or any replacement. Hence the project is in compliance with latest version of the methodology AMS I.D. Version 18.0.
In the case of landfill gas, waste gas, wastewater treatment and agro-industries projects, recovered methane emissions are eligible under a relevant Type III category. If the recovered methane is used for electricity generation for supply to a grid then the baseline for the electricity component shall be in accordance with procedure prescribed under this methodology. If the recovered methane is used for heat generation or cogeneration other applicable Type-I methodologies such as “AMS-I.C.: Thermal energy production with or without electricity” shall be explored.	This is not a landfill gas, waste gas, wastewater treatment and agro-industries projects. Hence, this criterion is not applicable.	The project activity consists of installation of a new grid connected renewable power plant at a site where no renewable power plant was operated prior to the implementation of the project activity (Greenfield power plant). Hence the project is in compliance with latest version of the methodology AMS I.D. Version 18.0.
In case biomass is sourced from dedicated plantations, the applicability criteria in the tool “Project emissions from cultivation of biomass” shall apply.	This criterion is not applicable as this is not a biomass-based project activity.	The project activity consists of installation of a new grid connected hydro power plant. Hence this para is not applicable. Hence the project is in compliance with latest version of the methodology AMS I.D. Version 18.0.

TOOL 07: “Tool to calculate the emission factor for an electricity system”, version 07.0

Applicability condition	Applicability to this project activity	Validation Remarks
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 is the installation of greenfield hydro power generation plant. “Operating margin” (OM), “build margin” (BM) and “combined margin” (CM) need to be estimated to calculate baseline emissions of the project activity that substitutes electricity in the Laos grid. Hence the tool is applicable.	This project involves electricity generation from the hydro power plant where generated electricity is exported to a grid. Thus, the applicability criterion is met. In the absence of the project activity, the equivalent amount of power would have been drawn from the Laos grid which is dominated by fossil fuel power plants. The baseline emissions are calculated from electricity supplied to the grid by the project activity multiplies with emission factor of the National grid. The emission factor calculated using OM, BM and CM using this tool. Thus, the applicability criterion is met. Justification provided by the PP is found OK. Project is supplying electricity to Laos grid. PPA /22/ has already signed between Rasita Power Co., Ltd. and Electricite Du Laos

Applicability condition	Applicability to this project activity	Validation Remarks
		which has been verified by the validation team. Hence the project is in compliance with this tool.
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. Hence, this tool is applicable.	This project involves electricity generation from the hydro power plant where generated electricity is exported to a grid. Therefore, the emission factor is calculated for grid power plants. Hence the project is in compliance with this tool.
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.	The project electricity system is not located partially or totally in an Annex I country. It is located in Lao People's Democratic Republic. Hence, the tool is applicable.	The project is located on the host country Lao PDR, which is not Annex I country, hence the criterion is not applicable. Justification provided by the PP is found OK.

Applicability condition	Applicability to this project activity	Validation Remarks
		Hence the project is in compliance with this tool.
Under this tool, the value applied to the CO ₂ emission factor of biofuels is zero.	There are no biofuels used in the project activity. Hence this criterion is not applicable.	This project involves electricity generation from the hydro power plant where generated electricity is exported to a grid. Hence the condition is not applicable. Justification provided by the PP is found OK. Hence the project is in compliance with this tool.

TOOL 21: “Demonstration of additionality of small-scale project activities”, Version 13.1.

Applicability condition	Applicability to this project activity	Validation Remarks
The use of the methodological tool “Demonstration of additionality of small-scale project activities” is not mandatory for project participants when proposing new methodologies. Project participants and coordinating/managing entities may propose alternative methods to demonstrate additionality for consideration by the Executive Board.	The applied methodology is not a new methodology. Project proponent has applied this tool for the demonstration of additionality in compliance with the tool. Refer to section 3.5 of Joint PD and MR, for the detailed applicability of this	The tool is included by an approved methodology AMS I.D version 18.0 which is the applied methodology. Thus, the application of this tool was found to be acceptable, and the applicability criterion is met.

Applicability condition	Applicability to this project activity	Validation Remarks
	tool and additionality assessment. Hence the tool is applicable.	Hence the project is in compliance with this tool.
Project participants and coordinating/managing entities may also apply "TOOL19: Demonstration of additionality of microscale project activities" as applicable.	The proposed project activity is a small-scale activity. Hence, this criterion is not applicable.	The criterion is not applicable as the proposed project activity is a small-scale activity and will demonstrate the additionality accordingly.

TOOL 27: Investment analysis, version 12

Applicability condition	Applicability to this project activity	Validation Remarks
This methodological tool is applicable to project activities that apply the methodological tool "Tool for the demonstration and assessment of additionality", the methodological tool "Combined tool to identify the baseline scenario and demonstrate additionality", the guidelines "Non-binding best practice examples to demonstrate additionality for SSC project activities", or baseline and monitoring methodologies that use the investment analysis for the demonstration of additionality and/or the identification of the baseline scenario.	The additionality of the project activity is demonstrated using "Demonstration of additionality of small-scale project activities". Hence the tool is applicable.	The demonstration of additionality for the project activity is done using "Demonstration of additionality of small-scale project activities". Hence, TOOL 27 is used for conducting investment analysis. Hence the project is in compliance with this tool.
In case the applied approved baseline and monitoring methodology contains requirements for the investment analysis that are different from those described in this methodological tool, the requirements	The applied methodology does not contain requirements that are different from those	The additionality for the project activity is demonstrated using "Demonstration of additionality of small-

Applicability condition	Applicability to this project activity	Validation Remarks
contained in the methodology shall prevail.	described in this methodological tool for the investment analysis. Hence this criterion is not applicable.	scale project activities". The applied methodology contains requirements that are described in this methodological tool for the investment analysis. Hence the project is in compliance with this tool.

3.4.3 Project Boundary

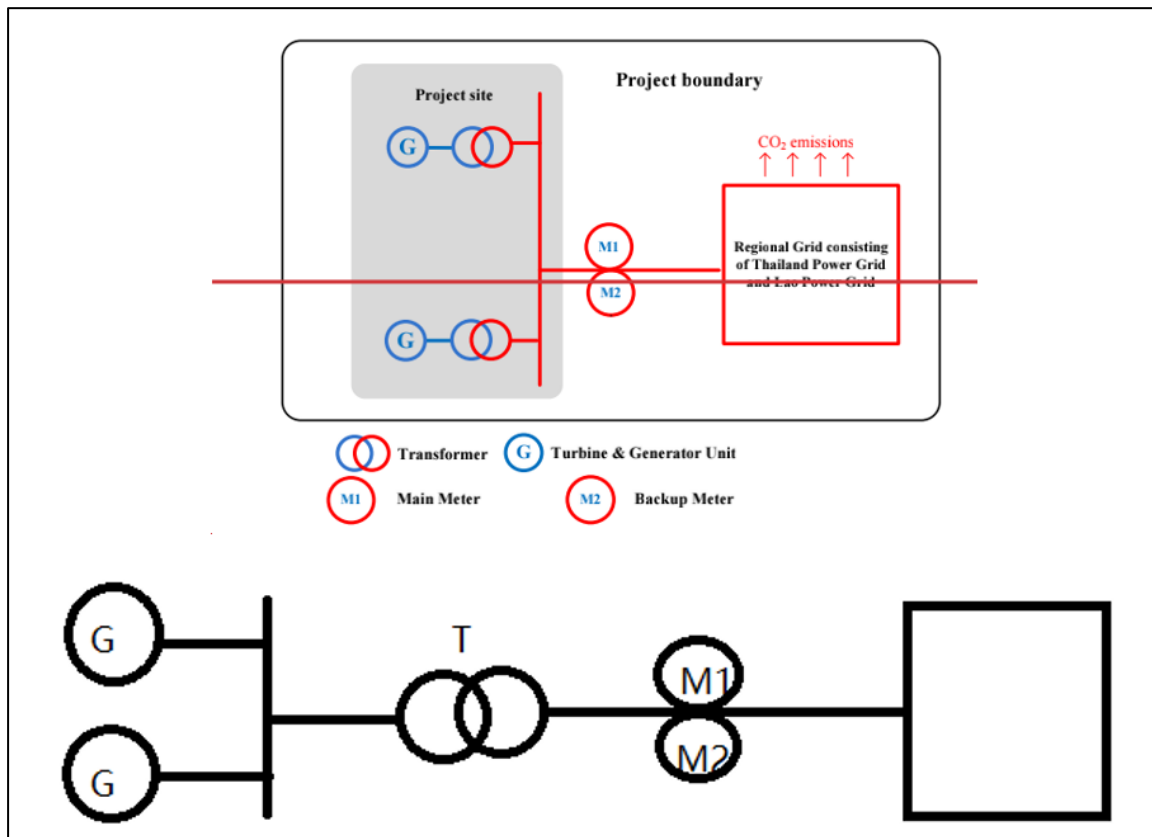
Para 18 of applied small-scale baseline methodology AMS I.D. version 18.0 delineates the project boundary. As per the applied methodology, the project boundary is defined as.

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

The project boundary is therefore determined as:

- the project activity site, where the electricity is being produced,
- the grid that the power plant is connected to.

The project boundary diagram is as follows.



The following emission sources have been considered under the project boundary which is found OK according to the on-site audit and the supportive documents.

Source	Gas	Included?	Justification/Explanation
Baseline	CO ₂	Yes	Main emission source
	CH ₄	No	Minor emission source
	N ₂ O	No	Minor emission source
	Other	No	Minor emission source
Project	CO ₂	No	Not applicable (Only for geothermal)
	CH ₄	No	Not applicable (Only for geothermal)
	N ₂ O	No	Not applicable
	Other	No	Not applicable

Source	Gas	Included?	Justification/Explanation
For binary geothermal power plants, fugitive emissions of hydrocarbons such as n-butane and isopentane (working fluid) contained in the heat exchangers	Low GWP hydro-carbon/ refrigerant	No	Not applicable (Only for geothermal)
CO ₂ emissions from combustion of fossil fuels for electricity generation in solar thermal power plants and geothermal power plants	CO ₂	No	Not applicable (Only for solar thermal power plants and geothermal power plants)
	CH ₄	No	Not applicable
	N ₂ O	No	Not applicable
	Other	No	Not applicable
For hydro power plants, emissions of CH ₄ from the reservoir.	CO ₂	No	Minor emission source
	CH ₄	Yes	It shall be a major source, if the power density is lower.
	N ₂ O	No	Minor emission source
	Other	No	Minor emission source

Opinion:

The validation team considers that GHG emissions as a result of the implementation of the proposed project activity which is not addressed by the applied methodology, i.e., AMS I.D version 18.0 is deemed to contribute less than 1% of the overall expected average annual emissions reductions. Validation team confirm that project boundary and selected sources, sinks and reservoirs are justified for the project.

3.4.4 Baseline Scenario

The project activity is the installation of a new grid-connected renewable power plant (Greenfield) as verified from the Commissioning certificate /16/, Monthly electricity invoices /20/, Photos/ video of site /21/, Signed PPA /22/ etc. Hence according to para. 19 of applied methodology AMS I.D. Version 18.0, the baseline scenarios is as follows:

“The baseline scenario is that the electricity delivered to the grid by the project activity would have otherwise been generated by the operation of grid-connected power plants and by the addition of new generation sources into the grid”.

Grid emission factor value to calculate the emission reductions of the hydro power plant project is 0.5542 tCO₂/MWh which is found correct.

PP has correctly identified the baseline as per the applied methodology and emission reduction has been calculated accordingly.

Opinion:

The assessment team confirms:

- (a) The identified baseline scenario is justified.
- (b) The approved baseline methodology has been correctly applied to identify the most plausible baseline scenario and the identified baseline scenario reasonably represents what would occur in the absence of the proposed project activity.

3.4.5 Additionality

According to the VCS standard v4.4 /3/ “Additionality shall be demonstrated and assessed in accordance with the requirements set out in the methodology applied to the project.” For assessment of additionality, the selected methodology AMS-I.D. v18 refers to “Guidelines on the demonstration of additionality of small-scale project activities” v13.1. Therefore, it has been explicated that project would not have occurred due to an investment barrier, i.e. a “financially more viable alternative to the project activity would have led to higher emissions.” For the purpose, client applied “Guidelines on the assessment of investment analysis” v12.

As indicated in JPDMR, project start date (i.e. date of investment decision, as in the sense of CDM methodology) is identified as 14/08/2017, i.e. the signing of EPC contract with Sichuan ANHE Hydraulic and Hydroelectric Engineering Co., Ltd. Validation team examined thoroughly the provided additionality assessment within the VCS PD and the supplementary “Equity IRR_Rasita.” workbook. Details are provided in the following subchapters.

Project developer had demonstrated that the financial returns of the proposed VCS project activity would be insufficient to justify the required capital investment as per CDM Validation and Verification Standard for project activities version 03.0. In the final Joint VCS PD & MR version 03. PP has adopted a conservative approach to identify the benchmark for the project activity. The project is earning revenue from the installation of the project activity. Thus, simple cost analysis (Option I) is not appropriate. Also in the absence of the project activity grid electricity would have been the obvious choice for the Project which requires no investment. Hence investment comparison analysis (Option II) is also not appropriate for the project activity. Therefore, benchmark analysis (Option III) is used for the project activity as per project type and decision-making context. Therefore, the Expected return on equity is considered appropriate benchmark. Accordingly, the post-tax Equity IRR has been considered as the relevant financial indicator for the project activity which is acceptable to the assessment team. Moreover, the financial indicator selected by the PP is correct based on the fact that tool do not restrict the PP to either use project IRR or Equity IRR. This is under the prerogative of the PP to select appropriate indicator based on his preferences to know the IRR based on his equity investment or debt investment. The same is thus acceptable to the assessment team. Assessment team however

checked the Equity IRR calculation and found that input assumptions used for the calculation of Equity IRR are applicable at the time of investment decision of the project and thus is in accordance with the relevant guideline of the tool.

As per Methodological tool “Investment Analysis” Version 12, “In situations where an investment analysis is carried out in nominal terms and the available IRR benchmarks are in real terms, project participants shall convert the real term values of benchmarks to nominal values by adding the inflation rate. The inflation rate shall be obtained from the inflation forecast of the central bank of the host country for the duration of the crediting period. If this information is not available, the target inflation rate of the central bank shall be used. If this information is also not available, then the average forecasted inflation rate for the host country published by the IMF (International Monetary Fund World Economic Outlook) or the World Bank for the next five years after the start of the project activity shall be used”.

The investment analysis has been carried out in Nominal terms. Accordingly, default value has been adjusted by adding 5 year forecasted inflation rate published by IMF. This is found to be appropriate as the central bank of Thailand does not provide long term inflation forecast or inflation target.

Appendix A in Methodological tool “Investment Analysis” Version 12 specifies default value of expected return on equity in real terms for Energy Industries (Group 1) in Laos = 20.68%

The Required return on equity (benchmark) was computed in the following manner:

$$\text{Nominal Benchmark} = \{(1 + \text{Real Benchmark}) * (1 + \text{Inflation rate})\} - 1$$

Where:

- Default value for Real Benchmark = 20.68% (as per Appendix of Methodological tool “Investment Analysis” Version 12)
- Inflation Rate: 3.30% as per the 5 year forecast provided in IMF’s World Economic Outlook database: April 2017¹ for Lao. The source has been verified and found to be available at the time of investment decision and correct.

$$\text{Nominal Benchmark estimated} = (1 + 20.68\%) * (1 + 3.30\%) - 1 = 24.66\%$$

Appropriateness of the input parameters:

The input parameters in the financial analysis have been taken as per the values and assumptions applicable and available at the time of decision to invest in the project activity in line with Paragraph 10, investment analysis tool version 12.0. The post-tax equity IRR for the

¹ <https://www.imf.org/en/Publications/WEO/weo-database/2017/April/weo-report?c=544,&s=PCPI,PCPIPC,PCPIE,PCPIEPCH,&sy=2017&ey=2022&ssm=0&scsm=1&sc=0&ssd=1&ssc=0&sic=0&sort=country&ds=.&br=1>

project activity at the time of investment decision comes out to 12.34%. Verification team assessment of all the input parameters is as follows:

Particulars	Value	Unit	Source/Remarks								
Capacity of the project	15	MW	Verified against FSR/12/ which was available at the time of investment decision and cross verified against PPA and commissioning certificate of the project. Further, the same has been confirmed during onsite visit.								
Annual Net generation	79.0000	GWh	Verified against FSR/12/ which was available at the time of investment decision. As the FSR is prepared by third party engineering company, it is found to be in line with EB 48, Annex 11. The actual generation achieved in the last one year (ie, Aug-21 to Jul-22) is 79.139 GWh/4/ which less than the value considered in the DPR. Hence, verification team confirms that the PLF considered for the project activity is conservative; hence acceptable.								
Project cost	36700.00	k USD	Verified against FSR/12/ which was available at the time of investment decision. From the total project cost considered for the project development, the unit cost of the project is estimated to be 2446.67 k USD/MW. The cost is reasonable with the market rate during investment decision time which varies from 2300 kUSD/MW to 2600 kUSD/MW. The project cost considered in the IRR calculation is found to be appropriate. The verification team also crosschecked the project with the project cost considered in other projects submitted under various carbon mechanisms which are commissioned: <table><tr><th>Project ID</th><th>Unit Cost (k USD/MW)</th></tr><tr><td>GS 3353</td><td>2588</td></tr><tr><td>GS6018</td><td>2318</td></tr><tr><td>CDM 10425</td><td>2041</td></tr></table> From the above cost, it is found that the project cost considered for the project activity is on par with the project cost of other similar projects. Also the PP's project completion report/40/ is verified and found that the property & plant cost of the project is 31,200,000 k USD which is less than the project considered for the FSR. However, even with the actual project cost, the IRR works out to be less than the benchmark.	Project ID	Unit Cost (k USD/MW)	GS 3353	2588	GS6018	2318	CDM 10425	2041
Project ID	Unit Cost (k USD/MW)										
GS 3353	2588										
GS6018	2318										
CDM 10425	2041										
Debt	64%	%									

Equity	36%	%	The debt equity ratio is based on the FSR/12/ which was available at the time of investment decision. Normally, the infrastructure projects are given loan between 60 to 80% of the project cost. Hence the debt equity ratio considered is acceptable
Interest rate	7.00%	%	The interest rate is based FSR/12/ which was available at the time of investment decision. As verified from PDDs of other registered projects, the interest rate considered in this project is found that this is also in line with the interest rate considered by other hydro projects in Laos.
Debt Repayment tenure	10	years	Loan Tenure is based on the FSR/12/ which was available at the time of investment decision. As verified from PDDs of other registered projects, the loan tenure considered in this project is found that this is also in line with the interest rate considered by other hydro projects in Laos.
Moratorium	0	year	
Repairs (% of annual income)	1.5%	%	The O&M cost and its escalation is based on the FSR/12/ which was available at the time of investment decision. The total O&M cost for the initial year is works out to be 187.11 k USD. As verified from the company financials, the actual O&M cost for the year 2021 is 283 k USD which is much higher than the O&M cost considered in the IRR calculation sheet. Hence, the O&M cost considered by PP is found to be conservative & appropriate.
Annual Labour Cost	4.4180	k USD	
Annual Material Cost	0.8	USD/kW	
Reservoir area annual maintenance cost	0.2	USD/MWh	
Other Expenses	5.0	USD/kW	
Tariff	6.25	USC/kWh	The tariff base rate is based on the FSR/12/ which was available at the time of investment decision. This is also crosschecked through the PPA/22/ signed for the project activity with grid authority. Hence, the tariff considered in the IRR calculation is found to be appropriate. As verified from the tariff amendment/22/ (signed on 8 th Feb 2021), the actual tariff is flat 5.89 USC/kWh for entire 30 years. With this actual tariff, the IRR further goes down 10.73%. Hence, the tariff considered for the investment decision is more conservative.
1st Year tariff	7	USC/kWh	
% reduction in tariff till 10th year	1%	USC/kWh	
Tariff from year 11 to 30	5.74	USC/kWh	
Depreciation Rate (Book)	4.00%	%	The book depreciation is based on the FSR/12/ available at the time of investment decision. This is found to be appropriate considering the life time of 25 years.
Salvage Value	10%	%	The salvage value of is based on the FSR/12/ which was available at the time of investment decision. Also

			this is found to be standard in the market. Hence, the salvage value considered is found to be appropriate.
Income tax rate	24%		The salvage value of is based on the FSR/12/ which was available at the time of investment decision. This is also found to be actual income tax rate applicable at the time of investment decision. Hence, the income tax rate value considered for IRR calculation is found to be appropriate.

Financial calculation and conclusion

The equity IRR calculations were provided in a spreadsheet. The calculation was verified and found to be correct by project verification team; as well as the assumptions used in the calculation were deemed to be correct. The equity IRR without carbon credit revenues is 12.34% which confirms that the proposed project activity in absence of the carbon credit benefits and compared to the benchmark return on equity 24.66% is not financially attractive.

Sensitivity Analysis:

A sensitivity analysis has been carried out for parameters contributing more than 20% revenues and costs, to demonstrate the robustness of the financial analysis. The parameters for which sensitivity analysis done are annual power generation (PLF), change in tariff, project costs, operational and maintenance cost, interest rate and debt equity ratio. Sensitivity analysis was conducted for $\pm 10\%$ variation. Reasonable variations for these parameters were checked by calculating the variation necessary to reach the benchmark and then discussing the likelihood for that to happen.

Variation %	-10%	Normal	10%	Variation required to reach benchmark	Value required to reach benchmark
Tariff	10.42%	12.34%	14.27%	63.20%	11.420
PLF	10.43%	12.34%	14.26%	63.40%	130.295
Project Cost	14.44%	12.34%	10.63%	-39.20%	22313.60
O&M Cost	12.41%	12.34%	12.27%	NA	NA

The results of sensitivity analysis show that even with a variation of $\pm 10\%$ in tariff, PLF, project cost, and O&M cost, equity IRR is significantly lower than the benchmark. And it is evident from the results given above; the project remains additional even under the most favourable conditions. Hence, the financial barrier is found to be valid.

Hence, the proposed project shall be considered as additional.

3.4.6 Quantification of GHG Emission Reductions and Removals

The emission reduction (ERy) by the project activity during the crediting period is the difference between baseline emissions (BEy), project emissions (PEy) and emissions due to leakage (Ly). The calculations and formulae as addressed in the approved baseline and monitoring methodology AMS I.D. Version 18.0 has been applied. All aspects related to the direct and indirect GHG emissions as relevant to the project activity have been addressed and are presented in a transparent manner, in line with the approved methodology.

Baseline emissions (BEy)

As per para 22 of the applied methodology AMS I.D. Ver 18.0, baseline emissions include only CO₂ emissions from electricity generation in 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:

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

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)
$EF_{grid,y}$	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”.

As per paragraph 23 of the applied methodology, the grid emission factor is calculated in a transparent and conservative manner as follows

- A combined margin (CM), consisting of the combination of operating margin (OM) and build margin (BM) according to the procedures prescribed in the “Tool to calculate the emission factor for an electricity system”; or
- The weighted average emissions (in t CO₂/MWh) of the current generation mix. The data of the year in which project generation occurs must be used.

The Project Participant has selected option a for calculation of emission factor for the project activity which is appropriate as per methodological requirement.

Calculation of EG_{PJ}

Because the project activity is the installation of a new grid-connected renewable power plant/unit at a site where no renewable power plant was operated prior to the implementation of the project activity, then:

$$EG_{PJ,y} = EG_{facility,y} \text{ (as per para 25 of the applied methodology)}$$

Where:

$EG_{PJ,y}$ = 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)

Therefore, the baseline emissions are calculated as follows:

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

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

Full calculation process of the grid emission factor in line with the “Tool to calculate the emission factor for an electricity system”, version 07.0 has been presented in an ER spread sheet.

4KES assessment is given below:

- Simplified CM is applied since the project activity is located in a LDC country. Under the simplified CM, the operating margin emission factor ($EF_{grid,OM,y}$) must be calculated using the average OM (Option (d) in Step 3 of the tool).
- The average OM emission factor is calculated as the average emission rate of all power plants serving the grid, using the methodological guidance as described under Step 4 (section 6.4.1) of the tool for the simple OM, but also including the low-cost/must-run power plants in all equations.
- “Ex ante option” is chosen for the project. The emission factor is calculated using a 3-year (2018-2020) generation-weighted average, based on the most recent data available at the time of submission of the CDM-PDD to the DOE for validation.
- For simple OM method, 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*’ is selected in the PDD and is justified as data for single power station and power unit are not publicly available in Lao PDR.
- Total net electricity generation of all power plants serving the system: The total electricity delivered to the LPG&TPG including low-cost/must-run power units and including electricity imports to the grid from Year 2018 to 2020 has been used, among of which, electricity delivered to Thailand Power Grid is obtained from the Annual Report 2018 to 2020 /29/ issued by Electricity Generating Authority of Thailand (EGAT), electricity delivered to Lao Power

- Grid is from Electricity Statistics Yearbook 2020 /30/ prepared by Statistics Planning Office of EDL and electricity imported from connected system is sourced from EDL Electricity Statistics Yearbook 2018 to 2020 /25/ and EGAT Annual Report 2018 to 2020/29/.
- The emissions from total fuel consumption: The emissions from total fuel consumption of the project electricity system LPG&TPG is calculated based on fuel types and the total fuel consumed in LPG and TPG. In Lao PDR, there is only one thermal power generation plant (Hongsa power plant), and the power generated is supplied to EDL (Lao grid) and EGAT (Thai grid) separately. Since the fuel consumption of the power station cannot be obtained, a conservative way (using power generation max efficiency of thermal power) is adopted to calculate the fuel consumption of the power station. The total capacity of Hongsa power plant is 1,878 MW which is a lignite-fired power plant (<http://www.hongsapower.com/index.php>). The load factor during the year of 2018-2020 is obtained from Sustainability Report 2020 /31/ issued by Banpu Power. The max value of plant efficiency for coal-PC sourced from Annex III of IPCC: "Technology-specific Cost and Performance Parameters"/33/ is adopted to calculate the total transformed calorific. For Thailand, the data of fuel consumption is sourced from Energy Balance of Thailand 2020 /32/ issued by Department of Alternative Energy Development and Efficiency of Thailand and the net calorific value of each type of fossil fuel are obtained from the IPCC 2006 default values /34/ for CO₂ emission factor of fossil fuels are deemed reasonable and conservative. Since the unit of fuel consumed has been converted to ktoe in Energy Balance of Thailand 2020, 41.868 GJ/toe is applied as per Unit converter and glossary established by International Energy Agency (<https://www.iea.org/reports/unit-converter-and-glossary>). 4KES confirms that the calculation of emissions from total fuel consumption in ER spreadsheet is correct.
 - Following the simplified CM approach applied to the proposed project, WBM=0 and WOM=1 are correctly applied in the renewed PDD. Thus, $EF_{grid,CM,y}=EF_{grid,OM,y}$.

The combined margin emissions factor is calculated as follows:

$$EF_{grid,CM,y} = EF_{grid,OM,y} * WOM + EF_{grid,BM,y} * WBM$$

Where:

$EF_{grid,BM,y}$ = Build margin CO₂ emission factor in year y (tCO₂/MWh)

$EF_{grid,OM,y}$ = Operating margin CO₂ emission factor in year y (tCO₂/MWh)

WOM = Weighting of operating margin emissions factor (%) = 100% (for simplified CM)

WBM = Weighting of build margin emissions factor (%) = 0% (for simplified CM)

Therefore,

$$EF_{grid,CM,y} = 0.5542 + 0 = 0.5542 \text{ tCO}_2/\text{MWh}.$$

Grid emission factor value to calculate the emission reductions of the hydro power plant project is 0.5542 tCO₂/MWh.

Further Tool to calculate the emission factor for an electricity system (version 07.0) is used for this emission factor calculation which is in compliance with the applied methodology i.e. AMS I.D Version 18.0 /06/. Hence the selected emission factor for the project activity is accepted by the validation team.

Project emission (PE_y)

According to para 39 of AMS I.D. Version 18.0, the project emissions for hydro power plants to be considered following the procedure described in “ACM0002: Grid-connected electricity generation from renewable sources”/25/.

Therefore, as per para 31 of ACM0002 Ver 20.0/25/, project emissions are calculated using the following equation:

$$PE_y = PE_{FF,y} + PE_{GP,y} + PE_{HP,y}$$

Where:

PE _y	Project emissions in year y (tCO ₂ e/yr)
PE _{FF,y}	Project emissions from fossil fuel consumption in year y (tCO ₂ /yr)
PE _{GP,y}	Project emissions from the operation of geothermal power plants due to the release of non-condensable gases in year y (tCO ₂ e/yr)
PE _{HP,y}	Project emissions from water reservoirs of hydro power plants in year y (tCO ₂ e/yr)

As per para 37 of the methodology ACM0002 Ver 20.0/25/, the power density (PD) of the project activity is calculated as follows:

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

Where:

PD = Power density of the project activity (W/m²)

Cap_{PJ} = Installed capacity of the hydro power plant after the implementation of the project activity (W) (ie, 15,000,000 W)

Cap_{BL} = Installed capacity of the hydro power plant before the implementation of the project activity (W). For new hydro power plants, this value is zero

A_{PJ} = Area of the single or multiple reservoirs measured in the surface of the water, after the implementation of the project activity, when the reservoir is full (m²) (ie, as per the satellite map it is 159,835 m²)

A_{BL} = Area of the single or multiple reservoirs measured in the surface of the water, before the implementation of the project activity, when the reservoir is full (m²). For new reservoirs, this value is zero.

Hence, $PD = (15,000,000-0) / (159,835-0) = 93.85 \text{ W/m}^2$.

Therefore, according to para 38 (c) of the methodology ACM0002 Ver 20.0, no project emissions are considered as the power density of the project activity is greater than 10 W/m².

Hence, $PE_y = 0$.

Leakage (LE_y)

According to para 42 of AMS I.D. Version 18.0, no leakage emissions are considered.

Hence, $LE_y = 0$.

Emission reductions (ER_y)

Emission reductions are calculated as follows:

$$ER_y = BE_y - PE_y - LE_y$$

Where:

ER_y Emission reductions in year y (t CO₂e).

BE_y Baseline emissions in year y (t CO₂e)

PE_y Project emissions in year y (t CO₂e).

LE_y Leakage emissions in year y (t CO₂)

Validation team confirm that the methodological choices/approaches and found OK. Validation team has verified the ex-ante ER calculation /04/ and found OK. The ex-ante Emission reduction is summarized below.

Ex-ante calculation of emission reductions:

	Value/Result	Source/reference
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Total installed capacity	15 MW	Validation team has verified the value from commissioning certificate /19/
Net electricity delivered to the grid (EG_{PJ,y})	79,740 MWh/yr	The value is verified by third-party assessment report (FSR) /12/
Grid emission factor (EF_{grid,CM,y})	0.5542 tCO ₂ e/MWh	Calculated
Baseline emissions (BE_y)	44,192 tCO ₂ e	Calculated
Project emissions (PE_y)	0 tCO ₂ e	Justified above.
Emission reductions (ER_y)	44,192 tCO ₂ e	ER _y = BE _y - PE _y

Summary of emission reductions

Year	Estimated baseline emissions or removals (tCO ₂ e)	Estimated project emissions or removals (tCO ₂ e)	Estimated leakage emissions (tCO ₂ e)	Estimated net GHG emission reductions or removals (tCO ₂ e)
01/02/2021 to 31/01/2022	44,192	0	0	44,192
01/02/2022 to 31/01/2023	44,192	0	0	44,192
01/02/2023 to 31/01/2024	44,192	0	0	44,192
01/02/2024 to 31/01/2025	44,192	0	0	44,192
01/02/2025 to 31/01/2026	44,192	0	0	44,192
01/02/2026 to 31/01/2027	44,192	0	0	44,192
01/02/2027 to 31/01/2028	44,192	0	0	44,192
Total	309,343	0	0	309,343

Total number of crediting years	7			
Annual average over the crediting period	44,192	0	0	44,192

Opinion:

As discussed above, the validation team confirms the following:

- a) All assumptions and data used by the project participants are listed in the Joint Project Description and Monitoring Report, including their references and sources;
- b) All documentation used by project participants as the basis for assumptions and source of data is correctly quoted and interpreted in the Joint Project Description and Monitoring Report;
- c) All values used in the Joint Project Description and Monitoring Report are considered reasonable in the context of the proposed project activity;
- d) The baseline methodology has been applied correctly to calculate project emissions, baseline emissions, leakage and emission reductions;

All estimates of the baseline/project emissions can be replicated using the data and parameter values provided in the Joint Project Description and Monitoring Report and corresponding spreadsheets.

Applied methodology and any referenced tools have been applied correctly to calculate baseline emissions, project emissions, leakage and net GHG emission reductions and removals during the project crediting period.

3.4.7 Methodology Deviations

No methodology deviations are identified.

3.4.8 Monitoring Plan

The project activity uses the approved baseline and monitoring methodology AMS I.D. (Version 18.0). Validation team considers the monitoring plan to be complying with the requirements of the methodology based on the following assessment. Details of the data collection and frequency of data recording and associated formats are described and observed to be adequate. The monitoring plan will give opportunity for real measurements of emission reductions that will be accrued.

The responsibilities and authorities for project management, procedures for monitoring and reporting, and QA/QC procedures have been systematically established and formalized. Data will be archived electronically until 2 years after the end of the crediting period.

Ex-ante parameter:

Following ex-ante parameter is reported under section 5.1 of VCS Joint PD & MR.

Data / Parameter	$FC_{i,y}$	VVB assessment
Data unit	mass or volume unit of the fuel	There is only one thermal power generation plant in Lao (Hongsa power plant), and the power generated will be supplied to EDL (Lao grid) and EGAT (Thai grid) separately. Since the fuel consumption of the power station cannot be obtained, a conservative way (using power generation max efficiency of thermal power) is adopted to calculate the fuel consumption of the power station. It was cross-checked by validation team. The purpose of the monitoring parameter is to calculate the electricity supplied to the grid. Hence the selected emission factor for the project activity is accepted to the VVB team.
Description	Amount of fossil fuel type i consumed in the project electricity system in year y	
Source of data	- Fuel consumption in Lao PDR is calculated based on the Sustainability Report 2020, Banpu Power Public Company Limited ¹¹ . Fuel consumption in Thailand is from “Energy Balance of Thailand 2019”, EGAT.	
Value applied:	Refer Table 5 and 6 in Appendix 1 of Joint PD & MR /02/	
Justification of choice of data or description of measurement methods and procedures applied	Data are from Banpu Power Public Company Limited (shareholder of Hongsa power plant) and Thailand authority, EGAT	
Purpose of Data	Calculation of baseline emissions	
Comments	This parameter is fixed ex-ante for the entire crediting period	

Data / Parameter	$EF_{CO_2, i, y}$	VVB assessment
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Data unit	tCO ₂ /TJ	There is only one thermal power generation plant in Lao (Hongsa power plant), and the power generated will be supplied to EDL (Lao grid) and EGAT (Thai grid) separately. Since the fuel consumption of the power station cannot be obtained, a conservative way (using power generation max efficiency of thermal power) is adopted to calculate the fuel consumption of the power station. It was cross-checked by validation team. The purpose of the monitoring parameter is to calculate the electricity supplied to the grid. Validation and verification team has checked and found OK. Hence the selected emission factor for the project activity is accepted to the Validation team.
Description	The CO ₂ emission factor per unit of fuel i in year y	
Source of data	2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 2 Chapter 1 Table 1.4	
Value applied:	Refer Table 5 and 6 in Appendix 1 of Joint PD & MR /02/	
Justification of choice of data or description of measurement methods and procedures applied	No specific local value available, the value from IPCC 2006, Guidelines for National Greenhouse Gas Inventories was adopted.	
Purpose of Data	Calculation of baseline emissions	
Comments	This parameter is fixed ex-ante for the entire crediting period	

Data / Parameter	EGy	VVB assessment
Data unit	Gwh	The monitoring parameter is measured by energy meters. The installed electricity meters are digital bi-direction meters. The metering system includes the main system and back-up system. There are two lines going from the project to the grid and each line has a separate main and back-up meter. VVB team has verified the reported electricity export data. The electricity export is continuously measured and monthly recorded in the form of the monthly electricity protocols as verified during the remote audit. The
Description	Net electricity generated and delivered to the grid by all power sources serving the system, including low-cost/must-run power plants/units, in year y.	
Source of data	- The data of the electricity generated and delivered to Lao PDR National Power Grid are from Electricity Statistic (2020), EDL - The data of the electricity generated and delivered to Thailand National Power Grid are from Annual Report (2020, 2019, 2018), EGAT The data of the electricity generated and delivered by Lao IPP directly	

	supply to Thailand are from Electricity Statistic (2020), EDL	purpose of the monitoring parameter is to calculate the electricity supplied to the grid.
Value applied:	Refer Table 5 and 6 in Appendix 1 of Joint PD & MR /02/	
Justification of choice of data or description of measurement methods and procedures applied	Data used are from Thailand authority, EGAT and Lao authority, EDL.	
Purpose of Data	Calculation of baseline emissions	
Comments	This parameter is fixed ex-ante for the entire crediting period	

Data / Parameter	$EG_{import,y}$	VVB assessment
Data unit	MWh	The monitoring parameter is measured by energy meters. The installed electricity meters are digital bi-direction meters. The metering system includes the main system and back-up system. There are two lines going from the project to the grid and each line has a separate main and back-up meter. Validation team has verified the reported electricity export data. The electricity export is continuously measured and monthly recorded in the form of the monthly electricity protocols as verified during the remote audit. The purpose of the monitoring parameter is to calculate the electricity supplied to the grid.
Description	The electricity (MWh) imported from Malaysia, China and Vietnam Power Grid in year y.	
Source of data	- Annual report (2020, 2019, 2018), EGAT Electricity Statistic (2020, 2019, 2018), EDL	
Value applied:		
Justification of choice of data or description of measurement methods and procedures applied	Data used are from Thailand authority, EGAT and Lao authority, EDL.	
Purpose of Data	Calculation of baseline emissions	
Comments	This parameter is fixed ex-ante for the entire crediting period	

Data / Parameter	EF _{grid,OM,y}	VB assessment
Data unit	tCO ₂ /MWh	The ex-ante parameter is as per the applied methodology AMS I.D. (Version 18.0). The applicable grid emission factor value to calculate the emission reductions of the hydro power plant project is 0.5542 tCO₂/MWh. Validation team has checked the standardized baseline and found applicable for the project activity. Further Tool to calculate the emission factor for an electricity system (version 07.0) is used for this emission factor calculation which is in compliance with the applied methodology i.e., AMS I. D. Hence the selected emission factor for the project activity is accepted to the Validation team.
Description	Operating Margin CO2 emission factor in year y	
Source of data	Calculated	
Value applied:	0.5542	
Justification of choice of data or description of measurement methods and procedures applied	Calculated as per “Tool to calculate the emission factor for an electricity system, version 07” as 3-year generation weighted average using data for the years 2018, 2019 & 2020.	
Purpose of Data	Baseline Emission calculation	
Comments	This parameter is fixed ex-ante for the entire crediting period	

Data / Parameter	EF _{grid,BM,y}	VB assessment
Data unit	tCO ₂ /MWh	The ex-ante parameter is as per the applied methodology AMS I.D. (Version 18.0). The applicable grid emission factor value to calculate the emission reductions of the hydro power plant project is 0 tCO₂/MWh. Validation team has checked the standardized baseline and found applicable for the project activity. Further Tool to calculate the emission factor for an electricity system (version 07.0) is used for this emission factor
Description	Build Margin CO2 emission factor in year y	
Source of data	Calculated	
Value applied:	0	
Justification of choice of data or description of measurement methods and	Calculated as per “Tool to calculate the emission factor for an electricity system, version 07”	

procedures applied		calculation which is in compliance with the applied methodology i.e., AMS I. D. Hence the selected emission factor for the project activity is accepted to the Validation team.
Purpose of Data	Baseline Emission calculation	
Comments	This parameter is fixed ex-ante for the entire crediting period	

Data / Parameter	$EF_{grid,CM,y}$	WB assessment
Data unit	tCO ₂ /MWh	The ex-ante parameter is as per the applied methodology AMS I.D. (Version 18.0). The applicable grid emission factor value to calculate the emission reductions of the hydro power plant project is 0.5542 tCO₂/MWh. Validation team has checked the standardized baseline and found applicable for the project activity. Further Tool to calculate the emission factor for an electricity system (version 07.0) is used for this emission factor calculation which is in compliance with the applied methodology i.e., AMS I. D. Hence the selected emission factor for the project activity is accepted to the Validation team.
Description	Combined Margin CO2 emission factor in year y	
Source of data	Calculated	
Value applied:	0.5542	
Justification of choice of data or description of measurement methods and procedures applied	The combined margin emissions factor is calculated as follows: $EF_{grid,CM,y} = EF_{grid,OM,y} * WOM + EF_{grid,BM,y} * WBM$ Where: $EF_{grid,BM,y}$ = Build margin CO2 emission factor in year y (tCO₂/MWh) $EF_{grid,OM,y}$ = Operating margin CO2 emission factor in year y (tCO₂/MWh) WOM = Weighting of operating margin emissions factor (%) = 100% (for simplified CM) WBM = Weighting of build margin emissions factor (%) = 0% (for simplified CM)	
Purpose of Data	Calculation of baseline emissions	

Comments	This parameter is fixed ex-ante for the entire crediting period	
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Data / Parameter	Cap _{PJ}	WB assessment
Data unit	MW	The monitoring parameter, Unit, and descriptions are as per the registered VCS-JMRPD. The data in the FSR at start of the project. Measure by check the nameplate after operation. Hence the installed capacity for the project activity is accepted to the VVB team.
Description	Installed capacity of the hydro power plant after the implementation of the project activity	
Source of data	<i>Project site</i>	
Value applied:	15	
Justification of choice of data or description of measurement methods and procedures applied	Use the data in the FSR at start of the project. Measure by check the nameplate after operation	
Purpose of Data	<i>Project emission</i>	
Comments	-	

Ex-post parameter:

Following ex-post parameter is reported under section 5.2 of VCS Joint PD and MR /02/.

		WB Assessment
Data / Parameter	EG _{PJ,y}	The monitoring parameter, Unit, and descriptions are found OK.
Data unit	MWh/yr	
Description	Quantity of net electricity generation supplied by the project plant/unit to the grid in year y	

Source of data	Monthly joint meter reading reports	Metering equipment is composed of two bi-directional meters for import/export, sub-station delivery point as verified during the remote audit and photos which is in compliance with the applied methodology.
Description of measurement methods and procedures applied	The difference of final value of export and import is used for monthly values of net electricity supplied to the grid by the project activity and same value will be considered for ER calculations.	The monitoring procedure is verified during the remote audit and found OK.
Frequency of monitoring/recording	Continuous measurement and at least monthly recording	The electricity export/import is continuous measured and monthly recorded which is in compliance with the applied methodology AMS I.D. Version 18.0
Value applied:	79,740	The estimated value is found OK. The value is verified Energy assessment report
Monitoring equipment	The electricity exported / supplied by the plant to pooling substation and further to substation. This meter also measures electricity imported by the plant from the grid.	Metering equipment is composed of two bi-directional meters for import/export, sub-station delivery point as verified during the remote audit which is in compliance with the applied methodology AMS I. D Version 18.0
QA/QC procedures applied	The meters are approved, tested & sealed by the State Utility. The meters are in the custody of State Utility. The frequency of calibration is once in 5 years. The monthly electricity supplied/exported by the project activity in the JMR report is cross checked with the monthly invoices of sale. In the absence or delay in the meter calibration appropriate Guidelines will be applied appropriately to confirm	Cross check of measurement results with invoiced electricity in accordance with the applied methodology AMS I. D Version 18.0.

	the conservativeness of metering. The metering arrangement, accuracy class of meters, calibration frequency is under control of state electricity board and PP does not have any control on it. PP is getting value of net electricity supplied to grid and the same is considered the monitoring parameter. The billing is raised based on substation meters.	
Purpose of data	Calculation of baseline emissions	Validation team has checked and found OK
Calculation method	Net electricity supplied to the grid by the project plant in a given month = Export(kWh) – Import (kWh)	Validation team has checked and found OK
Comments	Data will be archived in paper & electronic form for two years after the end of crediting period or of the last issuance of VERs for this project activity, whichever occurs later.	Validation team has checked and found OK

The monitoring plan and the QA/QC procedure would ensure the accurate monitoring of the data/parameters mentioned in the VCS PD throughout the implementation of the project activity. The validation team confirms that the monitoring procedures mentioned are best as per Industry norms.

Opinion: The assessment team confirms that:

- (a) The monitoring plan mentioned in VCS Joint PD & MR is in compliance with the applied methodology AMS I.D Version 18.0 and any referenced tools;
- (b) Based on the on-site audit, the assessment team confirms that monitoring arrangements described in the monitoring plan are feasible within the project design;

(c) Based on the interview with the PP, assessment team confirms that the project participant deputed the competent personal to execute the monitoring approach and to follow the monitoring plan.

3.5 Non-Permanence Risk Analysis

The project activity does not require a non-permanence risk analysis. Hence this is not applicable.

4 VERIFICATION FINDINGS

4.1 Accuracy of GHG Emission Reduction and Removal Calculations

VVB was able to confirm that the monitoring plan contained in Joined PD & MR /02/ is in accordance with the approved small-scale methodology applied for the project activity i.e., AMS I.D. ver. 18.0 /07/ and its applicable tools.

The parameter stated in the monitoring plan /02/ and the applied methodology /07/ has been fulfilled in the current monitoring period.

The GHG emission reductions were correctly calculated on the basis of the applied methodology AMS I.D. Version 18.0 /07/ and the formulae given in the Joined PD&MR /02/.

The project neither has been rejected nor included in an ETs or other compliance or voluntary mechanism. This is confirmed from the declaration/25/ provided by the project participant. Hence no double counting of carbon credits is involved.

Parameter monitored:

Verification team confirms through on-site audit verification and from the document review, the actual monitoring system complies with the monitoring plan mentioned in the Joined PD&MR /02/. According to the monitoring plan in the Joined PD&MR /02/, there is 1 monitoring parameter required to be monitored.

4.1.1 $EG_{PJ,y}$ (MWh)

		VVB Assessment
Data / Parameter	$EG_{PJ,y}$	The monitoring parameter, Unit and descriptions are as per the Joint PD&MR /02/.
Data unit	MWh/yr	
Description	Quantity of net electricity generation supplied by the project plant/unit to the grid in year y	

Value applied:	2021	2022	Total		The electricity export/import is continuous measured and monthly recorded by energy meters. Metering equipment is composed of two meters for measuring import/export of electricity (Make-EDMI, class 0.2, main and back-up meters) as verified during the on-site audit, and photos /21/. The electricity supplied to grid is continuously measured and monthly recorded and is cross checked with the monthly invoices of sale/20/ as verified during the on-site audit. The frequency of monitoring/recording is in accordance with the Joint PD&MR /02/. The monthly electricity data is cross-checked from the monthly invoices /20/ and found consistent. The purpose of the monitoring parameter is to calculate the baseline emission which is in accordance with the Joint PD&MR /02/.
	61,609	41,756	103,365		
Comments	The details of the energy meter and calibration are given in the table below:				Metering equipment is composed of two bi-directional meters for measuring import/export of electricity.

	Energy Meter	Meter details	Calibration Date	Validity date	The meters measure the electricity supplied by the plant to pooling substation and further to substation. This meter also measures electricity imported by the plant from the grid. Verification team has checked the meter details during the on-site audit, photos /21/ and calibration certificate /18/ and found consistent with the details mentioned in the Joint PD&MR /02/. During the monitoring period, no replacement of meter was observed. As per the PPA /22/, if any meters are found to be inaccurate by more than 2.0%, that metering equipment should be made accurate or replaced at the earliest. Calibration certificate of the energy meters /18/ has been checked by the VVB and found OK.
	Main	SI No: 219014734	01/02/2021 (COD)	31/12/2026	
		Accuracy class: 0.2s	21/09/2022	20/09/2027	
	Backup	SI No: 219014735	01/02/2021 (COD)	31/12/2026	
		Accuracy class: 0.2s	21/09/2022	20/09/2027	
		Make: EDM I			

Opinion: The verification team confirms;

- The monitoring plan has been implemented as per the Joint PD&MR /02/;
- The monitoring complies with the requirement of the applied methodology /06/;
- The information inflow (from data generation, aggregation, to recording, calculation and reporting) is included above under each parameter and confirms to the requirement of the Joint PD&MR /02/;
- The values included in the monitoring report and corresponding emission reduction sheets are verified and included under monitoring parameter, wherever appropriate;

Parameters not monitored/ex-ante:

4.1.2 EF_{grid,CM,y} (tCO₂/MWh)

	Discussion and verification assessment
Purpose of data	Calculation of baseline emissions
Verified value	0.5542 tCO ₂ /MWh
Source of value	Calculated
Justification	It is fixed for the entire crediting period as per the Joint PD&MR /02/. The value of the combined margin emission factor has been correctly taken as per the Joint PD&MR /02/ and hence accepted by the verification team.

Opinion:

In the opinion of assessment team, emission factor value that was applied in the calculations is consistent with Joint PD&MR /02/ and correctly emission reduction spread sheet /04/ and justified.

Assessment of Data and Calculation of GHG emission reductions:

Verification team has checked the emission reduction calculation /04/ for this monitoring period 01/02/2021 to 31/07/2022 (including both the days) and found correct and in compliance with the Joint PD&MR /02/ and applied methodology AMS I.D. Version 18.0 /07/. Summary of the baseline emissions, project emissions, leakage emissions and net emission reductions are as follows:

Baseline Emissions:

Year	BE _y	EF _{grid,CM,y}	EG _{PJ,y}
	t CO ₂	tCO ₂ /MWh	MWh
2021 (01/02/2021 to 31/12/2021)	34,143	0.5542	61,609
2022 (01/01/2022 to 31/07/2022)	23,141	0.5542	41,756
TOTAL	57,284		103,365

Project Emissions:

No project emissions are considered as the power density of the project activity is greater than 10 W/m². Hence, according to para 38 (c) of the methodology ACM0002 Ver 20.0, P_{Ey} = 0. The detailed calculation and explanation on the same is provided in the section 3.4.6 of this Joint Validation and Verification report.

Leakage emissions:

As stated in the applicable methodology, no leakage emissions are considered, therefore L_{Ey} = 0.

Net GHG Emission reductions for the monitoring period 01/02/2021 to 31/07/2022 (including both the days):

Year	Baseline emissions or removals (tCO ₂ e)	Project emissions or removals (tCO ₂ e)	Leakage emissions (tCO ₂ e)	Net GHG emission reductions or removals (tCO ₂ e)
2021 (01/02/2021 to 31/12/2021)	34,143	0	0	34,143
2022 (01/01/2022 to 31/07/2022)	23,141	0	0	23,141
Total	57,284	0	0	57,284

Opinion:

The verification team confirms that

- The complete data set for the identified and required parameter for the operational days in the current monitoring period was available;
- The reported data has been cross checked with available records, as indicated in the section 4.3 above under monitored data, wherever appropriate;
- The baseline, project and leakage emissions have been determined in accordance with the requirement of the applied methodology, as contained in the final Joint PD&MR /02/ and corresponding emission reductions spreadsheet;
- The assumptions, emission factors and default values used are justified, as indicated in the section 4.3 above.
- There is not double counting of emission reduction involved as the project the project neither has been rejected nor included in an ETs or other compliance or voluntary mechanism.

4.2 Quality of Evidence to Determine GHG Emission Reductions and Removals

Evidences referred for verification of monitoring parameter and fixed parameter are defined under section 4.3. We further confirm that, sufficient evidence covering the entire monitoring period and at the required frequency were available. A list of referred documents for verification is also included in Appendix 1 of this report.

5 VALIDATION AND VERIFICATION OPINION

Kosher Climate India Private Limited has commissioned “4K Earth Science Private Limited” to carry out the Joint Validation and Verification of the project “15 MW Nam Hinboun Downstream Hydropower Project”, with regard to the relevant requirements of VCS Standard Version 4.3. The monitoring period verified is from 01/02/2021 to 31/07/2022 (including both the days).

The project activity is developed by Rasita Power Co., Ltd. Which involves the installation and operation of a 15 MW hydro power plant in Songhong village, Hinboun District, Khammouane province, Lao PDR. The project activity consists of two bulb turbines with the unit capacity of 7.5MW each.

This is a Green-field project activity. The electricity generated by the project activity will be delivered to the grid, under a long-term power purchase agreement (PPA) /22/ signed between Rasita Power Co., Ltd. and Electricite Du Laos.

The technical details of the project is verified from the technical specifications /17/, signed PPA /22/, photos /21/ and during on-site audit and found consistent.

In the absence of the project activity, electricity would have been generated by the operation of grid connected power plants, which are predominantly fossil fuel based. Therefore, “15 MW Nam

Hinboun Downstream Hydropower Project” #3662 displaces carbon dioxide that would have been produced in the absence of the project activity by the grid connected power plants.

It has been estimated that approximately 79,740 MWh of electricity will be generated annually by the project, displacing approximately 44,192 tonnes of carbon dioxide (tCO₂) per annum and over 309,343 tCO₂ over the 7-years crediting period.

Validation and Verification is a requirement for all VCS projects and is seen as necessary to provide assurance to stakeholders of the quality of the project and its intended generation of estimated verified emission reductions (VERs).

A risk-based approach has been followed to perform this joint validation and verification. In the course of the joint validation and verification, 13 Corrective Action Requests (CAR) and 07 Clarification Requests (CL) were raised and successfully closed out. 00 Forward action request (FARs) was raised.

The joint validation and verification is based on the Joint PD & MR, additional documents related to baseline and monitoring methodology, ER calculation sheet, the subsequent background investigation, follow-up interviews and supporting documents made available to the validation and verification team by project proponent.

The objective of this validation activity is to have an independent third party for the assessment of the project design, estimated ER sheet and to ensure a thorough assessment of the proposed project activity against the applicable CDM and VCS requirements. As a result of the validation, the validation team confirms that:

- The project fulfils criteria of VCS Standard Version 4.3.
- The project is in line with all relevant VCS requirements.
- The project additionality is sufficiently justified in the Joint PD & MR.
- The monitoring plan is transparent, adequate and in line with applied baseline and monitoring methodology AMS I.D version 18.0.
- The calculation of the Baseline emission reductions is carried out in a transparent and conservative manner, so that the calculated emission reductions of 309,343 tCO₂e is most likely to be achieved within the 7 years of crediting period.
- The projects compliance with the requirements of Article 12 of the Kyoto Protocol, the CDM Modalities and Procedures as agreed in the Marrakech Accords under decision 3/CMP.1, the annexes to this decision, subsequent decisions and guidance made by COP/MOP & CDM Executive Board and other relevant rules, including the Host Country legislation and sustainability criteria.

No restrictions or uncertainties were identified related to the joint validation and verification.

The management of the ‘Rasita Power Co. Ltd.’ responsible for the preparation of the GHG emissions data and the reported GHG emissions reductions on the basis set out within the project final JOINT PROJECT DESCRIPTION & MONITORING REPORT Version 04 dated 20/03/2023. The calculation and determination of GHG emission reductions from the project is the responsibility of the management of ‘Kosher Climate India Private Limited’. The development and maintenance of records and reporting procedures are in accordance with the JOINT PROJECT DESCRIPTION & MONITORING REPORT Version 04 dated 20/03/2023.

It is our responsibility to express an independent GHG verification opinion on the GHG emissions and on the calculation of GHG emission reductions from the project for the period 01/02/2021 to 31/01/2022 based on the reported emission reductions in the final JOINT PROJECT DESCRIPTION & MONITORING REPORT Version 04 dated 20/03/2023 for the same period.

Further during this monitoring period (01-February-2021 to 31-July-2022), the project has produced a net total of 103,365 MWh electricity and a total amount of 57,284 tCO₂e of emission reduction. The monitoring period subject to this monitoring report is inclusive of first and last day of period.

Based on an understanding of the risks associated with reporting GHG emissions data and the controls in place to mitigate these, 4KES planned and performed our work to obtain the information and explanations that we considered necessary to provide sufficient evidence for us to give reasonable assurance that this reported amount of GHG emission reductions for the period is fairly stated.

4KES confirms the following;

Verification period: From [01-February-2021] to [31-July-2022]

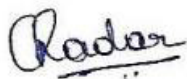
Verified GHG emission reductions and removals in the above verification period:

Year	Baseline emissions or removals (tCO ₂ e)	Project emissions or removals (tCO ₂ e)	Leakage emissions (tCO ₂ e)	Net GHG emission reductions or removals (tCO ₂ e)
2021 (01/02/2021 to 31/12/2021)	34,143	0	0	34,143
2022 (01/01/2022 to 31/07/2022)	23,141	0	0	23,141
Total	57,284	0	0	57,284

Validation and Verification team confirm that, project complies with the validation and verification criteria for projects and their GHG emission reductions or removals set out in VCS Version 4.

Therefore, 4KES is able to certify that the project is in full compliance with the VCS Standard Version 4.3 and recommend registration and issuance of the project activity.

Approved by



Chandrakala .R

Managing Director

4K Earth Science Pvt. Ltd

Date: 28/03/2023

Place: Bangalore, India

APPENDIX 1: REFERENCES

Sl. No.	Name of document	Reference
/1/	Initial JOINT PROJECT DESCRIPTION & MONITORING REPORT	Version 02, dated 10/10/2022
/2/	Final JOINT PROJECT DESCRIPTION & MONITORING REPORT	Version 04, dated 20/03/2023
/3/	ER spread-sheet for the crediting period (01/02/2021 to 31/01/2028)	Corresponding to Joint PD & MR Version 04
/4/	ER spread-sheet for the current monitoring period (01/02/2021 to 31/07/2022)	Corresponding to Joint PD & MR Version 04
/5/	IRR spreadsheet	Corresponding to Joint PD & MR Version 04
/6/	CDM-EB: Clean Development Mechanism Validation and Verification Standard for project activity	Version 03.0
/7/	Approved CDM Methodology AMS I.D.: Grid-connected renewable electricity generation	Version 18.0
/8/	VCS Verified Carbon Standard: VCS Program Guide	Version 4.2
/9/	VCS Verified Carbon Standard: VCS Standard	Version 4.3
/10/	VCS Verified Carbon Standard: Registration and Issuance Process	Version 4.1
/11/	VCS Verified Carbon Standard: Validation and Verification Manual	Version 3.2
/12/	Feasibility Study Report	
/13/	TOOL07: "Tool to calculate the emission factor for an electricity system"	version 7.0
/14/	TOOL 21: Demonstration of additionality of small-scale project activities	Version 13.1
/15/	TOOL 27: Investment analysis	Version 12
/16/	Commissioning Certificate	24/02/2021
/17/	Technical specification of the turbine, generator and energy meters	-
/18/	Calibration certificate of meters	

/19/	Approval from Ministry of Mine and Energy	24/08/2016
/20/	Monthly invoices for the monitoring period from February 2021 to July 2022.	-
/21/	Photographic/video evidence of project site along with meter and transmission	-
/22/	Signed PPA between PP and Electricite Du Laos	16/12/2015 Addendum 08/02/2021
/23/	Evidence documents related to local stakeholder meeting • Announcement note • Screenshots of meeting • Attendance sheet • Summary of meeting	-
/24/	ACM0002: Large-scale Consolidated Methodology: Grid-connected electricity generation from renewable sources, Version 20.0	
/25/	Declaration for double counting	
/26/	Engineering, Procurement and Construction (EPC) Contract	
/27/	Initial Environmental Examination Document Environmental clearance from Water Resources and Environment Agency (WREA)	
/28/	Project Completion report	
/29/	Electricity Generating Authority of Thailand (EGAT)- Annual Report	2018 - 2020
/30/	Electricite du Laos (EDL) - Electricity Statistics Yearbook	2018-2020
/31/	Sustainability Report 2019 of Banpu Power	2020
/32/	Energy Balance of Thailand 2019 published by Department of Alternative Energy Development and Efficiency of Thailand	-
/33/	Annex III of IPCC: "Technology-specific Cost and Performance Parameters"	-
/34/	IPCC Guidelines for National Greenhouse Gas Inventories, Volume 2 Energy.	2006

APPENDIX 2: CLARIFICATION REQUESTS, CORRECTIVE ACTION REQUESTS, FORWARD ACTION REQUESTS (CAR/CL/FAR)

Table 1. CL from this validation

CL ID	01	Section no.	1.1	Date: 02/01/2023
Description of CL				
In section 1.1 of JPDMR, it is mentioned as - “The use of firewood will be reduced because of displacement by electricity, this reduces the damage to the local vegetation”. However, this is hydro power project. Hence, PP is requested to clarify this.				
Project participant response				Date: 10/01/2023
<i>The sentence has been corrected now.</i>				
Documentation provided by project participant				
Revised JPDMR				
DOE assessment				Date: 24/01/2023
The corrected sentence has been verified and closed successfully.				

CL ID	02	Section no.	1.10, 4.4	Date: 02/01/2023
Description of CL				
In the table provided under section 1.10, PP is requested to provide the actual years, where emissions reductions are claimed ex-ante.				
Project participant response				Date: 10/01/2023
<i>The actual period/year are mentioned in the section 1.10 of the PDD</i>				
Documentation provided by project participant				
Revised JPDMR				
DOE assessment				Date: 24/01/2023
The actual year of emission reduction has been verified and found to be ok. Thus, the CL 02 is closed.				

CL ID	03	Section no.	1.11	Date: 02/01/2023
Description of CL				
In the table 1 of Section 1.11, the rated capacity of the turbine is given as 7.8 MW. However, the turbines are of capacity 7.5 MW. Please clarify.				
Project participant response				Date: 10/01/2023
<i>The turbine capacity is 7.8 MW only. However, the generator capacity is 7.5 MW. The technical specification of the turbines & generator are submitted.</i>				
Documentation provided by project participant				
Technical specification of turbine & generator				
DOE assessment				Date: 24/01/2023
The main technical parameter of the project has been revised and found to be ok. Thus, the CL 03 is closed.				

CL ID	04	Section no.	2.4	Date: 02/01/2023
Description of CL				
In section 2.4 of JPDMR, PP has mentioned that “Comments to be provided after the project is listed”. As the project is now listed, PP can revise it accordingly.				
Project participant response				Date: 10/01/2023
<i>Now the listing period is completed. But no comments received during the period. The same is updated in section 2.4 of the JPDMR</i>				
Documentation provided by project participant				
Revised JPDMR				
DOE assessment				Date: 24/01/2023
The section 2.4 has been revised and found to be ok. Thus, the CL 04 is closed.				

CL ID	05	Section no.	3.1	Date: 02/01/2023
Description of CL				
Link provided in the footnote -2 is not functional.				

Project participant response	Date: 10/01/2023
The footnote 2 is now updated with correct link	
Documentation provided by project participant	
Revised JPDMR	
DOE assessment	Date: 24/01/2023
The Footnote 2 has been verified and found to be ok. The CL 05 is closed.	

CL ID	06	Section no.	3.1, 5.2	Date: 02/01/2023
Description of CL				
PP is requested to provide - The proof for Local Stakeholder Consultation and invitation letter of the same. - Calibration certificates for the meters. - Proof to check the generation value for the current monitoring period. - Please provide the PLF details and Proof for the same.				
Project participant response				Date: 10/01/2023
The following documents are submitted - Stakeholder consultation report (With invitations, minutes, attendance & photographs) - Calibration certificates of energy meters - Energy meter reading statements for the current monitoring period - FSR Prepared by third party engineering company (as proof for plant Load factor)				
Documentation provided by project participant				
- Stakeholder consultation report (With invitations, minutes, attendance & photographs) - Calibration certificates of energy meters - Energy meter reading statements for the current monitoring period - FSR Prepared by third party engineering company (as proof for plant Load factor)				
DOE assessment				Date: 24/01/2023
The following document has been revised. Thus, the CL 06 is closed.				

CL ID	07	Section no.		Date: 02/01/2023
Description of CL				

It is not clear if an EIA is required for this project as per the requirements of host country regulations. Please clarify.	
Project participant response	Date: 10/01/2023
As per host country regulation detailed EIA is not required. However, Initial Environmental Examination (IEE) has to be conducted. The IEE report and IEE report approval are now submitted to VVB.	
Documentation provided by project participant	
IEE report IEE report approval	
DOE assessment	Date: 24/01/2023
The mentioned clarification has been verified and found to be ok. Thus, the CL 07 is closed.	

Table 2. CAR from this validation

CAR ID	01	Section no.	1.11	Date: 02/01/2023
Description of CAR				
In the main technical parameter of the project, mention the turbine speed, turbine type and assured run off.				
Project participant response				Date: 10/01/2023
The turbine speed, Turbine type & rated flow are now included in the section 1.11 of the JPDMR				
Documentation provided by project participant				
Revised JPDMR				
DOE assessment				Date: 24/01/2023
The main technical parameters of the project has been verified and found to be ok. Thus, the CAR 01 is closed.				

CAR ID	02	Section no.	1.17.2 (Table 1)	Date: 02/01/2023
Description of CAR				

In Sustainable Development Contributions table,	
- For SDG 8, please provide the quantitative value for the no of employment opportunities created for the project activity. - For SDG 13, the ER value for lifetime mentioned will be $44615 \times 25 = 1115375$ tCO2 which is not consistent with the value provided in the Joint Project Description and Monitoring Report. Check this and correct the same in ER excel sheet(I21).	
Project participant response	Date: 10/01/2023
- For SDG 8, please provide the quantitative value for the no of employment opportunities created for the project activity. - For SDG 13, the ER value for lifetime mentioned is corrected to 1115375 tCO2	
Documentation provided by project participant	
Revised MR	
DOE assessment	Date: 24/01/2023
The SDG table has been verified and found to be ok. Thus, the CAR 02 is closed.	

CAR ID	03	Section no.	2.1	Date: 02/01/2023
Description of CAR				
PP is requested to provide the information on the risk mitigation measures taken for preventing any harm on aquatic species.				
Project participant response				Date: 10/01/2023
The main impact to the aquatic species will be changes to quantity of water. However, the Quantity of water released from dam and the flow rate are controlled to ensured that the water flow as releases as natural flow				
Documentation provided by project participant				
-				
DOE assessment				Date: 24/01/2023
The given statement has been verified and found to be ok. Thus, the CAR 03 is closed.				

CAR ID	04	Section no.	2.2	Date: 02/01/2023
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Description of CAR	
While addressing the stakeholder comments, PP has mentioned that they would take mitigation measures on various aspects as described in Table 3 of section 2.2. Therefore, PP has to clarify what mitigation measures were taken and was it effective?	
Project participant response	Date: 10/01/2023
The mitigation measures taken and the effectiveness are now provided in section 2.2 of JPDMR	
Documentation provided by project participant	
Revised JPDMR	
DOE assessment	Date: 24/01/2023
The given remarks have been corrected and found to be ok. Thus, the CAR 04 is closed	

CAR ID	05	Section no.	3.2	Date: 02/01/2023
Description of CAR				
In section 3.2 of JPDMR, - PP needs to discuss all the applicability conditions of the applied methodology and tools. - For TOOL 07, the justification provided is the baseline scenario as per methodology ACM0002. However, the project is small scale and the methodology applied is AMS I.D. Please justify accordingly. - TOOL 27 is used for IRR calculations. Hence, PP is requested to include the applicability conditions of TOOL 27 in section 3.2.				
Project participant response				Date: 10/01/2023
- All the applicability conditions of the applied methodology and tools are now included - In TOOL 07 justification, there is no reference of ACM002 is mentioned - The applicability conditions of TOOL 27 is now included in section 3.2.				
Documentation provided by project participant				
Revised JPDMR				
DOE assessment				Date: 24/01/2023
All the applicability conditions for methodology and tools have been incorporated in the revised Joint PD & MR. Thus, the CAR 05 is closed.				

CAR ID	06	Section no.	3.4	Date: 02/01/2023
Description of CAR				
In section 3.4 of JPDMR, - The baseline scenario stated is the baseline scenario as per para 22 of methodology ACM0002. Hence, PP needs to change the baseline scenario as per para 19 of applied methodology AMS I.D. - For calculating Combined, Operating and Build Margin emission factor, PP has referred the document published by “the Institute for Global Environmental Strategies” based on the “data from Electricity Generation Authority of Thailand”. Hence, PP needs to clarify why is data of Thailand considered and not Laos?				
Project participant response				Date: 10/01/2023
In section 3.4 of JPDMR, - There is no reference of ACM0002 in this section - The reference of Thailand is provided as the electricity is supplied to regional grid consisting of Thailand Power Grid and the Lao Power Grid. It shall also be noted that the emission factor is now revised based on the latest emission data.				
Documentation provided by project participant				
Revised JPDMR				
DOE assessment				Date: 24/01/2023
The correction incorporated in the revised Joint PD & MR have been checked and found to be ok. Thus, CAR 06 is closed.				

CAR ID	07	Section no.	3.5	Date: 02/01/2023
Description of CAR				

In section 3.5 of JPDMR, - Under “Selection of Appropriate Benchmark”, it is stated that “Average forecasted inflation rate for the host country (Thailand) published by the IMF (International Monetary Fund) World Economic Outlook for the next five years has been considered”. However, the host country for the project activity is Laos and not Thailand. Correction requested. - Nominal Benchmark formula is given as $\{(1+\text{Real Benchmark}) * (1+\text{Inflation rate})\}-1$. However, while calculating PP has used the formula $\{(1+\text{Real Benchmark}) + (1+\text{Inflation rate})\}-1$. Please clarify. - For “Default value benchmark” and “Benchmark estimation”, PP has mentioned benchmark value is sourced from database of Thailand. However, the host country for the project is Laos while the data is taken from the database of Thailand. Please clarify.	
Project participant response	Date: 10/01/2023
In section 3.5 of JPDMR, - Under “Selection of Appropriate Benchmark”, the reference to the Thailand is corrected to Cambodia. - The typo has been corrected. The correct formula (ie, $\{(1+\text{Real Benchmark}) * (1+\text{Inflation rate})\}-1$ is now mentioned. - The reference to the Thailand has been corrected.	
Documentation provided by project participant	
Revised JPDMR	
DOE assessment	Date: 24/01/2023
The revision incorporated in the revised Joint PD & MR have been checked and found to be ok. Thus, CAR 07 is closed	

CAR ID	08	Section no.	6.2	Date: 02/01/2023
Description of CAR				
In section 6.2 baseline emissions, PP is to clarify why the period is considered as 1-Jan-2021 to 31-Dec-2021 as the project is commissioned on 01- Feb- 2021.				
Project participant response				Date: 10/01/2023
In section 6.2 baseline emissions, the start date of monitoring period is corrected to 1-Feb-2021 to be in line with commissioning date				
Documentation provided by project participant				

Revised JPDMR	
DOE assessment	Date: 24/01/2023
The start date of the monitoring period has been corrected and found to be ok. Thus, the CAR 08 is closed.	

CAR ID	09	Section no.	4.2	Date: 02/01/2023
Description of CAR				
PP is requested to provide the detailed calculation of Power Density.				
Project participant response				Date: 10/01/2023
The detailed calculation of power density is provided				
Documentation provided by project participant				
Revised JPDMR				
Satellite map with area calculation				
DOE assessment				Date: 24/01/2023
The calculation of power density has been verified and found to be ok. Thus, the CAR 09 is closed.				

CAR ID	10	Section no.	5.1	Date: 02/01/2023
Description of CAR				
Under section 5.1, the source of data for the calculation of $EF_{grid,OM,y}$, $EF_{grid,CM,y}$ and $EF_{grid,BM,y}$ is mentioned as “The document published by Institute for Global Environmental Strategies based on the data from Electricity Authority of Cambodia”. However, the host country for this project is Laos. Hence, PP needs to clarify why is the data of Cambodia considered?				
Project participant response				Date: 10/01/2023
<i>The reference to the Cambodia is corrected in the section 5.1. Moreover, the emission factor is now calculated based on the latest data. The ER sheet & JPDMR is revised accordingly.</i>				
Documentation provided by project participant				
Revised JPDMR				
Revised ER sheet				
DOE assessment				Date: 24/01/2023
The source of data has been corrected and found to be ok. Thus, the CAR 10 is closed.				

CAR ID	11	Section no.	5.3	Date: 02/01/2023
Description of CAR				
In section “Monitoring apparatus and installation”, PP has stated that “the project is still under construction, the monitoring meters have not been installed yet, therefore the serial numbers of meters are not available”. However, the project is already commissioned on 01/02/2021. PP is requested to provide clarification on the same.				
Project participant response				Date: 10/01/2023
<i>The sentence has been corrected now.</i>				
Documentation provided by project participant				
Revised JPDMR				
DOE assessment				Date: 24/01/2023
The revision incorporated in the revised Joint PD & MR have been checked and found to be ok. Thus, the CAR 11 is closed.				

CAR ID	12	Section no.	6.5	Date: 02/01/2023
Description of CAR				
The estimated ER for current monitoring period i.e., 01/02/2021 to 31/07/2022 is mentioned as 70,528 tCO _{2e} . Please check this value.				
Project participant response				Date: 10/01/2023
<i>The estimated emission reduction has been corrected now.</i>				
Documentation provided by project participant				
Revised JPDMR				
DOE assessment				Date: 24/01/2023
The estimated emission reduction has been verified and found to be ok. Thus, the CAR 12 is closed.				

CAR ID	13	Section no.	IRR Sheet	Date: 02/01/2023
Description of CAR				
The Tariff value considered is 6.25 USC/KWh for 30 years. However, PP need to clarify whether the tariff will remain constant for 30 years?				
Project participant response				Date: 10/01/2023
The tariff is now corrected as per the PPA which was available at the time of investment decision. The JPDMR & IRR sheet are revised accordingly.				

Documentation provided by project participant	
Revised JPDMR	
Revised IRR Sheet	
DOE assessment	Date: 24/01/2023
The tariff value considered for 30 years has been corrected in JPDMR and IRR. Thus, the CAR 13 is closed.	

Table 3. FAR from this validation

No FAR is raised during this validation

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

APPENDIX 3: COMPETENCE OF TEAM MEMBERS

<u>Certificate of Competence</u>						
Name	☒ Mr. ☐ Ms.	Ma Paa Puratchikkanal				
Qualification Procedure	Fulfills the requirement as per the appointment of personnel procedure of 4KES for Validation and Verification of CDM/VCS/GS/GHG Projects.					
Appointed to work as:						
	CDM Validator/Verifier	Team Leader	Team Member	Technical Expert	Technical Reviewer	Financial Expert
<i>Appointed</i>	Yes	Yes	Yes	Yes	Yes	No
<i>Appointed Date</i>	27-04-2021					
Authorized to work as Technical Expert for:						
<i>Authorized Technical Area</i>	Sectoral Scope	TA Code	Technical Area within the scope			
	Energy industries (renewable - / non-renewable sources)	1.1	Thermal energy generation			
	Energy industries (renewable - / non-renewable sources)	1.2	Renewables			
	Energy demand	3.1	Energy demand			
	Construction	6.1	Construction			
	Waste handling and disposal	13.1	Solid waste and wastewater			
	Waste handling and disposal	13.2	Manure			
	Agriculture	15.1	Agriculture			
Authorized to work as Local Expert for:						
<i>Country/Countries</i>	India and Sri Lanka					
<u>Compliance check by:</u> Anand S. R.						

<u>Certificate of Competence</u>						
Name	☐ Mr. ☒ Ms.	Swati S Acharya				
Qualification Procedure	Fulfils the requirement as per the appointment of personnel procedure of 4KES for Validation and Verification of CDM/VCS/GS/GHG Projects.					
Appointed to work as:						
	CDM Validator/Verifier	Team Leader	Team Member	Technical Expert	Technical Reviewer	Financial Expert
<i>Appointed</i>	No	No	Yes	No	No	No
<i>Appointed Date</i>	01-11-2021					
Authorized to work as Technical Expert for:						
<i>Authorized Technical Area</i>	Sectoral Scope	TA Code	Technical Area within the scope			
	Energy industries (renewable - / non-renewable sources)	1.2	Renewables			
Authorized to work as Local Expert for:						
<i>Country/Countries</i>	India					
Compliance check by: Anand S. R.						

<u>Certificate of Competence</u>						
Name	☒ Mr. ☐ Ms.	Praveen Babu				
Qualification Procedure	Fulfils the requirement as per the appointment of personnel procedure of 4KES for Validation and Verification of CDM/VCS/GS/GHG Projects.					
Appointed to work as:						
	CDM Validator/Verifier	Team Leader	Team Member	Technical Expert	Technical Reviewer	Financial Expert
<i>Appointed</i>	No	No	Yes	No	No	No
<i>Appointed Date</i>	08-07-2022					
Authorized to work as Technical Expert for:						
<i>Authorized Technical Area</i>	Sectoral Scope	TA Code	Technical Area within the scope			
	Energy industries (renewable - / non-renewable sources)	1.2	Renewables			
Authorized to work as Local Expert for:						
<i>Country/Countries</i>	India					
Compliance check by: Anand S. R.						

<u>Certificate of Competence</u>						
Name	☒ Mr. ☐ Ms.	Rohit Badaya				
Qualification Procedure	Fulfils the requirement as per the appointment of personnel procedure of 4KES for Validation and Verification of CDM/VCS/GS/GHG Projects.					
Appointed to work as:						
	CDM Validator/Verifier	Team Leader	Team Member	Technical Expert	Technical Reviewer	Financial Expert
Appointed	Yes	Yes	Yes	Yes	Yes	No
Appointed Date	30-04-2022					
Authorized to work as Technical Expert for:						
Authorized Technical Area	Sectoral Scope		TA Code	Technical Area within the scope		
	Energy industries (renewable - / non-renewable sources)		1.1	Thermal energy generation		
	Energy industries (renewable - / non-renewable sources)		1.2	Renewables		
	Energy distribution		2.1	Energy distribution		
	Energy demand		3.1	Energy demand		
	Waste handling and disposal		13.1	Solid waste and wastewater		
	Waste handling and disposal		13.2	Manure		
Authorized to work as Local Expert for:						
Country/Countries	India					
Compliance check by: Anand S. R.						

<u>Certificate of Competence</u>						
Name	☒ Mr. ☐ Ms.	Phoutkham Singphachon				
Qualification Procedure	Fulfils the requirement as per the appointment of personnel procedure of 4KES for Validation and Verification of CDM/VCS/GS/GHG Projects.					
Appointed to work as:						
	CDM Validator/Verifier	Team Leader	Team Member	Technical Expert	Technical Reviewer	Financial Expert
Appointed	No	No	No	No	No	No
Appointed Date	01-12-2022					
Authorized to work as Technical Expert for:						
	Sectoral Scope		TA Code	Technical Area within the scope		

Authorized Technical Area	NA	-	-
Authorized to work as Local Expert for:			
Country/Countries	Laos PDR		
Compliance check by: Anand S. R.			

APPENDIX 4: ABBREVIATIONS

CAR	Corrective Action Request
CDM	Clean Development Mechanism
CL	Clarification Request
EB	Executive Board
EISA	Environmental and Social Impact Assessment
ER	Emission Reductions
FAR	Forward Action Request
GHG	Greenhouse Gases
IPCC	Intergovernmental Panel for Climate Change
ISO	International Organization for Standardization
MP	Monitoring Period
MR	Monitoring Report
MW	Mega Watt
MWh	MegaWatt hour
PD	Project Description
PP	Project proponent
QA/QC	Quality Assurance/Quality Control
tCO ₂	Tonnes of Carbon Dioxide
UNFCCC	United Nations Framework Convention on Climate Change
VCS	Verified Carbon Standard
VCSA	Verified Carbon Standard Association
VCU	Verified Carbon Unit