

VALIDATION REPORT

Reference number: 2023SV-OVV00001_MercadoAmbientalAP

Date: 04/13/2023

Solar water heating systems – Guanajuato

VALIDATION REPORT

Project Name	Solar water heating systems – Guanajuato
Project Proponent	Secretaría de Medio Ambiente y Ordenamiento Territorial (SMAOT)
Project Developer	MERCADO AMBIENTAL AP S.C.
Project proponent's contact information	eduarDdP@mexico2.com.mx
Project Owner	David Robledo Beanes
Project Holder Contact Information	drobledob@guanajuato.gob.mx
Project Participants	Secretaría de Desarrollo Social y Humano (SEDESHU); Población beneficiaria; Dirección General de Recursos Materiales, Servicios Generales y Catastro adscrita a la Secretaría de Finanzas, Inversión y Administración (SFIA); Secretaría de la Transparencia y Rendición de Cuentas (STRC) Proveedores de equipos.
DdP Version	2.1
Project Type	Energy - Solar thermal
Grouped project	Yes.
Methodology applied	AMS-I.J.: Solar water heating systems (SWH) - Version 2.0
Project location (City, Country)	State of Guanajuato, Mexico
Start date	01/01/2021
Period of quantification of GHG reductions	01/01/2021 – 12/31/2030
Estimated total and average annual amount of GHG emission reduction	Total: 56,248 tCO ₂ Annual average: 5.62 ktCO ₂ /año
Validated - estimated total and annual average amount of GHG emissions reduction	Total: 56,248 tCO ₂ Annual average: 5.62 ktCO ₂ /año
Audit criteria	BioCarbon Registry (BCR)
Work performed by	Excalibur Ernesto Acosta Miranda.

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Acronyms and abbreviations

ANCE	Asociación de Normalización y Certificación, A.C.
BCR	BioCarbon Registry
CAR	Corrective action requirement
CL	Clarification request
SWH	Sistemas Solares de Calentamiento de Agua
GHG	Greenhouse Gases
LPG	Liquefied petroleum gas
NG	Natural Gas
VCC	Verified Carbon Credits
DdP	Formato Documento de Proyecto
CS	Competency Standard
FAR	Additional measures
LGCC	Ley General de Cambio Climático de México
CDM	Clean Development Mechanism
N.A.	Not applicable
NMX	Norma Mexicana
NDC	Nationally Determined Contributions
NOM	Norma Oficial Mexicana
NTCL	Norma Técnica de Competencia Laboral
SDG	Sustainable Development Goals
VVB	Validation and Verification Body
PP	Project Proponent
SEDESHU	Secretaría de Desarrollo Social y Humano
SMAOT	Secretaría de Medio Ambiente y Ordenamiento Territorial
SEMARNAT	Secretaria de Medio Ambiente y Recursos Naturales
SED	Sistema de Evaluación de Desempeño
tCO _{2e}	Tons of carbon dioxide equivalent

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1 Introduction

The project called Solar water heating systems - Guanajuato, is carried out by the Secretaría de Medio Ambiente y Ordenamiento Territorial (SMAOT) of Guanajuato, which with the intention of reducing Greenhouse Gas (GHG) emissions contracted the project developer MERCADO AMBIENTAL AP S.C., to register the project in the BioCarbon Registry Standard (BCR Standard) in order to obtain an initial and periodic issuance of Verified Carbon Credits (VCC).

The project formally started in 2021 and consists of the installation of residential solar water heating systems for the displacement of the use of fossil fuels such as LP gas by the use of boiler-type heaters or electric energy due to the use of grills, determining the activity as eligible for the AMS-I.J. Solar water heating systems methodology.

1.1 Objective

Evaluate the controls associated with the information system and the data corresponding to the GHG reductions reported by the Secretaría de Medio Ambiente y Ordenamiento Territorial through the project developer MERCADO AMBIENTAL AP S.C. for the Solar water heating systems - Guanajuato Project, taking as a reference the input information during the documentary and on-site validation activities.

1.2 Legal status of OVV

Asociación de Normalización y Certificación, A.C. is the GHG Emissions Validation/Verification Body, hereinafter referred to as OVV GEI ANCE, domiciled at Eje Lázaro Cárdenas, No. 869, Fracc. 3, Col. Nueva Industrial Vallejo, Delegación: Gustavo A. Madero, Ciudad de México, C.P. 07700, with accreditation number by the Mexican Accreditation Entity (ema) OVV/GEI 001/15, effective as of 06/26/2015 and updated on 07/22/2022 with an indefinite term of validity, with a scope for the sectors Power Generation and Electric Energy Transactions, Manufacturing in general (physical or chemical transformation of materials and substances into new products), Oil and Gas Exploration, as well as extraction, production and refining, and pipeline distribution, including petrochemicals, Metal production, Aluminum production, Mining and mineral production, Pulp, paper and printing, Chemical production, Carbon capture and storage, Transportation, Agriculture, forestry and other land use (AFO-LU/ASOUT) and General as indicated in the OVV/GEI 001/15 accreditation number. In addition, the OVV GEI ANCE is registered in the BioCarbon Registry platform.

1.3 OVV Impartiality

OVV GEI ANCE carried out a Declaration of No Conflict of Interest, according to OVV's internal procedures, in order to be able to execute the validation process. Also, the corresponding risk analysis was performed through the Risk Identification and Mitigation Matrix identified as Internal **Análisis COI Interno_Mercado Ambiental**, with the intention of determining that there are no risks of conflict of interest, impartiality and operational risks that prevent the execution of the validation process in an impartial manner, as well as the determination of applicable safeguards and mitigation measures.

1.4 Responsibilities addressed by OVV

For the evaluation of the risks derived from the validation activity, adequate means are available to cover the liabilities derived from the validation activities at the location of the Solar water heating systems - Guanajuato Project. OVV GEI ANCE has a Professional Liability policy (policy # 07000060) with Grupo Mexicano de Seguros S.A. de C.V. for a value of \$5,000,000.00 USD, valid from 07/19/2022 to 07/19/2023, to cover the normal course of its operations as a conformity assessment body.



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1.5 Scope and spatial and temporal limits

The Association for Standardization and Certification, A.C., (ANCE), through its Validation/Verification Body of Emission Declarations and Greenhouse Gas Projects (OVV-GEI) with address at Eje Lázaro Cárdenas, No. 869, Fracc. 3, Col. Nueva Industrial Vallejo, Delegación: Gustavo A. Madero, Mexico City, C.P. 07700; was hired by MERCADO AMBIENTAL AP S.C. (Project Developer) to represent the Secretaría de Medio Ambiente y Ordenamiento Territorial (SMAOT) for the purpose of validating its Greenhouse Gas Mitigation Project. (Project Developer) to represent Secretaría de Medio Ambiente y Ordenamiento Territorial (SMAOT) for the purpose of validating its Climate Change Mitigation Project, Solar water heating systems - Guanajuato, project type Energy - Solar thermal, under a reasonable assurance level, corresponding to the period from 01/01/2021 to 12/31/2030.

The validation is not intended to provide any advice to the client, however, the statements and/or corrective actions may provide information to improve the project design.

The validation team received a Project Document Format (PDD) Solar water heating systems - Guanajuato with a production date of 01/12/2022. The information included in the DdP prepared by MERCADO AMBIENTAL AP S.C., considers the basis and structure of the Solar water heating systems - Guanajuato Project for the reduction of emissions; these emissions are consolidated in kilograms of CO₂e. Based on this documentation, a document review and research activities were carried out in the form of on-site validation. This statement has been prepared for whoever may be the final interested party.

The project is eligible under the scope of the BCR Standard by meeting one or more of the following conditions.

The scope of the BCR Standard is limited to:	
The following greenhouse gases, included in the Kyoto Protocol: Carbon dioxide (CO ₂)	X
GHG projects using a methodology developed or approved by BioCarbon Registry, applicable to GHG removal activities and REDD+ activities (AFOLU Sector).	N.A.
Quantifiable GHG emission reductions and/or removals generated by the implementation of GHG removal activities and/or REDD+ activities (AFOLU Sector).	N.A.
GHG projects using a methodology developed or approved by BioCarbon Registry, applicable to activities in the energy, transport and waste sectors.	X
Quantifiable GHG emission reductions generated by the implementation of activities in the energy, transport and waste sectors.	X

The project aims to reduce emissions from the burning of fossil fuels, specifically liquefied petroleum gas (LPG) and natural gas (dry gas) and electricity consumption, by implementing solar water heating systems (SWH) that work based on solar radiation and heat exchange surfaces for water heating.

According to the document "Project Cycle" of the BIOCARBON REGISTRY program, 6.2 Project registration request, the holder must request the registration of the project in the Program's registration platform; this can happen before concluding the validation process, however, certification and registration will be given only when the project has the report and validation statement.

Project eligibility is assessed against the scope of the BCR Standard, validating that the Solar water heating systems - Guanajuato project accounts for CO₂ emission reductions (GHG included in the Kyoto Protocol), the Project Developer applies

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the CDM methodology AMS-I.J. Small-scale Methodology: Solar water heating systems, which is allowed by the BioCarbon Registry, and for the energy sector.

It is validated that the Project is not related to the AFOLU sector.

1.6 Commitment term

The OVV GEI ANCE and MERCADO AMBIENTAL AP S.C., in order to carry out the validation of the Project Solar water heating systems - Guanajuato, made the proposal Commercial offer: ANCE_PE_004_Proyecto Calentadores Solares.pdf and on January 11, 2023. MERCADO AMBIENTAL AP S.C. accepted the offer, which began to manage the validation service.

1.7 Assurance level and materiality

The OVV GEI ANCE through the Validation Plan dated 03/09/2023 agreed with the project proponent the level of assurance, which is Reasonable (considering at least 95%) and a materiality of 5%, as well as the form and timing of evidence collection, so as to obtain a reasonable level of confidence in accordance with the provisions of the BCR Standard and the laws in force.

2 Validation process

2.1 Validation plan

In order to establish the methods and criteria for the development of the validation, the OVV GEI ANCE prepared the Validation Plan, which specifies:

- a. The type of audit of the project validation is face-to-face and the date of the visit was set for 03/15/2023.
- b. The form of documentary or evidence review was established in two phases, a documentary review that will entail the evaluation of:

The GHG information management system and its controls to determine the sources of potential errors, omissions or deviations in accordance with:

- the selection, management of data and information related to GHG emission reductions;
- processes for collecting, processing, consolidating and reporting GHG information;
- processes to ensure the accuracy of GHG data and reporting information;
- the results of previous assessments, if any;
- Data and documentary information on the project's GHG emission reductions;

Information reviewed prior to on-site validation:

Name of document
Padrón calentadores solares.xlsx
BCR_Calentadores Solares GTO.pdf

- c. The identification and resolution of findings is performed according to the materiality established in the program, which is 5%.
- d. The audit period is scheduled according to the M.A. AP Project_Schedule, which corresponds to section V of the Validation Plan.

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- e. The identification of risks associated with the use or collection of data and data systems and the assessment of risks of non-conformity with the criteria are evaluated in the Risk Analysis of the Validation Plan, where it is evaluated::
- Inherent risks: risk of errors, losses or deviations attributable to the facility's handling of information.
 - Control risks: risk that the establishment's internal control system is unable to prevent, detect and/or correct errors.
 - Detection risk: risk that the verifier's procedures do not detect errors.

Any modifications to the validation plan and evidence gathering plan will be approved by the lead validator and communicated to the project sponsor.

2.2 Evaluation criteria

- a. Protocol: BCR Standard.
- GHG Project Validation and Verification Manual;
 - Project Cycle Metodología: AMS-I.J.: Solar water heating systems (SWH) - Version 2.0.
- b. Tools: CDM Tool 21 version 13.1: Demonstration of additionality for small-scale projects..
- c. Standards ISO:
- UNE-EN ISO 14064-2 Greenhouse gases. Part 2: Specification with guidance at the project level for quantification, monitoring and reporting of greenhouse gas emission reductions or removal enhancements.
 - UNE-EN ISO 14064-3 Greenhouse gases. Part 3: Specification with guidance for the verification and validation of greenhouse gas statements (ISO 14064-3:2019).
- d. Legal framework:
- *Acuerdo que establece gases o compuestos de efecto invernadero que se agrupan para efectos de reporte de emisiones, así como sus potenciales de calentamiento (SEMARNAT-Registro Nacional de Emisiones);*
 - *Acuerdo que establece las particularidades técnicas y las fórmulas para la aplicación de metodologías para el cálculo de emisiones de gases o compuestos de efecto invernadero (SEMARNAT-Registro Nacional de Emisiones);*
 - *Aviso sobre el factor de emisión eléctrico para el reporte 2022 (SEMARNAT-Registro Nacional de Emisiones);*
 - *Aviso sobre el factor de emisión eléctrico para el reporte 2021 (SEMARNAT-Registro Nacional de Emisiones);*
 - Norma Ambiental para el Distrito Federal NADF-008-AMBT-2017, que Establece las Especificaciones Técnicas para el Aprovechamiento de la Energía Solar en el Calentamiento de Agua en Edificaciones, Instalaciones y Establecimientos, sin embargo, esta legislación no es aplicable al Estado de Guanajuato;
 - NMX-ES-001-NORMEX-2018 Rendimiento térmico y funcionalidad de colectores solares para calentamiento de agua- Métodos de Prueba y Etiquetado: Establece los métodos de prueba para determinar el rendimiento térmico y las características de funcionalidad de los colectores solares que utilizan como fluido de trabajo agua, comercializados en los Estados Unidos Mexicanos;
 - NMX-ES-002-NORMEX-2007 Energía Solar- Definiciones y terminología: Establece los vocablos, simbología y la definición de los conceptos más usados en el campo de la investigación y el desarrollo de la tecnología para el mejor uso de la radiación solar como fuente alternativa de la energía;
 - NMX-ES-003-NORMEX-2021 Requerimientos mínimos para la instalación de sistemas solares térmicos, para calentamiento de agua: se extiende a todos los sistemas mecánicos, hidráulicos, eléctricos, electrónicos y demás que forman parte de las instalaciones de sistemas termo-solares de más de 500 litros, para sistemas menores de 500 litros se aplica lo establecido en el apéndice normativo;
 - NMX-ES-004-NORMEX-2010 Evaluación térmica de sistemas solares para calentamiento de agua – Método de ensayo (Prueba): Esta Norma Mexicana establece el método de ensayo (prueba) para evaluar y comprar el comportamiento térmico de sistemas de calentamiento de agua solar, principalmente para uso doméstico hasta una

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capacidad máxima de 500 litros y hasta una temperatura máxima de 90°C como dominio de temperaturas de agua caliente;

- Norma Técnica de Competencia Laboral (NTCL) para “Instalación del sistema de calentamiento solar de agua” Certifica las competencias laborales de las personas que instalan calentadores solares de agua, las cuales incluyen interpretar diagramas y manuales, preparar el área, materiales y herramientas e instalar, y poner en marcha componentes del sistema;
- NOM-027-ENER/SCFI-2018, Rendimiento térmico, ahorro de gas y requisitos de seguridad de los calentadores de agua solares y de los calentadores de agua solares con respaldo de un calentador de agua que utiliza como combustible gas L.P. o gas natural. Especificaciones, métodos de prueba y etiquetado;
- Dictamen técnico de energía solar térmica en vivienda;
- EC-0325 Estándar de competencia para la instalación de sistema de calentamiento solar de agua termosifónico en vivienda sustentable;
- EC-0473 Estándar de competencia para la instalación del sistema de calentamiento solar de agua de circulación forzada con termotanque.

2.3 Evidence collection plan

The design of the Evidence Collection Plan was carried out considering the scope or timing of the validation activities, the evidence collection procedures, the places and sources of information for evidence collection, the identification during the validation process of new risks that could lead to material errors or non-conformities, the review of the information was considered considering an assurance level of 95%, and an emission reduction period from 01/01/2021 to 12/31/30, the calculation variables involved in the estimation of emission reductions were reviewed, in addition to the application of the RETScreen® Clean Energy Management software.

2.4 Visits to the Project site or area

Once the aforementioned activities for documentary validation have been completed, we will continue with the review of the evidence of the information that makes up the GHG Project Design Document and the Monitoring Plan, the activities to be carried out during the site visit are as follows:

The on-site visit involves:

- The exhaustive on-site review according to the project limits.
- Interview personnel involved in the different processes, data generation and management, and keep a detailed record of both project reviews and interviews conducted.
- Confirm whether all sources of GHGs were considered.
- Review the processes for identifying, selecting and justifying the baseline scenario.
- Corroborate the availability of evidence for GHG reporting and declaration by the responsible party;
- Validate the application of assumptions and considerations;
- Validate the operational and control procedures that the responsible party will implement to ensure the quality, integrity and security of the GHG information;

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A sampling of 20 pieces of equipment installed in the homes was carried out to validate the operation and ownership of the equipment, the locations of the facilities visited are shown below (See Figure 1 and 2).

Source: <https://earth.google.com/earth/d/1GwFfFS9Zjryry8ZLvTWe1j5fyGxtwtR?usp=sharing>

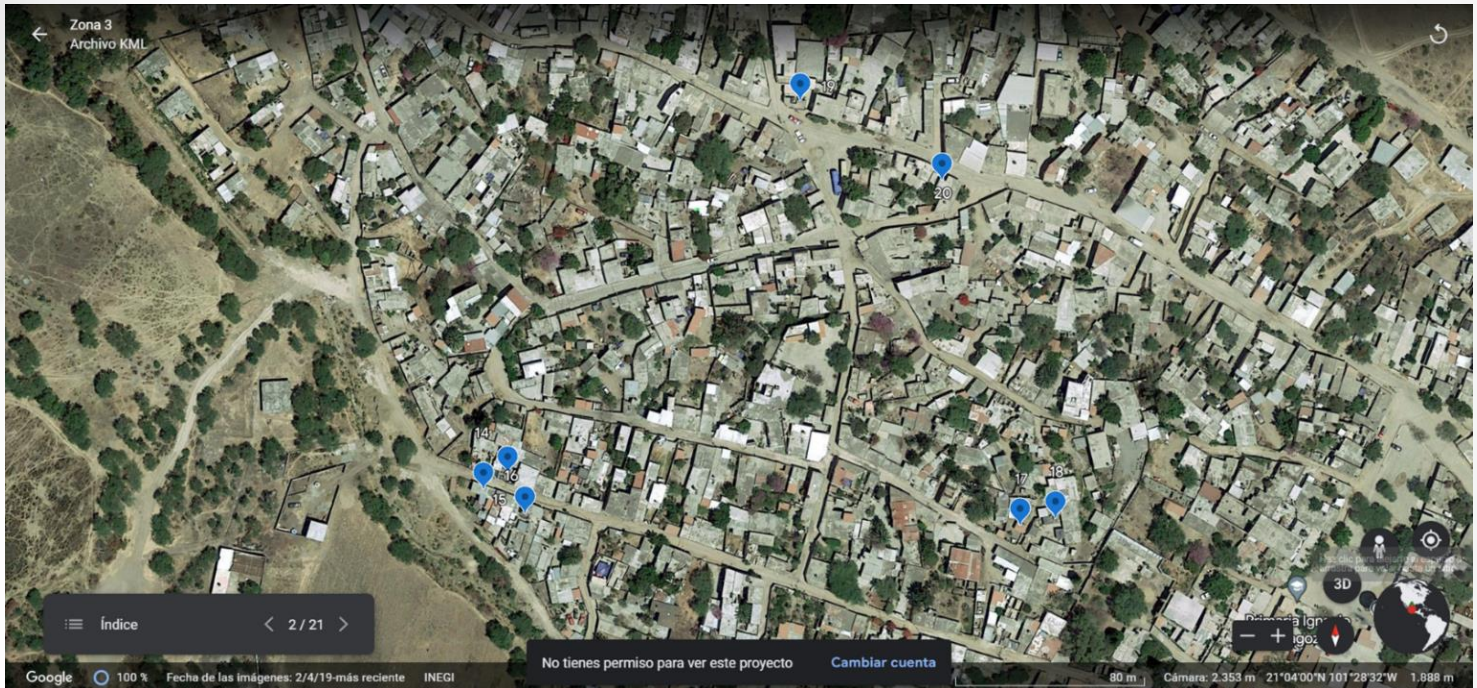


Figure 1. Facilities visited in the town of Silao, Guanajuato.

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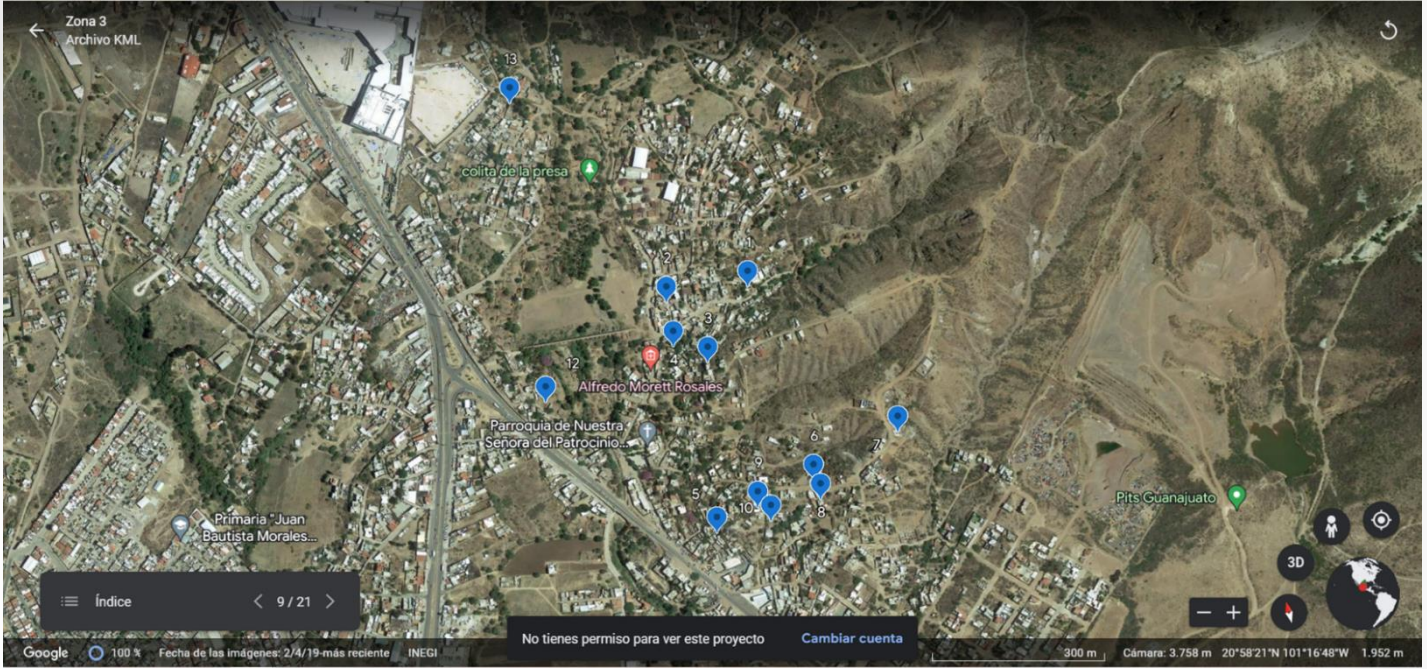


Figure 2. Facilities visited in the town of Guanajuato, Guanajuato.

2.5 Requests required by the OVV

During the information audit of the Solar water heating systems - Guanajuato project, the following information was requested for validation purposes:

Supporting evidence
Ubicación 20 viviendas.docx
Zona 3.kml
1649355040_084-40051001-006-22-JA-T.pdf
1651525330_089-40051001-006-22-A-T.pdf
1651525346_107-40051001-006-22-F-T.pdf
Act Programa Gobierno_2021.pdf
ANEXO 1 Etiqueta.pdf
ANEXO 2 Diagrama Instalacion CSA 2022.pdf
ANEXO 3 Terminos Referencia CSA 2022.pdf
asistencia ANCE 15-Mar-2023.pdf
COTIZACION Getgreen.pdf
COTIZACION OnlySun_pagina web.pdf
COTIZACION Renovables.pdf
Envio Cotización GETGREEN.pdf
Envio Cotización RENOVABLES.pdf
HISTORICOS 4410_ANEXO 4.pdf
INFORME FINAL SMAOT CSA 2021.pdf

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Supporting evidence
Ley Contrataciones Publicas Edo Gto.pdf
LPGE_2023_PO_30Dic2022.pdf
PAM Investigacion mercado_anexo4_compra CSA 2022.pdf
PED_Gto2040_WEB.pdf
PLABSOL-13-F1.8.1 Rev07 Informe 22-CAS-037 RENOVABLES NOM027 - Curvas NMX004.pdf
ROP CSA 2021_Periodico Oficial.pdf
ROP Programa CSA 2022_Periodico oficial.pdf
Solicitud de cotización.pdf
40051001-006-21-C.pdf
ANEXO I 40051001-006-22.pdf
BASES-LPNM-40051001-006-22.pdf
ANEXO AB (MANIFIESTOS ESTATALES).docx
ANEXO C (DECLARACION INTERESES).docx
ANEXO E (REQUISITOS FACTURACIaN 2020).docx
ANEXO J (ACTA ENTREGA RECEPCION).docx
ANEXO L (TERMINOS DE REFERENCIA).docx
ANEXO M Diagrama Instalacion CSA 2022.docx
ANEXO N (ETIQUETA).docx
ANEXO R (REGISTRO PROPUESTA) (1).docx
ANEXO D (ACREDITACION DE PERSONALIDAD. PERSONA F+SICA.doc
ANEXO D (ACREDITACION DE PERSONALIDAD. PERSONA MORAL.doc
ANEXO F (FORMATO FIANZA).doc
ANEXO G (ENTREGA DE PREGUNTAS).doc
ANEXO H (E-COMPRAS).doc
ANEXO K (DISTRIBUCIaN POR MUNICIPIO).xlsx
ANEXO A (TÉCNICA).xls
ANEXO B (ECONaMICA).xls
40051001-105-20-C\40051001-105-20-C.pdf
40051001-105-20-C\Anexos 105.PDF
40051001-105-20-C\Bases 105.PDF
210129_Acta 1SO_firmada.pdf
Contrato 2021 8900003721-9900008366_firmado.pdf
Ejemplo Acta Entrega Recepcion 2021.pdf
Factura_3876_1er pago.pdf
Factura_3879_2do pago.pdf

2.6 Information system, data management and control

On March 15, 2023 an on-site visit was made to the Secretaría de Medio Ambiente y Ordenamiento Territorial, located at Cam. Aldana 12, Pueblito de Rocha, 36040 Guanajuato, Guanajuato, in order to validate the stipulations of the DdP of the Solar water heating systems - Guanajuato Project. During the interviews conducted with the project personnel, the following findings were made:

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No.	Reference to noncompliance	Type of nonconformity: (CAR, CL, FAR)	Description of the finding	Emission source materiality (%)																				
1	CDM Participation Requirements, Project Activities, A.3, A.4	CL	During the on-site validation, through interviews with the PP, the participation of the Government of the State of Guanajuato was mentioned as the main funding vector for the project and the route for its allocation was observed. It is required to specify the budget allocation route within the DdP, this with the objective of demonstrating that it does not result in a deviation of official development assistance.	N.A.																				
2	B.2. Project category applicable to the project activity	CL	Although the project developer applied laboratory tests to obtain energy from hot water consumption (16.3 MJ/day), it is important to adhere to the selected method of the "System Measurement Method" methodology. Therefore, it is important that the PP and the developer demonstrate evidence of the measurements, according to the sampling cited in the DdP. The lead validator observed the traceability in terms of the quality of estimation of the variables of the baseline emission reduction estimation equation in such a way that the application of the assumption applied is validated, taking into account that throughout the life of the project it will have to be adjusted to the selected methodology.	N.A.																				
3	B.3. Description of how anthropogenic GHG emissions by sources are reduced below what would have occurred in the absence of the registered CDM project activity.	CAR	During the review of the project's DdP, the additionality analysis was reviewed based on the CDM tool "TOOL 21 Demonstration of additionality of smallscale project activities", in which only the investment barrier analysis was performed; however, the analysis should be performed for all the barriers mentioned in the tool.	N.A.																				
4	C.1. Duración de la actividad de proyecto	CL	During the on-site validation, through interviews and review of the information, the start of the project was reported, it is important to clarify in the DdP the start date of the project as the start date of execution or construction or actual action of the project activity and the documents supporting the start of operations.	N.A.																				
5	D.3. Data to be monitored	CL	During the revision of the DdP, no reference is made to the uncertainty of measurements for the energy determination of the SWH system.	N.A.																				
6	D.3. Data to be monitored	CAR	During the review of the DdP, the information regarding the Monitoring Plan was reviewed, but the schedule (periodicity) of the verifications to be carried out on the project was not found.	N.A.																				
7	Voluntary Carbon Market Standard, V. 2.1, 16 Stakeholder Consultation;	CL	During the on-site validation it was observed that the PP performs a stakeholder consultation analysis, however, in the DdP it is mentioned that it has not yet been performed.	N.A.																				
8	E. Estimating GHG emissions by source	CAR	During the documentary validation, it was observed that the calculation tool has a tracking error in the formula for calculating CO ₂ emissions from natural gas, in addition, it is important to show the projection of the calculation of CO ₂ emissions for all the years of the project or, if applicable, to clarify the emissions (from 2025 to 2030). <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>Año</th> <th>RE_{Proyecto}</th> <th>RE_{ANCE}</th> <th>%Mat</th> </tr> </thead> <tbody> <tr> <td>2021</td> <td>664</td> <td>653</td> <td>1.68</td> </tr> <tr> <td>2022</td> <td>1267</td> <td>1261</td> <td>0.51</td> </tr> <tr> <td>2023</td> <td>4052</td> <td>4025</td> <td>0.67</td> </tr> <tr> <td>2024</td> <td>7318</td> <td>7308</td> <td>0.13</td> </tr> </tbody> </table>	Año	RE _{Proyecto}	RE _{ANCE}	%Mat	2021	664	653	1.68	2022	1267	1261	0.51	2023	4052	4025	0.67	2024	7318	7308	0.13	0.09
Año	RE _{Proyecto}	RE _{ANCE}	%Mat																					
2021	664	653	1.68																					
2022	1267	1261	0.51																					
2023	4052	4025	0.67																					
2024	7318	7308	0.13																					

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No.	Reference to noncompliance	Type of nonconformity: (CAR, CL, FAR)	Description of the finding				Emission source materiality (%)
			2025	8293	8293	-	
			2026	8293	8293	-	
			2027	8293	8293	-	
			2028	8293	8293	-	
			2029	8293	8293	-	
			2030	8293	8293	-	
			Total	63,006	63061	0.09	
Materiality in the reduction of the Project's emissions (%):							

REVIEW OF THE PROJECT INFORMATION SYSTEM		
Personnel in charge of obtaining, collecting, handling and safeguarding information	Specific activity or procedure performed in the Project's information management.	Frequency
David Robledo Beanes Director General SMAOT-DGCCSE	Responsible for the direction and management of the project Solar water heating systems - Guanajuato	Yearly
Luis Humberto Aguilar Rosales Especialista técnico de implementación de proyectos	Tracking of SCA systems intentions and hard data feed for indicators.	Monthly
Carlos Abdiel Jaramillo Castillo Especialista técnico de implementación de proyectos	Follow-up to SCA systems intention	Monthly
Fernando Esparza Hernández Especialista técnico de implementación de proyectos	Responsible for project management Solar water heating systems - Guanajuato	Yearly
Erik Germán Flores Hernández Jefe de Departamento de Mitigación	Solar Heater Program Technical Manager	Monthly
Selection and management of GHG data and information	During the on-site validation, an explanation of the project was requested, the start date of the project was ratified, the financial structure of the project, those responsible, the scope and rules of operation, the engineering design of the heaters was observed, and visits were made to the residences where the SWH systems are installed.	
Processes for collecting, processing, and consolidating GHG data and information	Project management is linked to the Performance Evaluation System of the Government of Guanajuato, whose evaluation is based on the Logical Framework methodology, the financial investment is delegated to the State Finance Secretariat and the operation is defined in the Official Gazette of the State of Guanajuato and the annual Government Program.	
Systems and processes that ensure the validity and accuracy of GHG data and information	From the AMS-I.J. Small-scale Methodology Solar water heating systems Model-based approach was used, using the modeling of the RETScreen® Clean Energy Management Software.	
GHG information system design and maintenance	Follow-up for the design and maintenance of the information system is tracked through the Project Monitoring Plan.	

2.7 Audit team

Describe the personnel in charge of the validation process..

Name	Responsability	Type of activities developed
Ing. Excalibur Ernesto Acosta Miranda	Lead Validator	Visita in situ
Ing. Janai Monserrat Hernández Contreras	Independent Reviewer	Technical review

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3 Validation results

3.1 Project components

3.1.1 Project holder information

Full name	David Robledo Beanes
Name of institution	Secretaría de Medio Ambiente y Ordenamiento Territorial (SMAOT)
Roles or responsibilities	Responsable de Proyecto
Identification	Guanajuato, Guanajuato
Location	473 7352600 ext. 6201
Telephone number(s)	drobledob@guanajuato.gob.mx

3.1.2 tion from other Project institutional participants

Full name	Eduardo Piquero
Name of institution	MERCADO AMBIENTAL AP S.C.
Roles or responsibilities	Desarrollador del Proyecto
Identification	Ciudad de México
Location	(+52) 55 8530 1993
Telephone number(s)	eduarDdP@mexico2.com.mx

3.1.3 Project description

The project consists of the installation of SWH systems in homes in the municipalities of Guanajuato that present a certain degree of vulnerability, in accordance with the poverty index of the municipalities.

The SWH system includes a storage system and a vacuum tube heat exchanger. Heating occurs through a thermosyphon process, where the water is brought into contact through the surface of the heat exchanger with solar radiation. As the water heats up, it begins to circulate to the top of the tank, while cold water will enter the collector tubes. This cycle is repeated until a uniform average temperature is reached throughout the system. The project is estimated to last 10 years and is not considered a mandatory requirement of any national, state or local legislation.

3.1.4 Sectoral scope and type of the Project

The sectoral scope of the project, the type of program or project (small or large scale) and the activity to be implemented are as follows:

Sector	Energy - Solar thermal	
Program or project (small or large scale)	Small Scale.	
Activity to be implemented	Activities in the AFOLU sector, other than REDD+	
	REDD+ activities	

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	Activities in the energy sector	X
	Activities in the transportation sector	
	Activities related to waste management and disposal	

3.1.5 Location and boundaries of the Project

During the on-site validation, the location of the SWH systems was validated, which are installed in the municipalities of the State of Guanajuato, and the control that is kept for the follow-up of each equipment was validated; the technical specialist for project implementation controls this process and the georeferencing control. The Project's PoP specifies the location of the SWH and the coordinates of the equipment installed in 2021 and 2022 can be seen in the document Padrón Padron solar heaters.xlsx.

3.1.6 Total Project area, facilities or processes

During the on-site validation, 20 residences were sampled in order to corroborate their installation and correct operation. Up to 2022, 6265 systems were installed; the project is proposed as a clustered project, so heaters will continue to be installed until 2030.

3.1.7 Ownership or right of use of the area, facility or process

Ownership or rights only apply to the purchase of SWH equipment, which is traceable to the Request for Quotation for the same.

3.1.8 Characteristics and preconditions prior to the start of the Project

Prior to the installation of solar water heating systems, residences used fossil fuels (liquefied petroleum gas and natural gas) and electric energy for water heating.

3.1.9 PMCC technologies, products and services

The technologies to be implemented by the Project are viable, supported by a market analysis (Investigacion mercado_anexo4_compra CSA 2022.zip).

3.1.10 Evaluación al plan cronológico

Indicate whether the dates and justification for the timing plan are consistent and feasible:

- Duration or life of the PMCC: It was validated that the start date of the Project is 01.01.2021 and the end date is 31.12.2030, in total the Project duration is 10 years.
- The DdP establishes the monitoring frequency of the Project, contemplating the dependent variables for the estimation of emissions (inlet and outlet temperature), water volume, Emission Factors, Efficiency of the water heating equipment prior to the SWH system and Procedures established for the management of GHG emission reductions or removals and related to quality control.
- The frequency of verification events shall be every two years as established by the AMS-I.J. methodology

3.2 Methodological elements

3.2.1 Selected methodology

The use of the AMS-I.J. Small-scale Methodology Solar water heating systems, Version 02.0 and published by the CDM is validated.

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3.2.2 Additionality

The DdP contains the additionality analysis according to the TOOL21 Methodological tool: Demonstration of additionality of small-scale project activities, Version 13.1, validating additionality.:

Criteria	Compliance	Compliance evaluation
	Yes/No	
Investment barrier	Yes	The project proved to be additional because, during project validation, the project's financial analysis and budget allocation were reviewed, concluding that the project can continue without carbon credit financing.
Technological barrier	Yes	The Project proved to be additional because, during the validation of the Project, the description of the System design was reviewed, as a conclusion it is determined that the SWH systems directly reduce GHG emissions, so it is additional.
Barrier due to prevailing practice	Yes	The Project proved to be additional derived from the fact that it is not a regulatory requirement, so it is considered additional.
Other barriers	N.A.	N.A.

3.2.3 No double counting

It is recorded that the Project is not registered in any other climate change mitigation standards or certification programs; furthermore, there are no potential overlaps with other climate change mitigation initiatives.

3.2.4 Baseline scenario

The baseline calculation was calculated based on the methodology registered in the CDM, AMS-I.J. Small-scale Methodology Solar water heating systems. The baseline was calculated based on the temperature differential measured in laboratory tests, the environmental conditions of the state of Guanajuato, solar radiation, estimated water volume, all of which were entered into the RETScreen® Clean Energy Management Software program. With the heat value obtained from the simulation, the baseline scenario was compared with the estimated consumption of liquefied petroleum gas, natural gas and electric energy.

3.2.5 Project scenario

It is validated that the installation of SWH systems in the most vulnerable population considerably reduces emissions from fossil fuel burning and electricity consumption, taking into account that the use of liquefied petroleum gas, natural gas and electricity represents 63%, 2% and 21%, respectively.

3.2.6 GHG emission sources

It is validated that the emission sources are boilers or electric energy heaters and the use of grills used in the residences that apply to the SWH systems grant program..

3.2.7 Deviations in Project implementation from the Project Document.

There were no deviations in the processes.

3.2.8 Methodological deviations

No methodological deviations are presented, the application of the modeling-based method is validated..

3.2.9 Quantification of GHG emissions and GHG emission reductions in project scenario

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During the validation of the project, the quantification of GHG emissions of the baseline was reviewed, using the CDM AMS-I-J methodology as a reference. During the interview with the project developer, the tools and procedures applied to estimate the emissions of the baseline scenario and the reductions due to the implementation of the project were validated. Through the document "Padrón calefactores solares.xlsx" the calculation and use of emission factors for the Mexican national electric power system (2021 and 2022) and for CO₂ emissions from LPG and NG combustion was observed.

3.2.10 Lackages

The provisions of the DdP are validated, leakage emissions do not apply according to the methodology.

3.2.11 Reducciones netas de emisiones de GEI

During the validation of the Project, the quantification of the net GHG emission reductions of the baseline was reviewed (the net emissions of the project scenario are considered as zero), taking as a reference the AMS-I.J. methodology: Solar water heating systems (SWH) of the CDM. During the interview with the project developer, the tools and procedures applied to obtain heat generated without the presence of SWH systems were validated. The document "Padrón calentadores solares.xlsx" shows the calculation and use of the emission factors of the Mexican national electric power system and the emission factors for LPG and NG combustion. The following are the results of the validation of the Project's emission reductions:

Year	Net emissions reduction OVV GHG ANCE (tCO ₂ e)	Net emissions reduction SMAOT Project (tCO ₂ e)	Materiality %
2021	586.55	586.55	0.00
2022	1,122.34	1,122.34	0.00
2023	3,615.17	3,615.17	0.00
2024	6,529.22	6,529.22	0.00
2025	7,399.09	7,399.09	0.00
2026	7,399.09	7,399.09	0.00
2027	7,399.09	7,399.09	0.00
2028	7,399.09	7,399.09	0.00
2029	7,399.09	7,399.09	0.00
2030	7,399.09	7,399.09	0.00
Total	56,247.81	56,247.81	0.00

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4 Legal and documentary aspects

4.1 Legal requirements

Not applicable.

4.2 Linkage to Sustainable Development Goals

4.3 Project Documentation

Documentation	Conformity	Remarks
Formato Documento de Proyecto (DdP), Solar water heating systems – Guanajuato, Versión 2.1	OK	The last update was performed on 03/24/2023 derived from the findings found during validation.
INFORME FINAL SMAOT CSA 2021	OK	Description of the SWH systems installation program.
LEY DE CONTRATACIONES PÚBLICAS PARA EL ESTADO DE GUANAJUATO	OK	Procurement processes, basis for the purchase of SWH systems.
Periódico Oficial del Gobierno de Guanajuato	OK	Operating rules for system implementation.
Actualización del Programa de Gobierno Plan Estatal de Desarrollo Guanajuato 2040	OK	Certainty of the Project's durability.
Pruebas de laboratorio "PLABSOL-13-F1.8.1 Rev07 Informe 22-CAS-037 RENOVABLES NOM027 - Curvas NMX004.pdf"	OK	No observations.

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5 Environmental and socioeconomic aspects

The analysis of the environmental and socioeconomic aspects involved in the implementation of the Project was validated, and as a conclusion, no negative impacts on the results presented were detected.

6 Stakeholder consultation

It was validated that the Proponent of the project carries out consultations with the interested parties, in this case with the owners of the residences that have the installation of the SWH systems..

7 Uncertainty

No uncertainty per se was evaluated, since the method used is by modeling and the values used for the calculation of emission reductions are national assumptions.

8 Contributions to the Sustainable Development Goals of the United Nations.

During interviews with the project proponent, it was validated that the project constitutes the SDGs:

ODS	Compliance	Evaluación de cumplimiento
	Yes/No	
ODS 1	Yes	The project was shown to build the resilience of people in vulnerable situations and reduce their exposure to vulnerability.
ODS 7	Yes	The Project was shown to generate non-polluting energy.
ODS 11	Yes	The Project was shown to contribute to the expansion of least-cost services while reducing negative environmental impacts.
ODS 13	Yes	The Project was shown to contribute to the reduction of GHG emissions.

9 Grouped project

It is validated that the Project is formulated as grouped; the area to continue developing the Project will continue to be in the municipalities of the State of Guanajuato, in the residences with vulnerable situations. The DdP contains the measures to be followed to comply with the clustering criterion in the Project.

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10 Project monitoring plan

The valid and most recent version of the approved methodology AMS-I.J.: Solar water heating systems (SWH) - Version 2.0 is applied to the Project. The validation team identified and assessed, during the desk review, that all parameters contained in the monitoring plan meet the requirements of AMS-I.J. Version 2.0, as well as the applicable tools, and confirmed that no deviations relevant to the project are found in the monitoring plan. The validation team also confirmed that the monitoring arrangements described in the monitoring plan are feasible within the project design, and the means of implementation of the monitoring plan are sufficient and the Proponent has the capacity to implement the monitoring plan to ensure emission reductions.

– **Parameters determined ex ante:**

The PP has chosen the option of fixing the CO₂ emission factor of grid electricity during the crediting period.

Parameter	Value	Description	Compliance
EF _{RED 2021}	0.423 tCO ₂ /kWh	EMISSION FACTOR OF THE NATIONAL ELECTRICITY SYSTEM 2021	The validator confirms the source of the busy value.
EF _{RED 2022}	0.435 tCO ₂ /kWh	EMISSION FACTOR OF THE NATIONAL ELECTRICITY SYSTEM 2022	The validator confirms the source of the busy value.
EF _{CO2 GLP}	6.31x10 ⁻⁵ t/MJ	Emission factor of Secretaries Agreement, SEMARNAT	The validating team confirms the source of the busy value.
EF _{CO2 GN}	5.61x10 ⁻⁵ t/MJ	Emission factor of Secretaries Agreement, SEMARNAT	Validating equipment confirms the source of the occupied value.
V _{H2O}	120 l	Estimated volume of hot water consumed.	Use of measuring equipment in the connection pipe between the heater and the shower connection.
ΔT	(67-19.6) °C	Difference between water inlet temperature and outlet temperature.	Measured values.
Q _{ex}	5252.03 MJ	Useful heat delivered by the system	Obtained by RETScreen® Clean Energy Management Software modeling.

– **Parameters controlled ex post:**

The following parameters will be applied according to AMS-I.J. methodology: Solar water heating systems (SWH).

Parameter	Value	Description	Compliance
EF _{RED 2023}	Data Issued by the Energy Regulatory Commission	EMISSION FACTOR OF THE NATIONAL ELECTRICITY SYSTEM 2023	El equipo validador, confirma de acuerdo a la redacción del plan de monitoreo la obtención del dato en su futura emisión
EF _{RED 2024}	Data Issued by the Energy Regulatory Commission	EMISSION FACTOR OF THE NATIONAL ELECTRICITY SYSTEM 2024	El equipo validador, confirma de acuerdo a la redacción del plan de monitoreo la obtención del dato en su futura emisión
Q _{ex}	Data to be estimated	Useful heat delivered by the system	Dato que se obtiene diario o mensual, de acuerdo a la medición de la radiación solar.

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11 Conclusion of validation

11.1 Resolution of findings

N°	CAR, CL, FAR	Attention to the NC made by the Project developer.	Materiality (%):		Evidence shown in the attention to the NC	Date of closure of the NC (mm/dd/yy)
			before NC attention	after attention		
1	CL	<p>Findings: During the on-site validation, through interviews with the PP, the participation of the Government of the State of Guanajuato was mentioned as the main funding vector for the project and the route for the allocation of the same was observed. It is required to specify the budget allocation route within the DdP, this with the objective of demonstrating that it does not result in a detour of official development assistance.</p> <p>Response: Section 2.5 Additional GHG project information of the DdP has been described Project Budget Allocation.</p>	N.A.	N.A.	DdP Solar water heating systems – Guanajuato	Closed 04/03/2023
2	CL	<p>Finding: While the project developer applied laboratory tests to obtain energy from hot water consumption (16.3 MJ/day), it is important to stick to the selected method of the methodology "System Measurement Method". Therefore, it is important that the PP and the developer demonstrate evidence of the measurements, according to the sampling cited in the DdP. The lead validator observed traceability in terms of the quality of estimation of the variables of the baseline emission reduction estimation equation in such a way that the application of the applied assumption is validated, taking into account that throughout the life of the project it will have to be adjusted to the selected methodology.</p> <p>Response: The project developer changed the described method from the methodology to the Modeling method, obtaining a new useful heat value (5252.03 MJ). The Validation team performed the recalculation with the results of the modeling with the program used (RETScreen® Clean Energy Management Software).</p>	N.A.	N.A.	DdP Padrón calentadores solares.xlsx Solar water heating systems – Guanajuato	Closed 04/03/2023
3	CAR	<p>Findings: During the review to the project's DdP the additionality analysis was reviewed based on the CDM tool "TOOL 21 Demonstration of additionality of smallscale project activities", in which only the analysis of the investment barrier was performed, however, it should perform the analysis for all the barriers cited in the tool.</p> <p>Response: The Project Developer performed the analysis described in the tool "TOOL 21 Demonstration of additionality of smallscale project activities" contemplating all the points to be evaluated in the methodology.</p>	N.A.	N.A.	DdP Solar water heating systems – Guanajuato	Closed 04/03/2023
4	CL	<p>Findings:</p>	N.A.	N.A.	DdP	Closed 04/03/2023

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N°	CAR, CL, FAR	Attention to the NC made by the Project developer.	Materiality (%):		Evidence shown in the attention to the NC	Date of closure of the NC (mm/dd/yy)
			before NC attention	after attention		
		During the on-site validation, through interviews and review of information the start of the project was reported, it is important to clarify in the DdP the start date of the project as the start date of execution or construction or actual action of the project activity and the documents supporting the start of operations. Response: The Project Developer clarified in the DdP the Project start date and supporting document described in item 3.2.3 Time Limits and Periods of Analysis of the DdP.			Solar water heating systems – Guanajuato	
5	CL	Finding: During the DdP review there is no reference to measurement uncertainty for the SWH system energy determination. Response: The Project Developer makes reference to the uncertainty of the project measurements in the DdP in item 3.5 Uncertainty Management.	N.A.	N.A.	DdP Solar water heating systems – Guanajuato	Closed 04/03/2023
6	CAR	Findings: During the review of the DdP the information regarding the Monitoring Plan was reviewed, in this the schedule (periodicity) of the verifications to be performed to the project was not found. Response: The Project Developer placed the periodicity of the verifications that the Project will undergo.	N.A.	N.A.	DdP Solar water heating systems – Guanajuato	Closed 04/03/2023
7	CL	Finding: During the on-site validation it was observed that the PP performs a stakeholder consultation analysis, however, in the DdP it is mentioned that it has not yet been performed. Response: The Project Developer contemplates the stakeholder consultation performed by the Project Proponent in the DdP.	N.A.	N.A.	DdP Solar water heating systems – Guanajuato	Closed 04/03/2023
8	CAR	Findings: During the documentary validation it was observed that, the calculation tool has a tracking error in the formula for the calculation of CO ₂ emissions from natural gas, in addition, it is important to show the projection of the calculation of CO ₂ emissions for all the years of the project or in its case to place the clarification of the emissions (from year 2025 to 2030). Response: The Project Developer made the corrections to the estimated project emission reductions for natural gas fuel.	0.09	0.00	DdP Padrón calentadores solares.xlsx Solar water heating systems – Guanajuato	Closed 04/03/2023
% Total materiality						0.00

11.2 Validation opinion

Based on the risk-based validation approach and the evidence obtained as a result of the activities associated with the validation process and the attention to findings, the OVV GEI ANCE has reached the following conclusion:

The Greenhouse Gas Emissions reductions for the Solar water heating systems - Guanajuato Project prepared by the Secretaría de Medio Ambiente y Ordenamiento Territorial del Estado de Guanajuato and developed by Mercado Ambiental



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AP S.C. for the period of operations from 01/01/2021 to 12/31/2031, are substantially correct and the validated emissions reductions are a true representation of the information and emissions data below:

Net GHG emission reductions generated during the period: 56,248 t CO₂e

This Validation Report is issued based on a reasonable assurance level, which is guaranteed at a materiality level of less than 5%, specifically 0.00%, between the net emission reductions reported by the Project and the net reductions validated by the OVV-GEI-ANCE.

In conclusion, OVV-GEI-ANCE issues a positive opinion because there is sufficient or appropriate evidence to support a claim; there are no material misstatements, there is sufficient and appropriate evidence to support the emissions and the necessary data management controls are in place for emissions reduction reporting.

11.3 Facts discovered after validation

Based on the review of adequate and sufficient information, up to the date of issuance of the validation opinion, The Asociación de Normalización y Certificación, A.C. declares that no new facts or information have been found that could materially affect the Validation Opinion.

Excalibur Ernesto Acosta
Lead validator
Asociación de Normalización y Certificación, A.C.

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13 Document History (Validation Report)

Version	Date	Comments or changes
1.0	05.abril.2023	Versión inicial.
2.0	11.abril.2023	Se aplican cambios emitidos por el Desarrollador.