

GOLD STANDARD FOR THE GLOBAL GOALS (GS4GG) REPORT

-

DESIGN CERTIFICATION (RENEWAL)



Project Title:	Kocaeli Landfill Gas to Electricity Project
GS project ID:	GS 1013
Internal ID:	50322
Customer:	EKI Energy Services Limited
Project Participant/s:	Körfez Enerji San. ve Tic. A.S.
Date:	03/12/2024
Revision:	04

SUMMARY			
Reference No.	Date (first version)	Version No.	Date (last version)
A+SH_SYST_TQC_GS_RCP_50322	22/06/2023	04	03/12/2024
Client	EKI Energy Services Limited		
Project Title	Kocaeli Landfill Gas to Electricity Project		
Project Participants	Körfez Enerji San. ve Tic. A.S.		
Project Location	Kocaeli Province, Solaklar District, Marmara Region, Turkey.		
Contact Person	Mr. Ahmet Çiçekçi		
GS4GG Version: GS4GG v 1.2 GS4GG Activity Requirements: RE Activity Requirements, Version 1.4 Applied Methodology Version: ACM0001, Flaring or use of landfill gas (Version 19.0) The following tools and guidance's have been followed (References): - Methodological tool (EB 66, Annex 47) "Assessment of the validity of the original /current baseline and update of the baseline at the renewal of the crediting period." (Version 03.0.1)^{1/}. - Combined tool to identify the baseline scenario and demonstrate additionality (Version 07.0.0)² "Project emissions from flaring" Version 04.0³ "Tool to determine the mass flow of a greenhouse gas in a gaseous stream" version 03.0⁴ "Emissions from solid waste disposal sites" Version 08.0⁵ "Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation" Version 03.0⁶ "Applied Methodology Version for GS first Crediting period: ACM0001, Version 15.0.		GS4GG Sectoral Scope: 2 UNFCCC CDM Sectoral Scope: 1,13 Technical Area: 1.2,13.1	
GS4GG First PDD Version: 07 Date: 11/11/2022			
Estimated Annual SDG Impacts:			
Sustainable Development Goals Targeted	SDG Impact	Estimated Annual Average	
7 Affordable and Clean Energy	MWh of renewable energy generated	56,400 MWh/Year	
	Employees	10 employments	

¹ <https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-11-v3.0.1.pdf>

² <https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-01-v7.0.0.pdf>

³ <https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-06-v4.0.pdf>

⁴ <https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-08-v3.0.pdf>

⁵ <https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-04-v8.1.pdf>

⁶ <https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-05-v3.0.pdf>

8 Decent Work and Economic Growth	Trainings	01 training
13 Climate Action (mandatory)	Emission Reduction	225,495 tCO ₂ /year (GS VER)

Selected Sustainable Development Goals (SDGs): 7; 8; 13

Design Certification Summary

LGAI Technological Center, S.A. (hereafter referred to as Applus+ Certification) has been contracted by EKI Energy Services Limited to perform the GS Design Certification Renewal (Design Certification Renewal) of **"Kocaeli Landfill Gas to Electricity Project"** applying the methodology ACM0001, Version 19.0.

The management of Körfez Enerji San. ve Tic. A.Ş. is responsible for the preparation of the GHG emissions data and the reported GHG emission reductions.

A desk review, remote audit document review has been conducted to verify the data submitted in the GS4GG PDD. Applus+ Certification confirms the following have been reviewed:

- GS4GG approved Transition annex ^{/1/} and the corresponding validation report;
- The applied monitoring methodology^{/4/};
- Relevant decisions, clarifications and guidance from the CMP and the CDM Executive Board^{/5/ /6/};
- The Gold Standard for Global Goals "Principles and Requirements" Version 1.2^{/8/}.
- All information and references relevant to the project activity's resulting in estimated emission reductions.

The scope of the Design Certification Renewal is defined as an independent and objective review of the project design document, against the Kyoto Protocol requirements, UNFCCC rules, applicable CDM requirements and requirement of Gold Standard. The validation report is finalized based on the assessment of the Gold Standard GS4GG PDD, and applying standard auditing techniques including but not limited to document reviews, follow up actions (e.g., Remote audit, telephone or e-mail interviews) and also the review of the applicable approved methodology and underlying formulae and calculations.

The report and the annexed validation checklist describe a total number of 07 findings which include:

- 4 Corrective Action Requests (CARs);
- 3 Clarification Requests (CLs/CRs);
- 01 Forward Action Requests (FARs).

The PP has responded these findings by modifying the Gold Standard GS4GG PDD and providing adequate additional explanations and evidences. Applus+ Certification confirm that all the findings have been "closed out" before submitting the request for renewal to GS board (Renewal of Crediting period).

As a summary of the Design Certification Renewal, the review of the Gold Standard GS4GG PDD and the subsequent follow-up interviews have provided Applus+ Certification with sufficient evidence for the determination of the project's fulfilment with all stated criteria. In our opinion, the project meets all relevant UNFCCC requirements for the CDM and requirement of Gold Standard. Therefore, Applus+ Certification recommends the project for renewal of crediting period by the GS Registry as GS VER project.

ASSESSMENT TEAM		
Team Members	Type of Resource ⁷	Organization (for OEs)
Lead Auditor, Validator & GS approved Auditor: Mr. Atul Takarkhede	☐ IR ☐ EI ☒ OE	M/s True Quality Certifications Private Limited

⁷ IR (Internal Resource); EI (External Individual); OE (Outsourced Entity)

ASSESSMENT TEAM		
Team Members	Type of Resource ⁷	Organization (for OEs)
Technical Expert: Mr. Atul Takarkhede	☐ IR ☐ EI ☒ OE	M/s True Quality Certifications Private Limited
Local Expert: Dr. Yusuf Serengil	☐ IR ☐ EI ☒ OE	M/s True Quality Certifications Private Limited
Technical Reviewer: Mr. Denny Xue	☐ IR ☒ EI ☐ OE	-

In line with the GS Rule Update RU 2020 PR – PR V2 dated 19/09/2022, the VVB hereby discloses that the VVB has not performed verification of this project.

ABBREVIATIONS	
AMS	Approved Methodology Small Scale
Applus+ LGAI / Applus+	LGAI Technological Center, S.A. (Applus+ Certification)
BM	Build Margin
CAR	Corrective Action Request
CDM	Clean Development Mechanism
CDM EB	CDM Executive Board
CER	Certified Emission Reduction
CL / CR	Clarification Request
CM	Combined Margin
CMP	Conference of the Parties serving as the Meeting of the Parties to the Kyoto Protocol
DNA	Designated National Authority
DOE	Designated Operational Entity
EF	Emission Factor
EIA	Environmental Impact Assessment
ER	Emission Reduction
FAR	Forward Action Request
GHG	Greenhouse Gas(es)
GS4GG (or GS)	Gold Standard for Global Goals
IPCC	Intergovernmental Panel on Climate Change
KP	Kyoto Protocol
MP	Monitoring Plan
NGO	Non-Governmental Organization
Design Certification Renewal	Validation for Renewal of Crediting Period
SDG	Sustainable Development Goal
TAC	Gold Standard Technical Advisory Committee
OM	Operational Margin
PP	Project Participant
PS	Project Standard
PPA	Power Purchase agreement
TEIAS	Turkish Electricity Transmission Company
UNFCCC	United Nations Framework Convention for Climate Change
VVB	Validation and Verification Body
VVS	CDM validation and verification standard for project activities, Version 03.0

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Appendix 1: Corrective Action Request / Clarification Request / Forward Action Request resolution table.

Appendix 2: Audit Team CVs.

1. INTRODUCTION

EKI Energy Services Limited has commissioned Applus+ Certification to perform a Design Certification renewal of "Kocaeli Landfill Gas to Electricity Project" (hereafter referred to as the project activity). This validation report summarizes the findings of the Design Certification Renewal of the project, performed on the basis of UNFCCC criteria refer to Article 12 of the Kyoto Protocol, the CDM modalities and procedures and the subsequent decisions by the CDM/GS Executive Board as well as requirement of Gold Standard.

The project activity primarily aims at reducing Green House Gas (GHG) emissions through utilization of landfill gas recovery technology for generation of electrical energy. The electricity generated from the project activity (approximately 56,400 MWh annually) will displace equivalent electricity generation in grid connected power plants. The project activity will reduce the anthropogenic GHG emissions (approximately 225,495 tCO₂e annually) associated with the equivalent amount of electricity generation from Turkish national grid connected power plants predominantly fossil fuel based.

The project activity is operational with 5 sets of gas engines with a total capacity of 6.508 MW installed capacity and generated electricity has been delivered to the national electricity system through a transformer substation Kocaeli Province, Solaklar District, Turkey. Further, the total installed capacity of the project activity is estimated to reach 9.338 MW with total of 7 gas engines with a nominal capacity between 1.2 MW and 1.415 MW range VVB team verified the same with transition document ^{/1/} further remaining 2 engines will be installed in fourth quarter of financial year of 2023. The project activity is in line with the sustainable development priority of the country. The electricity generated from the landfill plant is sale to Turkish national grid.

Project has gone through a design change process (approved in 2015) since the registration of the project activity. The registered capacity of project activity from 2 gas engines with 2.4 MW capacity was increased to 7 gas engines with total capacity of 9.338 MW.

The start date of project activity is 22/03/2011 and the start date of the second crediting period of the project is from 01/03/2019 to 28/02/2026.

Assessment team checked the technical parameters of the project equipment during remote audit and confirm that the details as mentioned in the GS PDD submitted for 2nd CP are correct.

Technology Transfer

No technology transfer from other countries is involved in the project.

The project activity is Landfill Gas recovered from solid waste disposal site (SWDS) - Solaklar Landfill Area in Solaklar District, Kocaeli Province Project and utilized by gas engines to produce electricity which will be delivered to national grid.

The project activity is commissioned on 01/03/2012^{/20/}. Same is verified from the commissioning certificate issued by State government agency.

The details of geo-coordinates are cross-checked during remote audit via google maps and are as below:

Latitude : 40°47'14.83" N, Longitude : 30° 1' 33.60" E

1.1 Objective

The purpose of the Design Certification Renewal is to have an independent third-party assessment of the GS4GG PDD for renewal of crediting period and compliance with the GS requirements as described in the Gold Standard documentation and supporting documents by the client. Validation is part of the GS VER project cycle and will finally result in a conclusion by Applus+ Certification whether a project activity is valid and should be submitted for registration/renewal of crediting period of a project activity rests at the GS and the Parties involved.

1.2 Scope

The Design Certification Renewal scope is defined as an independent and objective review of the project PDD, the project's baseline study and monitoring plan and other relevant documents. The information in these documents is reviewed against all applicable GS requirements including the approved baseline and monitoring methodology ACM0001, Version 19.0. The validation was based on the requirements in the Gold Standard GS4GG requirement^{/13//8//4/}.

The validation is not meant to provide any consulting towards the project participants. However, stated requests for clarifications and/ or corrective actions may have provided input for improvement of the PDD.

2. METHODOLOGY

The project assessment is based on the CDM validation and verification standard for project activities, Version 03.0^{/6/} Gold Standard requirement for GS4GG and is conducted using standard auditing technique^{/24/} to assess the correctness of the information provided by the project participants. Before the assessment begins, members of the team covering the technical scope(s), sectoral scope(s), and relevant host country experience for evaluating the project activity are appointed. Once the project is made available for Applus+ Certification, the members of the assessment team carried out:

1. A desk review of the PDD;
2. Follow-up interviews with project stakeholders;
3. The resolution of outstanding issues and the issuance of the final validation report and opinion.

The prepared validation report and other supporting documents then undergo an internal quality control before being submitted to the GS Registry.

The GS overview documents which is referred as DVR is as below

Validation Checklist Table 3: Resolution of Audit Findings					
Type:	☐ CAR	☐ CL/CR	☐ FAR	Number:	
Raised by:					
Description of the audit finding				Date:	
The description of the audit finding should be clearly included here.					
Project Participant's response				Date:	

The responses given by the project participants during the communications with the validation team should be included here.		
Documentation provided as evidence by Project Participant		
The evidences provided by the project participants should be included here.		
Auditor's assessment comment	Date:	
This section should include how the audit finding is assessed by the assessment team.		

The Complete List of CAR/CL/FAR is included as Appendix 1 of this report.

2.1 Appointment of the assessment team

According to the applicable sectoral scope / technical area and experience in the sectoral or national business environment, Applus+ Certification has composed an assessment team in compliance with the Contract Review and Assessment Team appointment rules in the internal Quality Management System of Applus+ Certification as well as in compliance with the applicable requirements in the Accreditation Standard.

The composition of the Assessment Team (Applus+ Certification's validation team) has been approved by Applus+ Certification during the Contract Review process ensuring that the required skills and capabilities are covered.

The qualification levels for Assessment Team members that are assigned by aforementioned appointment rules are as presented below:

- Lead Auditor (LA).
- Auditor (A)/Validator/Verifier.
- Technical Expert (TE).
- Technical Reviewer (TR).
- Country Expert (CE)/Local Expert (LE).
- Other supporting roles such as Financial Expert (FE), GS Approved Auditor.
- Any of the above-mentioned roles in training (iT, e.g. AiT for auditor in training/TEiT for Technical Expert in Training).
- .

The Sectoral Scopes / Technical Areas required knowledge linked to the applied methodology(ies) is covered by the Assessment Team as shown below:

Name	Role	SS Coverage	TA Coverage	Financial aspect	Host country experience
Mr. Atul Takarkhede	Lead Auditor, Validator, GS approved auditor	YES	YES	YES	YES

Name	Role	SS Coverage	TA Coverage	Financial aspect	Host country experience
Dr. Yusuf Serengil	Local Expert	NA	NA	NA	YES
Mr. Denny Xue	TR	YES	YES	YES	NA

The complete list of CVs is included as Appendix 2 of this report.

2.2 Document review

The Gold Standard PDD submitted by the Client was reviewed against the approved methodology and other relevant criteria to verify the correctness, credibility, and interpretation of the presented information. Furthermore, a cross-check between information provided and information from other sources has been done. A complete list of all documents and evidence material reviewed is included in Section 4 of this report.

2.3 Follow up Interviews

On-site visit has not been conducted for the renewal of crediting period of the project activity as not mandatory at the validation (Design Certification or Design Certification Renewal) of a project.

Therefore, physical site visit was not performed for validation of this project and exemption has been considered in compliance with site visit and remote audit requirement and procedures version 1.0⁸, VVB used audit technique for remote audit. It is worthwhile to note that PP already lost carbon credit revenue to delay in Design Certification Renewal process and postponement of validation may impact the investment plan of the PP and could lead to significant financial implications.

In order to allow a credible and sufficient means for the present validation, the VVB adopted standard auditing techniques for validation in line with GS4GG interim guidelines, as follows:

- Short video tour during remote audit
- Current pictures of plan and all the equipment
- Document review
- Interview with PP representatives (responsible for the management and monitoring of project activity), and
- Interview with stakeholders

Therefore, PP have provided all necessary information for a transparent and precise understanding of the project and has been considered sufficient by the VVB for the purpose of the present validation of RCP.

Interviewed Personnel	Functions	Organization
Mr. Ahmet Çiçekçi	Manager	Körfez Enerji
Yusuf Enön	Plant Manager	Kocaeli LFG

⁸ Para 3.2.1, https://globalgoals.goldstandard.org/112_par_site-visit-and-remote-audit-requirements-and-procedures

Mücahit Bayam	Gas Operations Engineer	Kocaeli LFG
Pankaj Rajpoot	Manager (Operations)	EKI Energy
Ayşegül Kılıç	Manager (Operations)	EKI Energy
Ünal Turan	-	Local stakeholder
Mukhtar Durhasan	-	Local stakeholder
Mr. Ata Ergun	-	Local stakeholder
Mr. Dio Dede	-	Local stakeholder

The details activity done during remote audit is as below:

Duration of Remote Audit: 09/12/2022				
No.	Activity performed during remote audit	Site location	Date	Team member
1.	Assessment team checked the implementation of the project, Baseline emission, Emission reduction calculation, technical description of the project and Monitoring. (Discussion with PP) Assessment team interviewed the local stakeholder and confirmed that there is no grievance resulted from the project activity in and out of the project location. The stakeholder confirmed that the project resulted in employment and improves lifestyles of the personal/families in the nearby villages. (Discussion with Stakeholder)	Kocaeli Province, Solaklar District, Turkey. (Remote audit through Skype)	09/12/2022	Mr. Atul Takarkhede

The stakeholder interaction during remote audit is described below:

Name of the stakeholder	Mr. Ata Ergun
Occupation	Employee/Villager
DOE QUESTION: Did this Landfill project plant cause any pollution? Answer: No, the plant does not cause any pollution. DOE QUESTION: Did local villagers getting benefitted due to project activity? Answer: Yes, peoples are getting benefitted through CSR activities. Company providing various trainings to youths and also helping local schools for buildings and study material etc. DOE QUESTION: Did PP promised employment opportunity?	

Answer: Yes, employment is generated for local peoples. The Landfill plant and electricity generation plant have provided various direct and indirect employment opportunities to the locals.

DOE also like to conclude that during the interviews with PP, that local people were employed for security and operation related work. VVB also found that skilled local persons were also employed by the organization for the operation and maintenance of the power plant.

Name of the stakeholder	Mr. Dio Dede
Occupation	Employee/Villager
DOE questions: Did the power plant discharge any harmful pollutants? Answer: NO the plant does not discharge any harmful pollutants. DOE questions: What are other benefits from plant? Answer: Electricity availability increased, locals getting various jobs like technical & non-technical and CSR activities increased. DOE thus conclude that stakeholders are happy with the implementation of the project activity.	

VVB also discussed labour conditions at project site during remote audit by means of interviewing local stakeholders and confirmed that PP is in compliance with national labour code/ national labour and occupational health and safety laws and no major accidents recorded at project site. All the employees at project site also given training on Occupational health and safety issues regularly

2.4 Resolution of Clarification and Corrective Action requests

The objective of this phase of the Design Certification Renewal was to resolve the requests for corrective actions and clarification and any other outstanding issues which needs to be clarified for Applus+ Certification positive conclusion on the PDD. The Corrective Action Requests and Clarification Requests raised by Applus+ Certification were resolved during communications between the Client and Applus+ Certification to guarantee the transparency of the validation process, the concerns raised and responses given are summarized in Appendix 1 below.

The Gold Standard GS4GG PDD version 11^{/2/} was submitted on 08/11/2024 for renewal of crediting period serves as the basis for the final assessment presented. Additional changes to the GS4GG PDD during the Design Certification Renewal process are not considered to be significant with respect to the main CDM and Gold Standard objectives.

2.5 Internal Quality Control

As a final step for Validation of RCP assessment, the final documentation, including the Validation of RCP Report, has to undergo an internal quality control by the Technical Reviewer(s) to be approved.

Details of the Technical Reviewer(s) are provided within the Validation of RCP Report in Section 2.1. and Appendix 2 for further references of knowledge and capability to conduct the quality checking.

After the Technical Review process, the final documentation may undergo a final quality checking process called Administrative Review, done by the Applus+ Certification's Project Manager and/or Technical Support.

For final approval, the final set of documents are prepared by the VVB's Technical Manager or its deputy and signed by the authorized signatory of the VVB.

In case any of the persons performing this final internal quality, control approval process has acted as a part of the Assessment Team or Technical Review team, the approval can only be given by VVB's authorized personnel who are not part of those teams.

If the final set of documents has been satisfactorily approved, a request of renewal of the Crediting Period (GS4GG Design Certification Renewal) is submitted to the GS Registry along with the relevant documents.

3. PROJECT DESIGN CERTIFICATION ASSESSMENT

3.1 Approval

The host country of the project activity is Turkey which is validated from the GS approved PDD available on GS portal. The Republic of Turkey is the host country. Turkey has ratified the Kyoto Protocol (on 28/05/2009⁹). Turkish National Focal Point to the UNFCCC is the Ministry of Environment and Forestry.

3.2 Participation

Körfez Enerji San. Ve Tic. A.S. is the project proponent from the host party Turkey. The host country involved is parties to the Kyoto Protocol and meet and requirements to participate in the Gold Standard.

3.3 Scale of the project

The project activity is identified as a Large-scale project in section A.4 of the GS4GG PDD applying a Large-scale methodology ACM0001, Version 19.0^{4/}. The total capacity of the power project is Project has an operational installed capacity of 6.508 MW and planned total capacity of 9.338 MW as validated from the GS4GG approved PDD^{01/}, since annualized emission reduction from the project activity of 225,495 tCO₂e/annum is higher than small-scale threshold of 60,000 tCO₂e per year in any year of the crediting period therefore the project activity complies to the large-scale project activity. Assessment team also checked the requirement of latest applicable methodology ACM0001, Version 19.0^{4/} and confirms that the project qualifies the requirement of the latest methodology also (i.e., scale, applicability, baseline, additionality and monitoring).

a) Type of project: The project type is Waste Handling and Disposal unit which is an eligible project type as it is in accordance with 1.2.2 of the Eligible Project Types & Scope under Gold

⁹ <https://unfccc.int/node/61221>

Standard for The Global Goals Community Services Activity Requirements. The project applies methodologies Approved consolidated baseline methodology ACM0001: Flaring or use of landfill gas Version 19.0.

General Eligibility Criteria under Renewable Energy Activity Requirements:

Assessment team reviewed the general eligibility criteria under Renewable Energy Activity Requirements, Version 1.4^{13/} and found that criteria appropriately provided & justified in the Section A.1.1 of the GS PDD.

General Eligibility Criteria under GHG Emissions Reduction & Sequestration Product Requirements v.2.3:

Assessment team reviewed the general eligibility criteria under GHG Emissions Reduction & Sequestration Product Requirements and found that the project activity meets criteria of the requirements.

- The project ongoing financial need is sufficiently justified in the GS4GG PDD as per para 7.2.1 and 7.2.2, GHG EMISSIONS REDUCTIONS & SEQUESTRATION PRODUCT REQUIREMENTS.
- Project activity applied latest version of the GS approved methodology.
- Project falls under the small scale category.
- The project activity has not been registered under other voluntary GHG schemes and PP has submitted declaration in effect that double counting of emission reduction will be avoided during issuance of VERs.

3.4 Greenhouse Gases

The project activity leads to displacement of electricity generation from fossil fuel-based power plants connected to the regional grid by renewable energy generated using waste handling and disposal. The operation of the project activity will result in reduction of carbon-dioxide/methane from the atmosphere due to displacement of electricity in grid by the renewable energy. Hence, the greenhouse gas identified in the PDD is carbon dioxide and methane which is duly validated by the VVB.

The GHG emission sources considered for the project boundary and their explanations are as follows:

Source		Gas	Included	Justification/Explanation
Baseline	Emissions from Decomposition of waste at the SWDS site	CH ₄	Yes	The major source of emissions in the baseline
		N ₂ O	No	N ₂ O emissions are small compared to CH ₄ emissions from SWDS. This gas is conservative.
		CO ₂	No	CO ₂ emissions from the decomposition of organic waste are not accounted.
	Emissions from electricity generation	CO ₂	Yes	Main emission source
		CH ₄	No	Excluded for simplification. This is conservative
		N ₂ O	No	Excluded for simplification. This is conservative

Source	Gas	Included	Justification/Explanation
Emissions from heat generation	CO ₂	No	Excluded. Major emission source if heat generation is included in the project activity
	CH ₄	No	Excluded for simplification. This is conservative
	N ₂ O	No	Excluded for simplification. This is conservative
	CO ₂	No	Excluded for simplification. This is conservative
	CH ₄	No	Excluded. Major emission source if supply of LFG through a natural gas distribution network, dedicated pipeline or using trucks is included in the project activity
	N ₂ O	No	Excluded for simplification. This is conservative
Project activity	CO ₂	No	Excluded. May be an important emission source
	CH ₄	No	Excluded for simplification. This emission source is assumed to be very small
	N ₂ O	No	Excluded for simplification. This emission source is assumed to be very small
	CO ₂	Yes	May be an important emission source
	CH ₄	No	Excluded for simplification. This emission source is assumed to be very small
	N ₂ O	No	Excluded for simplification. This emission source is assumed to be very small
	CO ₂	No	Emissions considered negligible
	CH ₄	Yes	May be an important emission source
	N ₂ O	No	Emissions considered negligible
	CO ₂	No	Excluded. May be an important emission source
	CH ₄	No	Excluded. May be an important emission source.
	N ₂ O	No	Emissions considered negligible
	CO ₂	No	Excluded. May be an important emission source
	CH ₄	No	Excluded. May be an important emission source.
	N ₂ O	No	Emissions considered negligible

3.5 Project timeframe

Other certification scheme: The project activity has not applied, confirmed by project developer, for any other certification like Green or White certification. Therefore, the validation team concluded that the project activity meets the applicability criteria of Gold Standard. Assessment team checked the double counting clarification guide GS guideline on double counting in the context of Green Certificate Schemes. A declaration dated 11/11/2022 submitted by PP confirms that the project activity is not claiming GHG reduction in any other mechanism. The project is applied for GS VER retroactive validation. Further, project activity is also not availing any International REC benefits.

3.6 Public announcement

Assessment team is in opinion, taking note of the validation report and PDD that the incentive in the form of carbon credits was seriously considered in the decision to proceed with the project activity. The project is registered under GS mechanism¹⁰.

3.7 Project Boundary

As per ACM0001, Version 19.0 (Latest methodology applied as available on CDM web site) - "The project boundary of the project activity shall include the site where the LFG is captured and Sites where the LFG is flared or used (e.g., flare, power plant, boiler, air heater, glass melting furnace, kiln, natural gas distribution network, dedicated pipeline or biogas processing facility).".

The project boundary includes the following: -

- Site where the LFG is captured;
- Site where the LFG is flared and used;
- Power generation sources connected to the grid, which are supplying electricity to the project activity;
- Power generation sources connected to the grid, which are supplying electricity in the baseline that is displaced by electricity generated by captured LFG in the project activity.

PD has clearly defined and identified the project boundary correctly which is checked and accepted by VVB.

Further, the geographic and system boundaries for the relevant electricity grid can be clearly identified and information on the characteristics of the grid is available as required by the "Tool to calculate the emission factor for an electricity system" (version 07.0). The electricity produced on-site will be delivered to the Turkish national grid.

3.8 Baseline Identification

This is 1st renewal of crediting period and PD has established baseline as per the registered GS PDD version 06 dated 31/10/2014¹¹ which is validated by VVB through its validation report ¹¹.

PD has discussed baseline scenario identification in the current GS PDD also which was checked against applicable methodologies and tools and found correct and hence accepted.

As this is renewal of crediting period, VVB need to access PD's demonstration of the validity of baseline in line with Tool 11 for "Assessment of the validity of the original/current baseline and update of the baseline at the renewal of the crediting period" Version 03.0.1.

The evaluation of the original baseline is performed in 4 steps, namely:

Step 1 Step 1: Assess the validity of the current baseline for the next crediting period The CDM PS requires assessing the impact of new relevant national and/or sectoral policies and circumstance on the baseline. The validity of the current baseline is assessed using the following sub-steps.

¹⁰ <https://registry.goldstandard.org/projects/details/92>

- **Step 1.1 Assessment of compliance of the baseline with relevant mandatory national and/or sectoral policies** – PD has clearly demonstrated in section B.4 that the original baseline complies with all relevant national and sectoral policies. PP has referred the following policies which were cross checked to confirm that the current baseline complies with all relevant mandatory national and/or sectoral policies which have come into effect after the submission of the project activity for validation or the submission of the previous request for renewal of the crediting period and are applicable at the time of requesting renewal of the crediting period:
 - Electricity Market Law¹¹
 Law on Utilization of Renewable Energy Resources for the Purpose of Generating Electricity Energy¹²
 - Environmental Law¹³
 - Regulation on Solid Waste Control¹⁴
 - Regulation on Managed Waste Landfilling¹⁵
- **Step 1.2 Assessment on impact of circumstances** – the evaluation is based on 3 relevant aspects, i.e., legislation and policy environment, electricity sales prices, and similar project activities, revealing that the conditions used to determine the baseline emissions in the 1st crediting period are still valid at the time of requesting the renewal of the current crediting period. VVB has assessed the impact of circumstances and it is noted that baseline emission factor needs to be re-calculated which is calculated as per “Tool to calculate the emission factor of an electricity system” version 07.0/^{12/} and no other impact of circumstances is applicable.
- **Step 1.3 Assessment whether the continuation of use of current baseline equipment(s) or an investment is the most likely scenario for the crediting period for which renewal is requested** – the step has been correctly noted as not relevant for the project activity as the technical life time of the equipment that would have continued to be used in the absence of the project activity exceeds the crediting period for which renewal is requested.
- **Assessment of the validity of the data and parameters** – PD has evaluated validity of the implemented data and parameters and concluded that the Global Warming Potential for CH₄ as well as the ex-ante determined combined margin emission factor for the 1st crediting period shall be updated for the requested renewal period.

Step 2: Update the current baseline and the data and parameters

Step 2.1: Update the current baseline

The baseline emission have been updated for this crediting period, without re-assessing the baseline scenario, based on the latest approved version (version 19.0) of methodology ACM0001 applicable to project activity taking into account the sectoral policies and circumstances that are applicable at the time of request for renewal of the crediting period.

¹¹ [Law Number: 4628 Ratification Date: 20/02/2001 Enactment Date: 03/03/2001] Reference: The official web page of EMRA; http://www.epdk.org.tr/mevzuat/kanun/elektrik/elektrik_piyasalari_kanunu.pdf

¹² [Law Number: 5346 Ratification Date: 10/05/2005 Enactment Date: 18/05/2005] Reference: The official web page of EMRA; <http://www.epdk.org.tr/mevzuat/diger/venilenebilir/venilenebilir.doc>

¹³ [Law Number: 2827 Ratification Date: 09/08/1983 Enactment Date: 11/08/1983] Reference: The official web page of the Ministry of Environment and Forestry; www.cevreorman.gov.tr/yasa/k/2872.doc

¹⁴ [Last updated on 05/04/2005] Reference: The official web page of the Ministry of Environment and Forestry; <http://www.cygm.gov.tr/CYGM/Files/mevzuat/yonetmelik/kaky.doc>

¹⁵ [Regulation number 27533 Enactment Date: 26/03/2010] Reference: The official web page of the Ministry of Environment and Forestry; http://www.cygm.gov.tr/CYGM/Files/mevzuat/yonetmelik/Duzenli_Depolama.doc

Step 2.2: Update the data and parameters

PD has updated the emission factor in accordance with "Tool to calculate the emission factor for an electricity system".

The emission factor updated $EF_{grid,OM,y}$, $EF_{grid,BM,y}$ and $EF_{grid,CM,y}$ as per turkey national electric network emission factor data sheet 2020.

The validation team confirmed that the applied data and parameter are latest available at the time of the project participant requesting renewal of the crediting period and valid for calculation of baseline grid emission factor of the third crediting period.

Therefore, it has been concluded that there is no need to update the original baseline scenario and is valid for the 2nd crediting period, though data and parameters shall be updated.

3.9 Eligibility Principles Assessment

- **Principle 1. Contribution to Climate Security & Sustainable Development**

The Republic of Turkey is the host country. Turkey has recently ratified the Kyoto Protocol (28/05/2009). Turkish National Focal Point to the UNFCCC is the Ministry of Environment and Forestry. Thus, the project's contribution towards sustainable development has been addressed based on the following sustainable development aspects:

I. Social well-being:

Implementation of this project enhance local employment during the construction and operation of landfill gas capture and its utilization. As a result, increased job opportunities and project trade activities partially eliminated local poverty and unemployment. As a contribution of the Project to the region's welfare, the quality of the electricity consumed in the region is increased by local electricity production, which also contributes to decreasing distribution losses.

II. Economic well-being:

Implementation of the project will accelerate the growth of the LFG capture and its utilization projects. Other entrepreneurs, irrespective of the sector, are encouraged to invest in this sector. It also assists in reducing Turkey's increasing energy deficit and diversify the electricity generation mix while reducing import dependency. Importantly, rural development is maintained in the areas around the project site by providing infrastructural investments to these remote areas.

III. Environmental well-being:

The project activities replace the grid electricity, which comprises different fuel sources causing greenhouse gas emissions. By substituting in the consumption of these fuels, it contributes to the conservation of water, soil, flora, and faunas. It transfers these natural resources and the additional supply of these primary energy sources to future generations. In the absence of the project activity, an equivalent amount of electricity would have been generated from the power plants connected to the grid, most of which are based on fossil fuels. Thus, the Project is replacing the greenhouse gas emissions (CO_2 , CH_4) and other pollutants (SO_x , NO_x , particulate matters) from extraction, processing, transportation, and burning of fossil fuels for power generation connected to the national grid.

IV. Technological well-being:

Implementation of the project contributes to the broader deployment of technology at a local and national level. It demonstrates the viability of the technology that supports improved energy security, alternative sustainable energy, and renewable energy industry development. This will also strengthen the pillars of the Turkish electricity supply based on ecologically sound technology.

Project Developer has also submitted SDG impact tool assessment which was checked by the assessment team and it could be confirmed that the project shall lead to contribution for SDGs 7, 8, and 13 mentioned which has been found appropriate as per observations made during the remote site inspection.

Principle 2: Safeguarding Principles

The Safeguarding principles assessment is as below:

Assessment Questions/ Requirements	Assessment of relevance to the project (Yes / potentially / no)	Justification of the Assessment team.	Mitigation Measures added to the Monitoring Plan (if required)
Principle 1. Human Rights			
1. The Project Developer and the Project shall respect internationally proclaimed human rights and shall not be complicit in violence or human rights abuses of any kind as defined in the Universal Declaration of Human Rights 2. The Project shall not discriminate with regards to participation and inclusion	Yes	The Project adheres to the internationally proclaimed human rights and is not in conflict in violence or human right abuses of any kind as defined in the Universal Declaration of Human Rights. Turkey is a party to the Universal Declaration of Human Rights, therefore does not violate these rights. The Project is not in conflict with the economic livelihood or other issue of the local community. Thus, the Project does not cause any human rights abuse and respects internationally proclaimed human rights issue. HR policy of the PP is in place which adheres to the human rights issues. Further, the Project meets the local labour law requirements thus does not cause any human rights abuse. Project activities are not expected to cause any human rights abuse. As a member of United Nations and part of UN Agreement on Human Rights, it is ensured by law in Turkey	Not required

Assessment Questions/ Requirements	Assessment of relevance to the project (Yes / potentially / no)	Justification of the Assessment team.	Mitigation Measures added to the Monitoring Plan (if required)
		that no action can be taken against human rights ¹⁶ . The Project shall not discriminate with regards to participation and inclusion. There is no conflict between the internationally proclaimed human rights including dignity, cultural property and uniqueness of indigenous people and the project activity.	
Principle 2. Gender Equality			
1. The Project shall not directly or indirectly lead to/contribute to adverse impacts on gender equality and/or the situation of women 2. Projects shall apply the principles of non-discrimination, equal treatment, and equal pay for equal work 3. The Project shall refer to the country's national gender strategy or equivalent national commitment to aid in assessing gender risks 4. (where required) Summary of opinions and recommendations of an Expert Stakeholder(s)	Yes	1. The Project is not in conflict with the economic livelihood of the local community and does not decrease women's access to or control of resources. Turkey, as one of the member states of the Council of Europe, aims to implement the Council of Europe Gender Equality Strategy 2018-2023. "Achieving gender equality is central to the fulfilment of the Council of Europe's mission: safeguarding human rights, upholding democracy and preserving the rule of law. Gender equality entails equal rights for women and men, girls and boys, as well as the same visibility, empowerment, responsibility and	Not required

¹⁶ <https://www.mevzuat.gov.tr/MevzuatMetin/1.5.6701.pdf>

Assessment Questions/ Requirements	Assessment of relevance to the project (Yes / potentially / no)	Justification of the Assessment team.	Mitigation Measures added to the Monitoring Plan (if required)
		participation, in all spheres of public and private life. It also implies equal access to and distribution of resources between women and men". 2. The project does not involve and is not complicit in any form of discrimination based on gender, race, religion, sexual orientation, or any other basis and promotes gender equality and the empowerment of women. Turkey is party to Convention on Discrimination 17 since 1972 to prevent any form of discrimination. Furthermore, the Project applies the relevant conventions, laws, commitments and strategies. Hence, it has been designed in accordance with the principles of non-discrimination, equal treatment, and equal pay for equal work. 3. The project does not involve in any form of discrimination. Turkey ratified ILO100 Equal Remuneration Convention and Discrimination (Employment and Occupation) Convention. Turkey, as	

¹⁷ https://treaties.un.org/Pages/ViewDetails.aspx?src=TREATY&mtdsg_no=IV-2&chapter=4#EndDec

Assessment Questions/ Requirements	Assessment of relevance to the project (Yes / potentially / no)	Justification of the Assessment team.	Mitigation Measures added to the Monitoring Plan (if required)
		one of the 57 participating states of Organization for Security and Cooperation in Europe (OSCE), is a party to the following OSCE commitments: Ministerial Council Decision No. 14/04 - 2004 OSCE Action Plan for the Promotion of Gender Equality ¹⁸ .	
Principle 3. Community Health, Safety and Working Conditions			
The Project shall avoid community exposure to increased health risks and shall not adversely affect the health of the workers and the community	Yes	The project owner is committed to the safe and healthy working conditions during all phases of the project. All employees have attended trainings regarding health & safety. This issue is protected by Occupational Health and Safety Law of Turkey, related regulations ¹⁹ and also by the UN Agreement on Human Rights ²⁰ . Project decreased health risks for workers and local community.	EHS training will be provided to all the employees during operation phase of the project
Principle 4.1 Sites of Cultural and Historical Heritage			
Does the Project Area include sites, structures, or objects with historical,	No	No cultural and historical heritage exists on the project site. The project	Not required

¹⁹ <https://www.mevzuat.gov.tr/mevzuat?MevzuatNo=6331&MevzuatTur=1&MevzuatTertip=5>

²⁰ <https://www.ohchr.org/en/countries/enacaregion/pages/trindex.aspx>

Assessment Questions/ Requirements	Assessment of relevance to the project (Yes / potentially / no)	Justification of the Assessment team.	Mitigation Measures added to the Monitoring Plan (if required)
cultural, artistic, traditional or religious values or intangible forms of culture?		area does not fall under UNESCO Cultural heritage sites. Cultural and environmental heritage is protected against alteration, damage or removal by the law.	
>>			
Principle 4.2 Forced Eviction and Displacement			
Does the Project require or cause the physical or economic relocation of peoples (temporary or permanent, full or partial)?	No	The project has received the necessary approvals from the local authorities and does not lead to any resettlement. The project activity does not have any major impact on land use patterns. In accordance with Article 1 of the International Covenant on Economic, Social and Cultural Rights the program does not complicit in resettlement. Thus, this project does not cause the physical or economic relocation of peoples.	Not required
>>			
Principle 4.3 Land Tenure and Other Rights			
a. Does the Project require any change, or have any uncertainties related to land tenure arrangements and/or access rights, usage rights or land ownership?	No	The project does not involve any change in land tenure arrangements. Thus, this project does not cause the physical or economic relocation of peoples.	Not required
b. For Projects involving land use tenure, are there any uncertainties with regards to land tenure, access rights, usage rights or land ownership?			
>>			

Assessment Questions/ Requirements	Assessment of relevance to the project (Yes / potentially / no)	Justification of the Assessment team.	Mitigation Measures added to the Monitoring Plan (if required)
Principle 4.4 - Indigenous people			
Are indigenous peoples present in or within the area of influence of the Project and/or is the Project located on land/territory claimed by indigenous peoples?	No	No indigenous people is present in or within the area of influence of the Project nor is the Project located on land/territory claimed by indigenous people.	Not required
>>			
Principle 5. Corruption			
1. The Project shall not involve, be complicit in or inadvertently contribute to or reinforce corruption or corrupt Projects	Yes	The project is landfill management and power generation activity and does not contribute to or reinforce corruption of any kind. Turkey as the project's host country has ratified the United Nations Convention against Corruption on 09/11/2006 ²¹ . Organisation Policy is in place which prohibits indulgence in any kind of corruption to their employees. The project abides by the United Nations Convention Against Corruption.	Not required
Principle 6.1 Labour Rights			
a. The Project Developer shall ensure that all employment is in compliance with national labour	Yes	1. The project owner is committed to the safe and healthy working conditions during all phases of the project.	Safe and healthy working conditions will be provided

²¹ https://treaties.un.org/Pages/ViewDetails.aspx?src=IND&mtdsq_no=XVIII-14&chapter=18&clang=en

Assessment Questions/ Requirements	Assessment of relevance to the project (Yes / potentially / no)	Justification of the Assessment team.	Mitigation Measures added to the Monitoring Plan (if required)
occupational health and safety laws and with the principles and standards embodied in the ILO fundamental conventions b. Workers shall be able to establish and join labour organisations c. Working agreements with all individual workers shall be documented and implemented and include: i. Working hours (must not exceed 48 hours per week on a regular basis), AND ii. Duties and tasks, AND iii. Remuneration (must include provision for payment of overtime), AND iv. Modalities on health insurance, AND v. Modalities on termination of the contract with provision for voluntary resignation by employee, AND vi. Provision for annual leave of not less than 10 days per year, not including sick and casual leave.		All employees will attend trainings regarding health & safety. This issue is protected by Labour Law ²², Occupational Health and Safety Law, related regulations and Human Rights. 2. Workers can establish and join labour organizations. 3. Working agreements with all individual workers documented and implemented and includes through Regulation on Working Hours Regarding Labour Law²³: (a) Working hours (must not exceed 45 hours per week on a regular basis), and (b) Duties and tasks, and (c) Remuneration (must include provision for payment of overtime), and (d) Modalities on health insurance, and (e) Modalities on termination of the	along with EHS trainings to the employees.

²² <https://www.mevzuat.gov.tr/mevzuat?MevzuatNo=4857&MevzuatTur=1&MevzuatTertip=5>

²³ <https://www.mevzuat.gov.tr/mevzuat?MevzuatNo=5447&MevzuatTur=7&MevzuatTertip=5>

Assessment Questions/ Requirements	Assessment of relevance to the project (Yes / potentially / no)	Justification of the Assessment team.	Mitigation Measures added to the Monitoring Plan (if required)
d. No child labour is allowed (Exceptions for children working on their families' property requires an <u>Expert Stakeholder</u> opinion) e. The Project Developer shall ensure the use of appropriate equipment, training of workers, documentation and reporting of accidents and incidents, and emergency preparedness and response measures		contract with provision for voluntary resignation by employee, and (f) Provision for annual leave of not less than 10 days per year, not including sick and casual leave. 4. The project owner and their subcontractors complying with all relevant national laws. The project owner will not employ children in any shape or form for their works. Turkey has ratified ILO 138 Minimum Age Conventions and 182 Worst Forms of Child Labour Convention²⁴. 5. The Project proponents will ensure the use of appropriate equipment, training of workers, documentation and reporting of accidents and incidents, and emergency preparedness and response measures.	
Principle 6.2 Negative Economic Consequences			

²⁴ http://www.ilo.org/dyn/normlex/en/f?p=1000:11200:0::NO::P11200_COUNTRY_ID:102893

Assessment Questions/ Requirements	Assessment of relevance to the project (Yes / potentially / no)	Justification of the Assessment team.	Mitigation Measures added to the Monitoring Plan (if required)
1. Does the project cause negative economic consequences during and after project implementation?	No	The project doesn't cause negative economic consequences during and after project implementation or during the operation. The goal of the project is to contribute to the economic and sustainable development of the country and the region.	Not Required
Principle 7.1 Emissions			
Will the Project increase greenhouse gas emissions over the Baseline Scenario?	No	The project activity will result in decrease of greenhouse gas emissions over the Baseline Scenario.	Not Required
Principle 7.2 Energy Supply			
Will the Project use energy from a local grid or power supply (i.e., not connected to a national or regional grid) or fuel resource (such as wood, biomass) that provides for other local users?	Yes	The Project target is to supply energy to the national grid through optimised use of landfill waste. Uncontrolled methane emissions captured and used for electricity generation which is supplied to the national grid of Turkey. If the project would use electricity from national grid, the electricity generated and supplied by the project will be much more than the consumed. On the other hand, to generate electricity, the project will use municipal waste as fuel resource which is not used by the local people.	Air quality/levels of sulphides combusted in the landfill gas engines will be monitored as part of Monitoring Plan

Assessment Questions/ Requirements	Assessment of relevance to the project (Yes / potentially / no)	Justification of the Assessment team.	Mitigation Measures added to the Monitoring Plan (if required)
Principle 8.1 Impact on Natural Water Patterns/Flows			
Will the Project affect the natural or pre-existing pattern of watercourses, ground-water and/or the watershed(s) such as high seasonal flow variability, flooding potential, lack of aquatic connectivity or water scarcity?	No	The project will collect waste via closed trucks and there is no damage to groundwater or to any other watercourses. In the absence of this landfill gas to electricity project, waste stored or buried may cause formation of bacteria, which would reach underground water. The Project is not expected to result in a significant change of water consumption. The Project has no activity related to water contamination or waste covering. During the operation phases, domestic wastewater produced by workers are given to the İZAYDAŞ pre-treatment plant²⁵ and then transferred to the İSU treatment plant²⁶ and treated in line with the related law and regulations.	Not Required
Principle 8.2 Erosion and/or Water Body Instability			
a. Could the Project directly or indirectly cause additional erosion and/or water body instability or	No	No, the project activity would result in additional erosion or water body instability and disrupt natural pattern of erosion.	Not Required

²⁵ https://www.izaydas.com.tr/1081-1-izaydas-_izmit_atik_ve_artiklari-_aritmaya_yakma_ve_degerlendirme-haberSayfaDetay-cop_sizinti_suyuna_yeni_aritma_tesisi.html

²⁶ <https://www.isu.gov.tr/index.aspx>

Assessment Questions/ Requirements	Assessment of relevance to the project (Yes / potentially / no)	Justification of the Assessment team.	Mitigation Measures added to the Monitoring Plan (if required)
disrupt the natural pattern of erosion? b. Is the Project's area of influence susceptible to excessive erosion and/or water body instability?			
Principle 9.1 Landscape Modification and Soil			
Does the Project involve the use of land and soil for production of crops or other products?	No	No, the project does not involve the use of land and soil for production of crops or other products.	Not Required
Principle 9.2 Vulnerability to Natural Disaster			
Will the Project be susceptible to or lead to increased vulnerability to wind, earthquakes, subsidence, landslides, erosion, flooding, drought or other extreme climatic conditions?	No	The project is neither susceptible to or lead to increased vulnerability to wind, subsidence, landslides, erosion, flooding, drought or other extreme climatic conditions.	Not Required
Principle 9.3 Genetic Resources			
Could the Project be negatively impacted by or involve genetically modified organisms or GMOs (e.g., contamination, collection and/or harvesting, commercial development, or take place in facilities or farms that include GMOs in their processes and production)?	No	The project is not likely to be negatively impacted by or involve genetically modified organisms or GMOs.	Not Required
Principle 9.4 Release of pollutants			

Assessment Questions/ Requirements	Assessment of relevance to the project (Yes / potentially / no)	Justification of the Assessment team.	Mitigation Measures added to the Monitoring Plan (if required)
Could the Project potentially result in the release of pollutants to the environment?	No	The project activity is based on the process of capturing the methane under control and produce clean energy. The project activity does not use pollutants which has the potential of being released. Waste transportation is allowed if it is executed by only authorized transportation establishments according to Environmental Law. Waste transportation must be conducted with covered trucks. Release of pollutants to the environment and odour spread is prevented by strict regulations for transportation of all types of wastes. Prior to the proposed project activity, the wastes are left to decay within landfill site and methane were emitted to the atmosphere without any control or utilization. Thus, the project contributes to the environmental welfare of the region.	Not Required
Principle 9.5 Hazardous and Non-hazardous Waste			
Will the Project involve the manufacture, trade, release, and/ or use of hazardous and non-hazardous chemicals and/or materials?	No	Hazardous wastes will not be accepted to the project activity. Separation is done in the first storage and domestic waste reaches the site. The methods are	Not Required

Assessment Questions/ Requirements	Assessment of relevance to the project (Yes / potentially / no)	Justification of the Assessment team.	Mitigation Measures added to the Monitoring Plan (if required)
		categorized for all materials and all wastes are disposed of according to related regulations.	
Principle 9.6 Pesticides & Fertilisers			
Will the Project involve the application of pesticides and/or fertilisers?	No	The project is a landfill gas to electricity project so the project does not involve pesticides or fertilisers.	Not Required
Principle 9.7 Harvesting of Forests			
Will the Project involve the harvesting of forests?	No	The project is a landfill gas to electricity project so the project does not involve the harvesting of forests.	Not Required
Principle 9.8 Food			
Does the Project modify the quantity or nutritional quality of food available such as through crop regime alteration or export or economic incentives?	No	The project area does not involve agricultural land, so the project activity does not have any negatively impact to access and availability of food for people.	Not Required
Principle 9.9 Animal husbandry			
Will the Project involve animal husbandry?	No	The project is a landfill gas to electricity project does not involve any animal husbandry.	Not Required
Principle 9.10 High Conservation Value Areas and Critical Habitats			
Does the Project physically affect or alter largely intact or High Conservation Value (HCV) ecosystems, critical habitats, landscapes, key	No	The project does not affect or alter High Conservation Value (HCV) ecosystems, critical habitats, landscapes, key biodiversity areas or cultural sites.	Not Required

Assessment Questions/ Requirements	Assessment of relevance to the project (Yes / potentially / no)	Justification of the Assessment team.	Mitigation Measures added to the Monitoring Plan (if required)
biodiversity areas or sites identified?			
Principle 9.11 Endangered Species			
a. Are there any endangered species identified as potentially being present within the Project boundary (including those that may route through the area)? b. Does the Project potentially impact other areas where endangered species may be present through transboundary affects?	No	There are no endangered species identified as potentially being present within the Project boundary (including those that may route through the area). The project is not within the vicinity of area that contains endangered species.	Not Required

The safeguarding principles relevant to the project activity are justified by PP based on supporting web links, references wherever applicable.

These safeguarding principles assessment is validated through references given by PP during the remote audit.

The SDG goals are also described below:

SDG Indicator	Assessment of Methodological choices/approaches for estimating the SDG outcome
SDG 7 –Affordable and Clean Energy: Electricity produced and supplied to the grid.	Measurement Method: - Electricity produced and supplied to the grid is monitored through energy meter. Monthly protocols will be signed by project participants and grid operator and stored. The amount of electricity produced by each type of gas engine will be monitored directly at the engines. QA/QC Process: This parameter is monitored monthly, there is secondary meter is used for crosschecking the accuracy and both meters are calibrated if required. TEİAŞ meter reading forms are considered as the main source for the net electricity and the values are crosschecked with EPIAŞ records. Relevant SDG Target: 7.2.1 - By 2030, increase substantially the share of renewable energy in the global energy mix.

SDG Indicator	Assessment of Methodological choices/approaches for estimating the SDG outcome
	Corresponding indicator: Electricity produced and supplied to the grid. (7.2.1 Renewable energy share in the total final energy consumption)
SDG 8 – Decent Work and Economic Growth: Employment generated due to project activity.	Measurement Method: - Total number of employments generated as part of project activity. The number of employment are to be assessed from the SSI (Social Security Institution of Turkey) records of the Organisation / staff register/ letter from O&M contractor/HSE/HR records on an annual basis. QA/QC Process: This parameter is based on records, data and no QA/QC procedure required. The DOE can confirm this parameter with SSI records for employment generation. Relevant SDG Target: 8.5.2 – Quantitative employment and income generation Corresponding indicator: 8.5.2. Employment generated due to project activity (10 persons) and 1 training/year.
SDG 13 – Climate Action: Emission reductions in tCO _{2e} from the project activity. (Emissions other than GHGs)	Measurement Method: - The emission reduction parameter is calculated as product of net electricity supplied to grid and grid emission factor calculated as considering the EPIAS records for the net electricity generated and the emission factor for the grid, 0.4616 tCO₂/MWh, which is calculated and published by The Ministry of Energy and Natural Resources of Turkey ²⁷. QA/QC Process: This parameter is calculated, and no any QA/QC procedure required. Relevant SDG Target: 13.3.1: Integrate climate change measures into national policies, strategies and planning Corresponding indicator: Emission reductions in tCO_{2e} from the project activity.

- **Principle 3: Stakeholder Inclusivity**

The project is applying for the renewal of the crediting period i.e. Second crediting period from 01/03/2019 to 28/02/2026. Thus, reassessment of stakeholder's inclusivity not required. However, PP has conducted 1 complementary stakeholder meeting on 14/07/2021 with the Mukhtar of Durhasan village (Ünal Turan) for the second CP renewal of the project activity. A grievance logbook was also placed at the Mukhtar's office of Durhasan village and anyone can record their grievances in the logbook which was resolved by PP. Same was confirmed during remote audit & documentary evidences submitted by PP.

- **Principle 4: Demonstration of real outcomes**

²⁷ https://enerjiapi.etkb.gov.tr/Media/Dizin/ETKB/Duyurular//0c6b62ea-bf2f-4fea-b9b3-28bc6f48ddf2_Bilgi_Formu_-_Web_Sitesi.pdf

The Sustainable monitoring plan is described below:

SDG Parameter/ Safeguarding principle	Indicator	Monitoring
SDG 7: Affordable and Clean Energy	Net Electricity Quantity to Turkish national grid delivered by the project (MWh)	Energy meter installed by Turkish grid company measure the electricity transferred to TEİAŞ substation. These meters are sealed by TEİAŞ and intervention by project proponent is not possible. Measured hourly and readings monthly.
SDG 8: Decent Work and Economic Growth	1. Employment generated due to project activity. 2. Quality of employment	Project Developer has Documentation pertaining to employment, SSI (Social Security Institution) records of the company. Assessment team also checked records and confirms that due to project activity peoples are getting more than minimum wages as a salary and this salary is better than local level salary. Based on the roles and responsibility of employee, the salary will be higher than the minimum salary of the region and hence the parameter monitoring is acceptable to the assessment team. Assessment team checked that at least more than 10 people are expected to be employed at site per year during remote audit & employment records. The employment opportunities generated are local or temporary or permanent as checked and confirmed by the assessment team. Trainings given to employees the trainings data maintained, attendance documents from trainings and interview with employees 01 training provided annually to employees. It will be ensured that safe working condition and safety equipment's has been provided for all skilled and unskilled Labor. It will be checked during verification through remote audit observations and interview with people if noise level is maintained within permissible limit.

SDG Parameter/ Safeguarding principle	Indicator	Monitoring
SDG 13: Climate Action	Emission Reductions	The emission reduction calculation will be done as per the formula mentioned in the PDD. As the parameter is subjected to monitoring the same will be checked during the verification of the project activity.

Principle 5: Financial Additionality & Ongoing Financial Need

The additionality of the project activity has been demonstrated in-line with “Combined tool to identify the baseline scenario and demonstrate additionality”, Version 07.0.^{9/} All steps of the additionality tool have been demonstrated in the CDM PDD and validation report.

The project activity is already registered with the GS and additionality of project already demonstrated in GS4GG approved PD (<https://registry.goldstandard.org/projects/details/92>), found the same to be correct and appropriate.

3.10 Calculation algorithm and/or formula used to determine emission reductions

The GS4GG PDD of the project activity is checked by the assessment team and found that ACM0001, Version 19.0 is used for the validation (2nd CP) which is also in line with the GS for Global Goals “Principles and Requirements” Version 1.2 which recommends the application of the latest version of the applied methodology along with the conservative argument of the approach followed. The latest version is ACM0001, Version 19.0 and VVB confirm that the project activity is in line with the latest methodology as well.

The formula used in the GS PDD was used for the calculation of emission reduction and same is found to be correct. Hence emission reduction calculation at this time of validation is conservative and appropriate.

Assessment team checked net emission reductions for the project activity are calculated in line with the applied methodologies.

LFG Capture and its Utilization for Power Generation as per ACM0001 version 19.0

Baseline Emissions

The baseline emissions are:

1. Emissions from decomposition of waste at the landfill site
2. Emissions resulting from electricity consumption

PD has determined baseline emissions according to equation (1) of ACM0001 version 19.0 as following:

$$BE_y = BE_{CH_4,y} + BE_{EC,y} + BE_{HG,y} + BE_{NG,y}$$

Where:

BE_y	Baseline emissions in year y (tCO ₂ e/yr)
$BE_{CH_4,y}$	Baseline emissions of methane from the SWDS in year y (tCO ₂ e/yr)
$BE_{EC,y}$	Baseline emissions associated with electricity generation in year y (tCO ₂ e/yr)
$BE_{HG,y}$	Baseline emissions associated with heat generation in year y (tCO ₂ e/yr)
$BE_{NG,y}$	Baseline emissions associated with natural gas use in year y (tCO ₂ e/yr)

Since there are no heat generations or natural gas usage in the baseline scenario, only baseline emissions from methane emissions from SWDS (A) and electricity generation (B) will be taken into account for whole calculation of baseline :-

$$BE_y = BE_{CH_4,y} + BE_{EC,y}$$

Where:

BE_y	Baseline emissions in year y (tCO ₂ e/yr.)
$BE_{CH_4,y}$	Baseline emissions of methane from SWDS in year y (tCO ₂ e/yr.)
$BE_{EC,y}$	Baseline emissions associated with electricity generation in year y (tCO ₂ e/yr)

According to the referred methodology the emission reductions are calculated with the following equation:

$$ER_y = BE_y - PE_y$$

Where:

ER_y	Emission reductions in year y (tCO ₂ e/year)
BE_y	Baseline emissions in year y (tCO ₂ e/year)
PE_y	Project emissions in year y (tCO ₂ e/year)

Step (A): Baseline emissions of methane from the SWDS ($BE_{CH_4,y}$)

Baseline emissions of methane from the SWDS are determined as follows, based on the amount of methane that is captured under the project activity and the amount that would be captured and destroyed in the baseline. In addition, the effect of methane oxidation that is present in the baseline and absent in the project is taken into account.

$$BE_{CH_4} = ((1 - OX_{top_layer}) \times F_{CH_4,PJ,y} - F_{CH_4,BL,y}) \times GWP_{CH_4} \quad (3)^{28}$$

Where:

$BE_{CH_4,y}$	Baseline emissions of methane from the SWDS in year y (t CO ₂ e/yr)
---------------	--

OX_{top_layer}	Fraction of methane in the LFG that would be oxidized in the top layer of the SWDS in the baseline (dimensionless)
$F_{CH_4,PJ,y}$	Amount of methane in the LFG which is flared and/or used in the project activity in year y (t CH ₄ /yr)
$F_{CH_4,BL,y}$	Amount of methane in the LFG that would be flared in the baseline in year y (tCH ₄ /yr)
GWP_{CH_4}	Global warming potential of CH ₄ (tCO ₂ e/tCH ₄)

Step A.1: Ex-post determination of $F_{CH_4,PJ,y}$

During the crediting period $F_{CH_4,PJ,y}$ is determined as the sum of quantities of methane flared and used in power plant(s) as follows:

$$F_{CH_4,PJ,y} = F_{CH_4,flared,y} + F_{CH_4,EL,y} \quad \text{Equation 3 in ACM0001 V19}$$

Where:

$F_{CH_4,PJ,y}$	Amount of methane in the LFG which is flared and/or used in the project activity in year y (tCH ₄ /yr)
$F_{CH_4,flared,y}$	Amount of methane in the LFG which is destroyed by flaring in year y (tCH ₄ /yr)

The working hours of the power plant(s) will be monitored.

The amount of methane destroyed by electricity generation ($F_{CH_4,EL,y}$)

$F_{CH_4,PJ,y}$ is determined using the "Tool to determine the mass flow of a greenhouse gas in a gaseous stream" version 03.0.0.

The tool provides procedures to determine the following parameter:

Parameter	SI Unit	Description
$F_{i,t}$ ²⁹	kg/h	Mass flow of greenhouse gas i (CO ₂ , CH ₄ , N ₂ O, SF ₆ or a PFC) in the gaseous stream in time interval t.

The mass flow of CH₄ in LFG is determined through measurement of the flow and volumetric fraction of the gaseous stream (LFG). The "Tool to determine the mass flow of a greenhouse gas in a gaseous stream" version 03.0.0 provides 6 different ways to make these measurements and the corresponding calculation option for $F_{i,t}$.

Table 1: Measurement options for $F_{i,t}$

²⁹ The parameter ($F_{i,t}$) under the "Tool to determine the mass flow of a greenhouse gas in gaseous stream" corresponds to the parameter ($F_{CH_4,EL,y}$) under ACM0001.

Option	Flow of Gaseous Stream	Volumetric Fraction
A	Volume flow-dry basis	Dry or wet basis
B	Volume flow-wet basis	Dry basis
C	Volume flow-wet basis	Wet basis
D	Mass flow-dry basis	Dry or wet basis
E	Mass flow-wet basis	Dry basis
F	Mass flow-wet basis	Wet basis

Option A is applied in the proposed project activity. Since option B and E has not been selected as an option, the absolute humidity of the gaseous stream will not be determined.

Option A:

According to the "Tool to determine the mass flow of a greenhouse gas in a gaseous stream" version 03.0.0, flow measurement on a dry measurement is not doable for a wet gaseous stream. Therefore, it will be demonstrated that the temperature of the gaseous stream (T_t) is less than 60°C (333.15 K) at the flow measurement point.

The mass flow of CH₄ ($F_{CH_4,t}$)³⁰ is determined as follows:

$$F_{CH_4,t} = V_{t,db} * v_{CH_4,t,db} * \rho_{CH_4,t} \quad (5)^{31}$$

With

$$\rho_{CH_4,t} = \frac{P_t * MM_{CH_4}}{R_u * T_t} \quad (6)^{32}$$

Where:

$F_{CH_4,t}$	Mass flow of CH ₄ in the gaseous stream in time interval t (kg gas/h)
$V_{t,db}$	Volumetric flow of the gaseous stream in time interval t on a dry basis (m ³ dry gas/h)
$v_{CH_4,t,db}$	Volumetric fraction of CH ₄ in the gaseous stream in a time interval t on a dry basis (m ³ gas CH ₄ /m ³ dry gas)
$\rho_{CH_4,t}$	Density of CH ₄ in the gaseous stream in time interval t (kg gas CH ₄ / m ³ gas CH ₄)

³⁰ $F_{CH_4,t}$ described under the "Tool to determine the mass flow of a greenhouse gas in a gaseous stream" corresponds to $F_{CH_4,EL,y}$ described under ACM0001 "Flaring or use of a landfill gas".

³¹ This equation is referred as (#5) under the "Tool to determine the mass flow of a greenhouse gas in a gaseous stream"

³² This equation is referred as (#6) under the "Tool to determine the mass flow of a greenhouse gas in a gaseous stream"

P_t	Absolute pressure of the gaseous stream in time interval t (Pa)
MM_{CH_4}	Molecular Mass of CH_4 (kg/kmol)
R_u	Universal ideal gases content (Pa.m ³ /kmol.K)
T_t	Temperature of gaseous stream in time interval t (K)

The amount of methane destroyed by flaring ($F_{CH_4, flared, y}$)

According to ACM0001 "Flaring or Use of Landfill Gas" version 19.0, $F_{CH_4, flared}$ is determined as the difference between the amount of methane supplied to the flare(s) and any methane emissions from the flare(s), as follows:

$$F_{CH_4, flared, y} = F_{CH_4, sent, flare, y} - \frac{PE_{flare, y}}{GWP_{CH_4}} \quad (8)^{33}$$

Where:

$F_{CH_4, flared, y}$	Amount of methane in the LFG which is destroyed by flaring in year y (tCH ₄ /yr)
$F_{CH_4, sent, flare, y}$	Amount of methane in the LFG which is sent to the flare in year y (tCH ₄ /yr)
$PE_{flare, y}$	Project emissions from flaring of the residual gas stream in year y (tCO ₂ e/yr)
GWP_{CH_4}	Global Warming Potential of CH_4 (tCO ₂ e/tCH ₄)

In line with the requirements of ACM0001 "Flaring or Use of Landfill Gas" version 19.0, $F_{CH_4, sent, flare, y}$ is determined directly using the "Tool to determine the mass flow of a greenhouse gas in a gaseous stream" using option A as described under the relevant tool.

In accordance with the requirements of ACM0001 "Flaring or Use of Landfill Gas" version 19.0, $PE_{flare, y}$ will be determined using the "Project emissions from flaring". If the LFG is flared through more than one flare, then $PE_{flare, y}$ is the sum of the emissions for each flare determined separately.

In accordance with the requirements of the "Project emissions from flaring", In the case of enclosed flares, project participants may choose between the following two options to determine the flare efficiency (n_{flare}).

- A) Apply a default value for flare efficiency
- B) Measure the flare efficiency

The PP opts to apply the default value for flare efficiency.

According to the tool, the flare efficiency for the minute m (n_{flare}) is 90% when the following two conditions are met to demonstrate that the flare is operating:

- (1) The temperature of the flare (T_{EG}) and the flow rate of the residual gas to the flare (F_{RG}) is within the manufacturers specifications for the flare ($SPEC_{flare}$); and

³³ This equation is referred as (#4) under the ACM0001

(2) The flame is detected (Flame).

Otherwise, the (η_{flare}) is 0%.

In line with the requirements of the "Project emissions from flaring", $PE_{flare,y}$ will be calculated as follows:

$$PE_{flare,y} = GWP_{CH_4} * \sum_{h=1}^{8760} F_{CH_4,RG,h} * (1 - \eta_{flare,h}) * 10^{-3} \quad (9)^{34}$$

Where:

$PE_{flare,y}$	Project emissions from flaring of the residual gas stream in year y (tCO ₂ e/yr)
$F_{CH_4,RG,y}$	Mass flow of methane in the residual gas in hour h (kg/h)
$\eta_{flare,h}$	Flare efficiency in hour h. In line with the tool "Project emissions from flaring" v 04.0, a default value of 90% will be used for the flare efficiency
GWP_{CH_4}	Global Warming Potential of methane valid for commitment period

Step A.1.1: Ex-ante estimation of $F_{CH_4,PJ,y}$

An ex-ante estimate of $F_{CH_4,PJ,y}$ is required to estimate baseline emissions of methane from the SWDS (according to equation 3) in order to estimate the emission reductions of the proposed project activity. In accordance with ACM0001 "Flaring or Use of Landfill Gas" version 19.0, it is determined as follows:

$$F_{CH_4,PJ,y} = \eta_{PJ} * BE_{CH_4,SWDS,y} / GWP_{CH_4} \quad \text{Equation 5 in ACM0001 V19}$$

Where:

$F_{CH_4,PJ,y}$	Amount of methane in the LFG which is flared and or used in the project activity in year y (tCH ₄ /yr)
$BE_{CH_4,SWDS,y}$	Amount of methane in the LFG that is generated from the SWDS in the baseline scenario in year y (tCO ₂ e/yr)
η_{PJ}	Efficiency of the LFG capture system that will be installed in the project activity
GWP_{CH_4}	Global Warming Potential of CH ₄ (tCO ₂ e/tCH ₄)

$BE_{CH_4,SWDS,y}$ is determined using the methodological tool "Emissions from solid disposal sites" version 08.0. The amount of methane generated from disposal of waste at the SWDS is calculated based on a first order decay (FOD) model. The amount of methane generated from disposal of waste at the SWDS is calculated for year y as follows:

$$BE_{CH_4,SWDS,y} = \varphi \cdot (1 - f) \cdot GWP_{CH_4} \cdot (1 - OX) \cdot \frac{16}{12} \cdot F \cdot DOC_f \cdot MCF \cdot \sum_{x=1}^y \sum_j W_{j,x} \cdot DOC_j \cdot e^{-k_j(y-x)} \cdot (1 - e^{-k_j})$$

Equation 1 in TOOL04 V8

³⁴ This equation is referred as (#15) under the "Project emissions from flaring"

Where:

$BE_{CH_4,SWDS,y}$	Methane emissions avoided during the year y from preventing waste disposal at the solid waste disposal site (SWDS) during the period from the start of the project activity to the end of the year y (tCO _{2e})
ϕ	Model correction factor to account for model uncertainties (0.9)
f	Fraction of methane captured at the SWDS and flared, combusted or used in another manner
GWP_{CH_4}	Global Warming Potential of methane valid for the commitment period (tCO _{2e} /tCH ₄)
OX	Oxidation factor (reflecting the amount of methane from SWDS that is oxidized in the soil or other material covering the waste)
F	Fraction of methane in the SWDS gas (volume fraction) (0.5)
DOC_f	Fraction of degradable organic carbon (DOC) that can decompose
MCF	Methane correction factor
$W_{j,x}$	Amount of organic waste type j prevented from disposal in the SWDS in the year x (tonnes)
DOC_j	Fraction of degradable organic carbon (by weight) in the waste type j
k_j	Decay rate for the waste type j
j	Waste type category (index)
x	Year during the crediting period: x runs from the first year of the first crediting period (x=1) to the year y for which avoided emissions are calculated (x=y)
y	Year for which methane emissions are calculated

Parameters required applying the FOD model

The parameters required to apply the FOD model is listed under table below. The parameters are selected according to Application A as defined under the tool "Emissions from solid disposal sites" Version 08.0, and under section B.2 "Applicability of the tool" in the PDD.

Parameter	Value
Φ_y	A default value of 0.75
OX	A default value of 0.1
F	A default value of 0.5
$DOC_{f,y}$	A default value of 0.5

MCF _y	A default value of 1.0		
k _j	The following values for the different waste types have been applied as a default value:		
		Waste type j	Boreal and Temperate (MAT < 20°C)
			WET (MAP/PET >1)³⁵
Slowly degrading	Pulp, paper, cardboard	0.06	
	Wood, wood products and straw	0.03	
Moderately degrading	Other (non-food) organic putrescible garden and park waste	0.10	
Rapidly degrading	Food, food waste, sewage sludge, beverages and tobacco	0.185	
IPCC 2006 Guidelines for National Greenhouse Gas Inventories (Adapted from Volume 5, Table 3.3)			
W _{j, x}	Estimated once. Please refer to table 7 of GS PDD and below table for (W _{j, x})		
DOC _j	The following values for the different waste types have been applied as a default value:		
		Waste type j	DOC_j (% wet waste)
		Wood and wood products	43
		Pulp, paper and cardboard	40
		Food, food waste, beverages and tobacco	15
		Textiles	24
		Garden, yard and park waste	20
		Glass, plastic, metal, other inert	0
f _y	A default value of 0		

Determining the model correction factor (Φ_y)

³⁵ MAT: 14.9 (Reference: <https://www.mgm.gov.tr/veridegerlendirme/il-ve-ilceler-istatistik.aspx?m=KOCAELI>); PET: 703 (Reference: http://tucaum.ankara.edu.tr/wp-content/uploads/sites/280/2015/08/tucaum4_4.pdf). MAT/PET= 1.16

In line with the requirements of the tool “Emissions from solid disposal sites” version 08.0, a default value: $\Phi_y = \Phi_{default}$ will be used. $\Phi_{default}$ is set as 0.75.

Determining the amounts of waste types j disposed in the SWDS ($W_{j,x}$)

In line with the “Emissions from solid disposal sites” version 08.0.0, $W_{j,x}$ is based on the waste characterization of Kocaeli Province.

Amount of solid waste type j disposed or prevented from disposal in the SWDS³⁶

Waste Type	Fraction of the waste type ³⁷
Pulp, paper and cardboard	5.23%
Wood and wood products	0
Textiles	0
Other (non-food) organic putrescible garden and park waste	21.53%
Food, food waste, beverages and tobacco	57.60%
Glass, plastic, metal, other inert	21.53%

Determining the fraction of DOC that decomposes in the SWDS ($DOC_{f,y}$)

In line with the requirements of the tool “Emissions from solid disposal sites” version 08.0, a default value: $DOC_{f,y} = DOC_{f,default}$ will be used. $DOC_{f,default}$ is set as 0.5.

Procedure to determine the methane correction factor (MCF_y)

In line with the requirements of the tool “Emissions from solid disposal sites” version 06.0.0, a default value: $MCF_y = MCF_{default}$ will be used. $DOC_{f,default}$ is set as 1.0, which corresponds to anaerobic managed solid waste disposal site.

Step A.2: Determination of $F_{CH_4,BL,y}$

This step provides a procedure to determine the amount of methane that would have been captured and destroyed (by flaring) in the baseline due to regulatory requirements, or contractual requirements, to address safety and odour concerns, or for other reasons. ACM0001 “Flaring or Use of Landfill Gas” version 19.0 provides 4 cases and corresponding instructions.

Situation at the start of the project activity	Requirement to destroy methane	Existing LFG capture and destruction system
Case 1: No requirement to destroy methane exists and no existing LFG capture	No	No

³⁶ <https://webdosya.csb.gov.tr/db/ced/icerikler/kocaeli-ilcdr-2021-20220816111805.pdf> page 70

³⁷ Since the report provides the fraction of waste type, fraction to the total amount of waste disposed in SWDS is provided in the table.

Case 2: Requirement to destroy methane exists and no existing LFG capture system	Yes	No
Case 3: No requirement to destroy methane exists and a LFG capture system exists	No	Yes
Case 4: Requirement to destroy methane exists and LFG capture system exists	Yes	Yes

The situation at the start of the project activity falls under case 1 since there are no legal requirements in Turkey to destroy methane and the LFG was not captured prior to the proposed project activity.

Therefore:

$$F_{CH_4,BL,y} = 0$$

Step B: Baseline emissions associated with electricity generation ($BE_{EC,y}$)

The baseline emissions associated with electricity generation in year y ($BE_{EC,y}$) is calculated in accordance with the "Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation" Version 3.0. The electricity source k in the tool corresponds to the sources of electricity generated by the grid, which is identified as the most plausible baseline scenario. $EC_{BL,k,y}$ in the tool is equivalent to the net amount of electricity generated using LFG in year y .

Generic approach

In the generic approach, baseline emissions from consumption of electricity are calculated based on the quantity of electricity consumed, an emission factor for electricity generation and a factor to account for transmission losses, as follows:

$$BE_{EC,y} = \sum EC_{BL,k,y} * EF_{EL,k,y} * (1 + TDL_{k,y}) \quad (10)^{38}$$

Where:

$BE_{EC,y}$	Baseline emissions from electricity consumption in year y (tCO ₂ e/yr)
$EC_{BL,k,y}$	Net amount of electricity generated using LFG in year y (MWh/yr)
$EF_{EL,k,y}$	Emission factor for electricity generation source k in year y (tCO ₂ e/MWh)
$TDL_{k,y}$	Average technical and transmission and distribution losses for providing electricity to source k in year y
k	the sources of electricity generated by the grid

Determination of the Emission Factor for Electricity Generation ($EF_{EL,k,y}$)

³⁸ This equation is referred as (#2) under the "Baseline, project and leakage emissions from electricity consumption"

The emission factor of the Turkish grid ($EF_{grid,CM,y}$) is calculated by Ministry of Energy and Natural Resources in accordance with The Clean Development Mechanism method of the Intergovernmental Panel on Climate Change (IPCC) and published in Turkey National Network Grid Emission Factor Data Sheet³⁹.

The CO₂ emission factor for the displacement of electricity generated by power plants in the project activity and fed to the grid is estimated using Tool to calculate the emission factor for an electricity system version 7.0. The estimation is carried out through following steps

- (a) Step 1: Identify the relevant electricity systems;
- (b) Step 2: Choose whether to include off-grid power plants in the project electricity system (optional);
- (c) Step 3: Select a method to determine the operating margin (OM);
- (d) Step 4: Calculate the operating margin emission factor according to the selected method;
- (e) Step 5: Calculate the build margin (BM) emission factor;
- (f) Step 6: Calculate the combined margin (CM) emission factor.

Step 1: Identify the relevant electricity systems

According to the "Tool to calculate the emission factor for an electricity system" V.7, a project electricity system has to be defined by the spatial extent of the power plants that are physically connected through transmission and distribution lines to the project activity and that can be dispatched without significant transmission constraints.

Similarly, a connected electricity system, e.g. national or international, is defined as an electricity system that is connected by transmission lines to the project electricity system. Power plants within the connected electricity system can be dispatched without significant transmission constraints but transmission to the project electricity system has significant transmission constraint.

The transmission lines in Turkey are operated by TEİAŞ (Turkish Electricity Transmission CO), which is a state-owned company. The interconnected grid system is operated continuously and there are no electricity price differences throughout the regions⁴⁰. Therefore, the relevant electric power system is defined as the national grid system of Turkey.

Step 2: Choose whether to include off-grid power plants in the project electricity system (optional)

Project participants may choose between the following two options to calculate the operating margin and build margin emission factor:

³⁹

<https://enerji.gov.tr//Media/Dizin/EVCED/tr/%C3%87evreVe%C4%B0klm/%C4%B0klmDe%C4%9Fi%C5%9Fikli%C4%9Fi/TUESEmisyonFktr/Belgeler/Bform2020.pdf>

⁴⁰ Reference: TEİAŞ (Turkish Electricity Transmission Co) official webpage <http://www.teias.gov.tr/>

Option I: Only grid power plants are included in the calculation.

Option II: Both grid power plants and off-grid power plants are included in the calculation.

The Project Participant has chosen only grid power plants in the calculation.

Step 3: Select a method to determine the operating margin (OM)

The calculation of the operating margin emission factor ($EF_{grid,OM,y}$) is based on one of the following methods, which are described under Step 4:

- (a) Simple OM; or
- (b) Simple adjusted OM; or
- (c) Dispatch data analysis OM; or
- (d) Average OM.

The data required to calculate Simple adjusted OM and Dispatch data analysis OM is not possible due to lack of availability of data to project developers. The choice of other two options for calculating operating margin emission factor depends on generation of electricity from low-cost/must-run sources. In the context of the methodology low cost/must run resources typically include hydro, geothermal, wind, low-cost biomass, nuclear and solar generation.

Table 2: In accordance with Electricity Market Production Capacity Projections List (TWh)⁴¹

Years	2016	2017	2018	2019	2020	2021	Share in 2021 (%)
Lignite	61.24	61.33	61.33	61.33	61.33	61.33	14.26%
Hard Coal	5.91	5.91	5.91	5.91	5.91	5.91	1.37%
Imported Coal	37.90	39.63	39.67	39.67	39.67	26.82	6.23%
Natural Gas	175.07	175.15	176.01	175.79	176.01	176.01	40.91%
Geothermal	1.40	1.40	1.40	1.40	1.40	1.40	0.33%
Fuel Oil	9.22	9.22	9.22	9.22	9.22	9.22	2.14%
Diesel	0.15	0.15	0.15	0.15	0.15	0.15	0.03%
Nuclear	0	0	0	4.200	12.60	21.00	4.88%
Other	1.41	1.41	1.41	1.41	1.41	1.41	0.33%
Thermal Total	292.30	294.21	295.11	299.08	307.71	316.11	70.49%
Biogas + Waste	1.20	1.20	1.20	1.20	1.20	1.20	0.28%

⁴¹ [EMRA | Energy Market Regulatory Authority \(epdk.gov.tr\)](https://www.epdk.gov.tr/)

Hydro	104.44	112.71	115.78	116.56	116.56	116.56	27.09%
Wind	9.21	9.21	9.21	9.21	9.21	9.21	2.14%
Total	407148	417317	421292	426044	434670	443070	100.0%

The above data clearly shows that the percentage of total grid generation by low-cost/ must-run plants (on the basis of average of five most recent years) for the national grid of Turkey is less than 50 % of the total generation capacity. Thus, the Average OM method cannot be applied, as low cost/must run resources constitute less than 50% of total grid generation. The simple OM emission factor is calculated as the generation-weighted average CO₂ emissions per unit net electricity generation (tCO₂/MWh) of all generating power plants serving the system, not including low-cost/must-run power plants/units.

For the simple OM, the simple adjusted OM and the average OM, the emissions factor can be calculated using either of the two following data vintages:

- (a) Ex-ante option: if the ex-ante option is chosen, the emission factor is determined once at the validation stage, thus no monitoring and recalculation of the emissions factor during the crediting period is required.

OR

- (b) Ex-post option: if the ex-post option is chosen, the emission factor is determined for the year in which the project activity displaces grid electricity, requiring the emissions factor to be updated annually during monitoring.

Step 4: Calculate the operating margin emission factor ($EF_{grid,OM,y}$) according to the selected method

For OM factor calculation, Chronological order of power generation plants from TEİAŞ Load Dispatch Department with, fuel types, electricity generation for the calculated year were used as input data. By using all the data which were mentioned above, Turkish Ministry of Energy and Natural Resources calculated $EF_{grid,OM,y}$ ⁴²:

$$EF_{grid,OM,y} = 0.7424 \text{ tCO}_2/\text{MWh}$$

Step 5: Calculate the build margin (BM) emission factor ($EF_{grid,BM,y}$)

As per Methodological tool: "Tool to calculate the emission factor for an electricity system" (Version 07.0, EB 100, Annex 4) para 72:

In terms of vintage of data, project participants can choose between one of the following two options:

⁴²

<https://enerji.gov.tr/Media/Dizin/EVCED/tr/%C3%87evreVe%C4%B0klim/%C4%B0klimDe%C4%9Fi%C5%9Fikli%C4%9Fi/TUESEmisyonFktr/Belgeler/Bform2020.pdf>

(a) Option 1 - for the first crediting period, calculate the build margin emission factor ex ante based on the most recent information available on units already built for sample group at the time of PDD submission to the DOE for project verification. For the second crediting period, the build margin emission factor should be updated based on the most recent information available on units already built at the time of submission of the request for renewal of the crediting period to the DOE. For the third crediting period, the build margin emission factor calculated for the second crediting period should be used. This option does not require monitoring the emission factor during the crediting period.

(b) Option 2 - For the first crediting period, the build margin emission factor shall be updated annually, ex post, including those units built up to the year of registration of the project activity or, if information up to the year of registration is not yet available, including those units built up to the latest year for which information is available. For the second crediting period, the build margin emissions factor shall be calculated ex ante, as described in Option 1 above. For the third crediting period, the build margin emission factor calculated for the second crediting period should be used.

Option 1 as described above is chosen by PP to calculate the build margin emission factor for the project activity. BM is calculated ex-ante based on the most recent information available at the time of submission of PD and is fixed for the entire crediting period.

For BM factor calculation by Turkish Ministry of Energy and Natural Resources EF_{grid,BM,y}⁴³ chronological order of power generation plants from TEİAŞ Load Dispatch Department with commissioning dates, plant names, fuel types, installed power values, electricity generation for the calculated year were used as input data.

$$EF_{grid,BM,y} = 0.3680 \text{ tCO}_2/\text{MWh}$$

Step 6: Calculate the combined margin (CM) emission factor (EF_{grid,CM,y})

As per Methodological tool: "Tool to calculate the emission factor for an electricity system" (Version 07.0, EB 100, Annex 4) para 81:

The calculation of the combined margin (CM) emission factor (EF_{grid,CM,y}) is based on one of the following methods:

- (a) Weighted average CM; or
- (b) Simplified CM.

PP has chosen option (a) i.e weighted average CM to calculate the combined margin emission factor for the project activity.

The combined margin emission factor is calculated by using weighted average CM as per Tool to calculate the emission factor for an electricity system (TOOL07) Version 07.0 formula below:

$$EF_{grid,BM,y} = EF_{grid,OM,y} * W_{OM} + EF_{grid,BM,y} * W_{BM} \quad \text{Equation 16 in TOOL07 V7}$$

Where:

⁴³

<https://enerji.gov.tr//Media/Dizin/EVCED/tr/%C3%87evreVe%C4%B0klim/%C4%B0klimDe%C4%9Fi%C5%9Fikli%C4%9Fi/TUESEmisyonFktr/Belgeler/Bform2020.pdf>

$EF_{grid,BM,y}$	Build margin CO ₂ emission factor in year y (tCO ₂ /MWh)
$EF_{grid,OM,y}$	Operating margin CO ₂ emission factor in year y (tCO ₂ /MWh)
W_{OM}	Weighting of operating margin emissions factor (%)
W_{BM}	Weighting of build margin emissions factor (%)

According to the Tool, for power generation project activities other than wind and solar for the second crediting period;

$$W_{OM} = 0.25 \text{ and } W_{BM} = 0.75$$

Then:

$$EF_{grid,CM,y} = 0.7424 \text{ tCO}_2/\text{MWh} * 0.25 + 0.3680 \text{ tCO}_2/\text{MWh} * 0.75 = 0.4616 \text{ tCO}_2/\text{MWh}$$

$$EF_{grid,CM,y} = 0.4616 \text{ tCO}_2/\text{MWh}$$

Project Emissions

In accordance with ACM0001 "Flaring or Use of Landfill Gas" version 19.0.0, the project emissions are calculated as follows:

$$PE_y = PE_{EC,y} + PE_{FC,y} + PE_{DT,y} + PE_{SP,y}$$

Where:

PE_y = Project emissions in year y (tCO₂/yr)

$PE_{EC,y}$ = Emission from consumption of electricity due to the project activity in year y (tCO₂e/yr).

$PE_{FC,y}$ = Emissions from consumption of fossil fuels due to the project activity, for purpose other than electricity generation, in year y (tCO₂/yr)

$PE_{SP,y}$ = Emissions from the supply of LFG to consumers through a dedicated pipeline, in year y (tCO₂/yr)

For the purpose other than electricity generation, there are no emissions related to these and therefore $PE_{DT,y}$, $PE_{FC,y}$ and $PE_{SP,y}$ are equal to "0" and has not been included in equation: $PE_y = PE_{EC,y}$. The project emissions from consumption of electricity by the project activity $PE_{EC,y}$ shall be calculated using the "Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation" (TOOL05) Version 3.0. When applying the tool, electricity sources j in the tool corresponds to the sources of electricity consumed due to the project activity.

$PE_{EC,y}$ is calculated as follows:

$$PE_{EC,y} = \sum EC_{PJ,y} * EF_{EL,j,y} * (1 + TDL_{j,y}) \quad \text{Equation 2 in TOOL05 V3}$$

Where:

$PE_{EC, y}$	Project emissions from electricity consumption in year y (tCO ₂ e/year)
$EC_{PJ, y}$	Quantity of electricity consumed by the project electricity consumption source j in year y (MWh/year)
$EF_{EL, j, y}$	Emission factor for electricity generation for source j in year y (tCO ₂ e/MWh)
$TDL_{j, y}$	Average technical transmission and distribution losses for providing electricity to source j in year y

The combined margin emission factor of the applicable electricity system, has been determined as emission factor for the electricity system ($EF_{EL, j, y}$), in line with Option A1 of scenario A (Electricity consumption from grid) under the "Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation" Version 3.0.

Project emissions from flaring

Application of "Project emissions from flaring" TOOL06

According to "Project emission from flaring" Version 04.0.0", the project emissions from flaring of the residual gas stream $PE_{flare, y}$ are determined considering the following steps:

STEP 1: Determination of the methane mass flow of the residual gas

STEP 2: Determination of flare efficiency

STEP 3: Calculation of project emissions from flaring

The calculation procedure in this tool determines the project emissions from flaring the residual gas ($PE_{flare, y}$) based on the flare efficiency ($\eta_{flare, m}$) and the mass flow of methane to the flare ($F_{CH_4, RG, m}$).

The project activity applies an enclosed flare.

STEP 1. Determination of the mass flow rate of the residual gas

This step is used to determine the mass flow of methane in residual gas stream. In accordance to the Tool, mass flow of methane is determined in accordance to Tool 08.

The following requirements apply:

- Tool 08 shall be applied to the residual gas;
- The flow of the gaseous stream shall be measured continuously;
- CH₄ is the greenhouse gas i for which the mass flow should be determined;
- The time interval t for which mass flow should be calculated is every minute m

$F_{CH_4, m}$ which is measured as the mass flow during minute m shall then be used to determine the mass of methane in kilograms fed to the flare in minute m ($F_{CH_4, RG, m}$). $F_{CH_4, m}$ is determined on dry basis.

The calculation follows the procedure as described by the "Tool to determine the mass flow of a greenhouse gas in a gaseous stream". Option A is applied: Dry basis is considered for the measurement of the volumetric flow rate of the residual gas and the measurement of the volumetric fraction of methane in the residual gas.

In order to determine the mass flow of CH₄, the equations mentioned above in the present document shall be used.

The mass flow of greenhouse gas i (F_{CH₄,t}) is determined as follows:

$$F_{CH_4,t} = V_{t,db} \times v_{CH_4,db,t} \times \rho_{CH_4,n}$$

With,

$$\rho_{CH_4,n} = \frac{P_t \times MM_{CH_4}}{R_u \times T_t}$$

Where:

$F_{CH_4,t}$	Mass flow of greenhouse gas (CH ₄) in the gaseous stream in time interval t (kg gas/h)
$V_{t,db}$	Volumetric flow of the gaseous stream in time interval t on a wet basis at normal condition (m ³ dry gas/h)
$v_{CH_4,wb,t}$	Volumetric fraction of greenhouse gas CH ₄ in the gaseous stream in a time interval t on a wet basis (m ³ CH ₄ /m ³ dry gas)
$\rho_{CH_4,n}$	Density of greenhouse gas CH ₄ in the gaseous stream at normal condition (kg CH ₄ /m ³ CH ₄)
P_t	Absolute pressure of the gaseous stream in time interval (Pa)
MM_{CH_4}	Molecular mass of methane (kg/kmol)
R_u	Universal ideal gases constant (Pa.m ³ /kmol.K)
T_n	Temperature of gaseous stream in time interval t(K)

Since the Volumetric flow of gaseous stream is measured in normal conditions therefore normal temperature and pressure are considered for determining of .

STEP 2. Determination of flare efficiency

Since the project activity uses enclosed flaring system therefore in accordance with paragraph 19 of the Tool06: Methodological tool: Project Emission from Flaring, Version 04.0, project participants may choose between the following two options to determine the flare efficiency for minute m ($\eta_{flare,m}$):

- (a) Option A: Apply a default value for flare efficiency;
- (b) Option B: Measure the flare efficiency

Option A is selected:

Option A: Default value

The flare efficiency for the minute m ($\eta_{flare,m}$) is 90% when the following two conditions are met to demonstrate that the flare is operating:

- (a) The temperature of the flare ($T_{EG,m}$) and the flow rate of the residual gas to the flare ($F_{RG,m}$) is within the manufacturer's operating specification for the flare ($SPEC_{flare}$) in the minute m; and
- (b) The flame is detected in the minute m ($Flame_m$).

Otherwise $\eta_{flare,m}$ is 0%.

For estimation of project emission from flaring default flare efficiency of 0% will be considered

STEP 3. Calculation of project emissions from flaring

Project emission from flaring is calculated as the sum of emission from each minute m , based on the methane mass flow in the residual gas ($F_{CH_4, RG, m}$) and the flare efficiency ($\eta_{flare, m}$), as follows:

$$PE_{flare, y} = GWP_{CH_4} \times \sum_{m=1}^{525600} F_{CH_4, RG, m} \times (1 - \eta_{flare, m}) \times 10^{-3}$$

Where:

$PE_{flare, y}$ Project emissions from flaring of the residual gas in year y (tCO₂e)
 $F_{CH_4, RG, m}$ Mass flow of methane in the residual gas in the minute m (kg)
 $\eta_{flare, m}$ Flare efficiency in minute m (default value of 0% considered)

Leakage

In accordance with ACM0001 "Flaring or Use of Landfill Gas" version 19.0, no leakage effects are accounted. no leakage effects are accounted which is accepted as it is in line with paragraph 71 of the applied methodology.

VVB assessed and confirmed the parameters considered ex-ante and ex-post in the current GS PDD and the assessment is presented below:

Sr. No.	Data / Parameter	Description	Value	Assessment
1	OX_{top_layer}	Fraction of methane that would be oxidized in the top layer of the SWDS in the baseline	0.1	The value is considered based on methodological tool "Emissions from solid waste disposal sites, version 08.0" and is consistent with how oxidation is accounted for and found correct.
2	GWP_{CH_4}	Global warming potential of CH ₄	28 tCO ₂ e/tCH ₄ and Before 01/01/2021, 25 tCO ₂ e/tCH ₄ .	The value applied is as per Default value from IPCC Sixth Assessment Report (AR6) available at https://www.ipcc.ch/assessment-report/ar6/ and found correct.
3	η_{PJ}	Efficiency of the LFG capture system that will be installed in the project activity	50%	The value applied is Default value under ACM0001, version 19.0 and hence accepted.

4	R_u	Universal ideal gases constant	8.314	The value applied is as referred under "Tool to determine the mass flow of a greenhouse gas in a gaseous stream" and hence accepted.
5	MM_{CH_4}	Molecular mass of CH_4	16.04	The value applied is As referred under "Tool to determine the mass flow of a greenhouse gas in a gaseous stream, version 03.0" and hence accepted.
6	$\phi_{default}$	Default value for the model correction factor to account for Model uncertainties	0.75	The value applied is as per the tool 04 "Emissions from solid disposal sites, version 08.0" and hence accepted.
7	OX	Oxidation factor (reflecting the amount of methane from SWDS that is oxidized in the soil or other material covering the waste)	0.1	The value is based on extensive review of published literature on this subject, including the IPCC 2006 Guidelines for National Greenhouse Gas Inventories and hence accepted.
8	$SPEC_{flare}$	Manufacturer's flare operating specifications for temperature	-	This is calculated from TOOL 06 Version 4.0 "Project emissions from flaring" hence accepted
9	F	Fraction of methane in the SWDS gas (volume fraction)	0.5	The value is based on IPCC 2006 Guidelines for National Greenhouse Gas Inventories. Hence accepted
10	$DOC_{f,default}$	Default value for the fraction of degradable organic carbon (DOC) in MSW that can decompose in the SWDS	0.5	The value is based on extensive review of published literature on this subject, including the IPCC 2006 Guidelines for National Greenhouse Gas Inventories and hence accepted.

11	MCF _{default}	Methane correction factor	1.0	This value is based on tool 04: Emissions from solid waste disposal sites, version 08.1 for unmanaged solid waste disposal sites – deep. This comprises all SWDS not meeting the criteria of managed SWDS and which have depths of greater than or equal to 5 meters. The value was cross checked and confirmed.														
12	DOC _j	Fraction of degradable organic carbon (by weight) in waste type j	<table><tr><th>Waste type j</th><th>DOC_j (% wet waste)</th></tr><tr><td>Wood and wood products</td><td>43</td></tr><tr><td>Pulp, paper and cardboard</td><td>40</td></tr><tr><td>Food, food waste, beverages and tobacco</td><td>15</td></tr><tr><td>Textiles</td><td>24</td></tr><tr><td>Garden, yard and park waste</td><td>20</td></tr><tr><td>Glass, plastic, metal, other inert</td><td>0</td></tr></table>	Waste type j	DOC _j (% wet waste)	Wood and wood products	43	Pulp, paper and cardboard	40	Food, food waste, beverages and tobacco	15	Textiles	24	Garden, yard and park waste	20	Glass, plastic, metal, other inert	0	The values are based on tool 04: Emissions from solid waste disposal sites, version 08.1. The value was cross checked and confirmed.
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Pulp, paper and cardboard	40																	
Food, food waste, beverages and tobacco	15																	
Textiles	24																	
Garden, yard and park waste	20																	
Glass, plastic, metal, other inert	0																	
13	EG _{gross}	Gross electricity production by fossil fuel power sources.	https://www.teias.gov.tr/turkiye-elektrik-uretim-iletim-istatistikleri	This the distribution of gross electricity generation by primary energy resources and the electric utilities in Turkey.														
14	FC _{i,y}	Amount of fossil fuel type i consumed in the project electricity system by generation sources in year y		This TEIAS (Turkish Electricity Transmission Company) www.teias.gov.tr Fuels consumed in thermal power plants in Turkey by the electric utilities.														

15	k_j	Decay rate for the waste type j	<table><tr><th colspan="2" rowspan="2">Waste type j</th><th colspan="2">Boreal and Temperate (MAT≤20°C)</th><th colspan="2">Tropical (MAT>20°C)</th></tr><tr><th>Dry (MAP/PET <1)</th><th>Wet (MAP/PET >1)</th><th>Dry (MAP<1000mm)</th><th>Wet (MAP >1000mm)</th></tr><tr><td rowspan="2">Slowly degrading</td><td>Pulp, paper, cardboard (other than sludge), textiles</td><td>0.04</td><td>0.06</td><td>0.045</td><td>0.07</td></tr><tr><td>Wood, wood products and straw</td><td>0.02</td><td>0.03</td><td>0.025</td><td>0.035</td></tr><tr><td>Moderately degrading</td><td>Other (non-food) organic putrescible garden and park waste</td><td>0.05</td><td>0.10</td><td>0.065</td><td>0.17</td></tr><tr><td>Rapidly degrading</td><td>Food, food waste, sewage sludge, beverages and tobacco</td><td>0.06</td><td>0.185</td><td>0.085</td><td>0.40</td></tr></table>	Waste type j		Boreal and Temperate (MAT≤20°C)		Tropical (MAT>20°C)		Dry (MAP/PET <1)	Wet (MAP/PET >1)	Dry (MAP<1000mm)	Wet (MAP >1000mm)	Slowly degrading	Pulp, paper, cardboard (other than sludge), textiles	0.04	0.06	0.045	0.07	Wood, wood products and straw	0.02	0.03	0.025	0.035	Moderately degrading	Other (non-food) organic putrescible garden and park waste	0.05	0.10	0.065	0.17	Rapidly degrading	Food, food waste, sewage sludge, beverages and tobacco	0.06	0.185	0.085	0.40	The values are based on tool 04: Emissions from solid waste disposal sites, version 08.1. The value was cross checked and confirmed.
Waste type j		Boreal and Temperate (MAT≤20°C)				Tropical (MAT>20°C)																															
		Dry (MAP/PET <1)	Wet (MAP/PET >1)	Dry (MAP<1000mm)	Wet (MAP >1000mm)																																
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16	$\eta_{m,y}$	Average net energy conversion efficiency of power unit m in year y	NA			This is by Ministry of Energy and Natural Resources has published the Operating, Build and Combined Margin Emission Factors for Turkish National Grid. The Ministry has calculated the emission factor by using the “Tool to calculate the emission factor for an electricity system” methodology.																															
17	$EF_{grid,OM,y}$	Operating Margin CO2 emission factor in year y (2020)	0.7424 tCO ₂ e/MWh			The value is based on the Ministry of Energy and Natural Sources published values for the operating, Build and Combined Margin Emission Factors for Turkish National Grid. The Ministry calculated the emission factor by using the “Tool to calculate the emission factor for an electricity system, version 07.0”. Since it was updated in 20/09/2022 by ministry these factors have been used for emission reduction calculation and found correct.																															
18.	$EF_{grid,BM,y}$	Build Margin CO emission factor in year y (2020)	0.3680 tCO ₂ e/MWh			The value is based on the Ministry of Energy and Natural Sources published values for the operating, Build and Combined Margin Emission Factors for Turkish National Grid. The Ministry																															

				calculated the emission factor by using the "Tool to calculate the emission factor for an electricity system, version 07.0". Since it was updated in 20/09/2022 by ministry these factors have been used for emission reduction calculation and found correct.
19.	EF _{grid,CM,y}	Combined Margin CO2 emission factor in year y	0.4616 tCO ₂ e/MWh	The value is calculated in line with tool 07: Tool to calculate the emission factor for an electricity system, version 07.0 and confirmed.

Ex-post parameters accessed and the information is presented in the following table:

Sr. No.	Data Parameter /	Description	Observation
1	Op _{j,h}	Operation of the equipment that consumes the LFG	As per the registered PDD, plant equipment operation will be calculated in hour 'h' by monitoring the product generated i.e., electricity generation on an hourly basis.
2	Management of SWDS	Management of SWDS	As per the PDD, if there is any change in the management of the SWDS after the implementation of the project activity should be justified by referring to technical or regulatory specifications.
3	V _{t,db}	Volumetric flow of the gaseous stream in time interval t on a dry basis	Generated gas will be monitored using volumetric flow meter in m ³ on continuous basis. The flow meter will be periodically calibrated against primary device of independent laboratory on a frequency specified by the manufacturer. Records of calibration and maintenance will be archived. Data will be archived electronically during the crediting period and two years after.
3	V _{CH₄,t,db}	Volumetric fraction of CH ₄ in a time interval t on a dry basis	The value of methane (CH ₄) will be continuously monitored using gas analyser on dry basis in m ³ . The gas analyser will be periodically calibrated against primary device of independent laboratory on a frequency specified by the manufacturer. Records of calibration and maintenance will be archived. Data will be archived electronically during the crediting period and two years after.

4	T_t	Temperature of the gaseous stream in time interval t	Gas temperature will be monitored on continuous basis in 'k' using analog or digital instrument. The temperature reading instrument will be periodically calibrated against primary device of independent laboratory on a frequency specified by the manufacturer. The meters have to be calibrated within a frequency of once per 10 years. Records of calibration and maintenance will be archived for 2 years from crediting period.
5	$EG_{PJ,y}$	Net amount of electricity generated using LFG by the project activity in year y	The generated electricity will be monitored using energy meters on continuous basis and monthly readings will be recorded. These energy meters are used to measure net electricity export to the electricity grid and then net export is used for billing purpose by PD. The meters are sealed by TEIAS (Turkish Electricity Transmission Co.). The meters will be calibrated as per TEIAS norms. Records of calibration and maintenance will be archived. Data will be archived electronically during the crediting period and two years after crediting period.
6	$EG_{EC,y}$	Quantity of electricity consumed by the project activity	The electricity consumed by project activity will be monitored using energy meters on continuous basis and monthly readings will be recorded. These energy meters are used to measure energy consumption by the project activity. The meters are sealed by TEIAS (Turkish Electricity Transmission Co.). The meters will be calibrated as per TEIAS norms. Records of calibration and maintenance will be archived. Data will be archived electronically during the crediting period and two years after crediting period.
7	$TDL_{k,y}$; $TDL_{j,y}$	Average technical transmission and distribution losses in year y source j,k in year y	The grid company calculates the TDL factor monthly and will use the factor directly for the creation of the monthly reports. Tool 05 "Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation" version 03 used for calculation value.
8	$T_{EG,m}$	Temperature in the exhaust gas of the enclosed flare in the minute m	The electricity consumed will be monitored using temperature measurement equipment on continuously and values averaged on hourly basis. Calibration of equipment be calibrated in accordance with the maintenance schedule. Data will be archived electronically during the crediting period and two years after.

9.	Quality of employment	Training to staff	Plant records or training records for all the employees/Letter from O&M contractor for employment generation/VVB interview with employees, local stakeholders etc. to be checked to confirm the monitored number. Together with the technology supplier, the Project proponent will organize training for the staff on the technology and the monitoring of the plant operation, and the emergency and safety procedures.
10.	Quantitative employment and income generation	Number of people employed directly due to the project activity	Plant records or the training records for all the employees/SSI Records/Letter from O&M independent for employment generation/VVB interview with employees, local stakeholders etc. to be checked to confirm the monitored number. The staff register/ HR records for income generation of staff/ HR Policies regarding health insurance/social security is checked for staff income generation and company policy benefits. This parameter also monitors number of men/women employed by the project activity. The project activity ensures that "equal pay for work of equal value" for both men and women and there is no discrimination against women.
11.	$F_{CH_4, BL, R, y}$	Amount of methane in the LFG which is flared due to a requirement in year y.	This parameter is referred as the quantity of methane emission that would be flared to comply with national or local safety requirement or legal regulations during the monitoring period which will cover under crediting period. Source of value will be considered as per the regulation made by host country i.e., turkey and frequency of the value will be as per monitoring period. Parameter found in line with the para 41 and 42 of ACM0001 "Flaring or use of Landfill gas" version 19.0"
12.	$\rho_{reg, y}$	Fraction of LFG that is required to be flared due to a requirement in year y.	This parameter is referred as the Fraction of LFG that is required to be flared due to a host country requirement during monitoring period. During current monitoring period, Value has been considered as zero (0) as there is no regulatory requirement in host country i.e., Turkey related to LFG to flare. Same has been verified during the onsite visit by lead auditor that there is no any flaring system available onsite, found correct thus accepted.

SDG 13 Climate Action

Parameter: GHG Emission Reduction

Year	Baseline estimate (tCO ₂ e/yr)	Project estimate (tCO ₂ e/yr)	Leakage estimate (tCO ₂ e/yr)	Net benefit (tCO ₂ e/yr)
01/03/2019 - 31/12/2019	148,809	12	0	148,797

01/01/2020 - 31/12/2020	189,950	14	0	189,936
01/01/2021 - 31/12/2021	219,498	14	0	219,484
01/01/2022 - 31/12/2022	228,155	14	0	228,141
01/01/2023 - 31/12/2023	239,004	14	0	238,990
01/01/2024 - 31/12/2024	252,795	14	0	252,781
01/01/2025 - 31/12/2025	257,813	14	0	257,799
01/01/2026 - 28/02/2026	42,539	14	0	42,536
Total	1,578,563	99	0	1,578,464
Total number of crediting years	7			
Annual average over the crediting period	225,509	14	0	225,495

VVB confirmed that due to delay in the completion of re-validation beyond the last date of First Crediting Period, no ERs will be issued for the delay period (i.e., 24/10/2022 – 22/06/2023). The project will be able to certify the period of 22/06/2023 – 23/10/2029 only. The date 22/06/2023 corresponds to the date by which the submission of the Renewal opinion by the VVB for Design Review to Gold Standard which might change during GS review)

SDG 7: Affordable and Clean Energy

Parameter: Amount of Clean electricity supplied to grid (MWh)

Year	Baseline estimate	Project estimate	Net benefit
01/03/2019 - 31/12/2019	0	40,920	40,920
01/01/2020 - 31/12/2020	0	48,810	48,810
01/01/2021 - 31/12/2021	0	48,810	48,810
01/01/2022 - 31/12/2022	0	48,810	48,810
01/01/2023 - 31/12/2023	0	55,904	55,904
01/01/2024 - 31/12/2024	0	70,035	70,035
01/01/2025 - 31/12/2025	0	70,035	70,035
01/01/2026 - 28/02/2026	0	11,478	11,478
Total	0	394,803	394,803

Total number of crediting years	7		
Annual average over the crediting period	0	56,400	56,400

SDG 8: Decent Work and Economic Growth

Parameter: Quantitative employment and income generation

Year	Baseline estimate	Project estimate	Net benefit
2019	0	Job-10	Job-10
2020	0	Job-10	Job-10
2021	0	Job-10	Job-10
2022	0	Job-10	Job-10
2023	0	Job-10	Job-10
2024	0	Job-10	Job-10
2025	0	Job-10	Job-10
2026	0	Job-10	Job-10
Total	0	Job-10	Job-10
Total number of crediting years	7		
Annual average over the crediting period	0	Job-10	Job-10

Parameter: Quality of employment

Year	Baseline estimate	Project estimate	Net benefit
2019	0	Training- 01	Training- 01
2020	0	Training- 01	Training- 01
2021	0	Training- 01	Training- 01
2022	0	Training- 01	Training- 01
2023	0	Training- 01	Training- 01
2024	0	Training- 01	Training- 01
2025	0	Training- 01	Training- 01
Total number of crediting years	7		
Annual average over the crediting period	0	Training- 01	Training- 01

4. **REFERENCE**

S. No.	Document/Evidence/Reference/Web link, Version, Date
1.	GS4GG PDD for 1 st crediting period version 06 dated 31.10.2014 Transition Annex document dated 01/03/2023
2.	Initial GS4GG PDD, version 07 dated 11/11/2022 Final GS4GG PDD, version 11 dated 08/11/2024 based on which final opinion was provided.
3.	Estimated Emission reduction sheet, version 01, dated 11/11/2022 Estimated Emission reduction sheet, version 03, dated 13/06/2023
4.	Methodology: ACM0001, Version 19.0
5.	Standard: CDM Project Standard for project activities, Version 03.0
6.	Standard: CDM validation and verification standard for project activities, Version 03.0
7.	Procedure: CDM Project Cycle Procedure for project activities, Version 03.0
8.	The Gold Standard for Global Goals "Principles and Requirements" Version 1.2
9.	Tools: I. Tool 06 "Project emissions from flaring" Version 04.0 II. Tool 08 "Tool to determine the mass flow of a greenhouse gas in a gaseous stream" version 03.0. III. Tool 04 "Emissions from solid waste disposal sites" Version 08.1; IV. Tool 07 "Tool to calculate the emission factor for an electricity system" Version 07.0; V. Tool 05 "Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation" Version 03.0; VI. "Assessment of the validity of the original/current baseline and update of the baseline at the renewal of the crediting period" Version 03.0.1;
10.	Employment record of project staff at site
11.	Universal declaration of Human Rights http://ua.mfa.gov.tr/detay.aspx?2634
12.	Turkey National Network Grid Emission Factor Data Sheet
13.	Renewable Energy Activity Requirements, version 1.4
14.	Attendance documents from trainings
15.	Generation License
16.	Electric meter Protocol
17.	Provisional acceptance protocol

S. No.	Document/Evidence/Reference/Web link, Version, Date
18.	Project Design Change Memo Dated 31/10/2014
19.	Declaration of not participating in any other GHG mechanism dated 11/11/2022
20.	Commissioning Certificates for the project activity
21.	Single Line Diagram
22.	EPIAS records for net electricity generation
23.	Technical life of gas engine report issued by third party dated 05/12/2022
24.	GS4GG Site Visit and Remote Audit Requirements and Procedures, version 01
25.	Records of the mail communication between PD & GS/SC for final version of 3-Week Issuance Review Period Feedback Form under GS Version 2.1 VER

5. **FINAL PROJECT DESIGN CERTIFICATION RENEWAL STATEMENT**

Applus+ Certification have performed a Design Certification Renewal of the “Kocaeli Landfill Gas to Electricity Project”. The Design Certification Renewal was performed on the basis of UNFCCC criteria of CDM validation and verification standard for project activities, Version 03.0, Gold Standard GS4GG guideline and host country criteria, as well as criteria given to provide for consistent project operations, monitoring and reporting.

The review of the GS4GG PDD and the subsequent follow-up interviews has provided Applus+ Certification with sufficient evidence to determine the fulfilment of stated criteria. In our opinion, the project meets all relevant UNFCCC and Gold Standard requirements for the Gold Standard and all relevant host country criteria. The project will hence be recommended by Applus+ Certification for renewal of crediting period with the Gold Standard Registry.

By displacing fossil fuel-based electricity with electricity generated from a renewable source, the project results in reductions of CO₂ emissions that are real, measurable and give long-term benefits to the mitigation of climate change. Emission reductions attributable to the project are hence additional to any that would occur in the absence of the project activity. Given that the project is implemented as designed, the project is likely to achieve the estimated amount of annual emission reductions of 225,495 tCO₂e per year.

The Design Certification Renewal has been performed following the requirements of the latest version of the CDM validation and verification standard for project activities, Version 03.0, Gold Standard GS4GG guideline and on the basis of the contractual agreement.

In detail the conclusions can be summarized as follows:

- The project does not result in negative social, environmental and/or economic impacts.
- The project contribution to Environment, Social Development and Economic and technological development
- The project ongoing financial need is sufficiently justified in the GS4GG PDD as per para 7.2.1 and 7.2.2, GHG EMISSIONS REDUCTIONS & SEQUESTRATION PRODUCT REQUIREMENTS¹⁵
- The project does not result in diversion of ODA.
- Conservative assumptions were applied in the project description.
- The monitoring plan of SD parameters is transparent and adequate.
- The project meets the stakeholder consultation requirements.

The conclusions of this report show, that the project, as it was described in the project documentation, is in line with all criteria applicable for the Design Certification Renewal.

Sustainable Development Goals Targeted	SDG Impact	Estimated Amount (Crediting average) period	Units/ Products
SDG 13 Climate Action	Emission Reductions	225,495	tCO ₂ e/VERs

Date: 03/12/2024

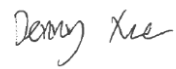
Lead Auditor: Mr. Atul Takarkhede

Tech. Expert: Mr. Atul Takarkhede

Tech. Reviewer: Mr. Denny Xue

Approver (*Applus+ Certification VVB Technical Manager*)

Mr. Agustín Calle de Miguel

ASSESSMENT TEAM	
Lead Auditor: Mr. Atul Takarkhede	Technical Reviewer: Mr. Denny Xue
Signature: 	Signature: 
Approver: Mr. Agustín Calle de Miguel	
Signature: 	

Appendix 1: Corrective Action Request/Clarification Request/Forward Action Request resolution table

Type:	☐ CAR ☒ CL/CR ☐ FAR	Number:	01
Raised by:	Dr. Atul Takarkhede	Ref. to checklist in GS4GG PDD:	
Description of the audit finding	Date:		22/02/2023
VVB team observed change in design of project activity, however design change approval from GS is missing in document. Further provide detail of expected commissioning date of rest 2 gas engine from total 7 gas engine mentioned in RCP PDD. Kindly clarify.			
Project Participant's response		Date:	20/03/2023
Latest approval of GS (as part of GS4GG transition annex review) in which below latest design approval from GS is stated have been submitted to DOE. "The Project is operational with 5 sets of gas engines with a total capacity of 6.508 MW1 installed capacity and generated electricity has been delivered to the national electricity system through a transformer substation. 6th and 7th gas engines have not been installed yet due to a future investment planning. They are envisaged to be installed in the future. The total installed capacity of the project activity is estimated to reach 9,338 MW with total of 7 gas engines with a nominal capacity between 1.2 MW and 1.415 MW range." Expected commissioning of the rest 2 gas engines is fourth quarter of 2023 and it is also stated in the Section A.3 of RCP PDD.			
Documentation provided as evidence by Project Participant			
GS4GG Transition Annex – GS Final Review Approval RCP PDD			
Auditor's assessment comment		Date:	15/06/2023
PP has submitted the design certificate and transition review annex by sustain-cert document VVB team thus found change in design has been approved by GS review team. Thus, CL is closed.			

Type:	☐ CAR ☒ CL/CR ☐ FAR	Number:	02
Raised by:	Dr. Atul Takarkhede	Ref. to checklist in GS4GG PDD:	
Description of the audit finding	Date:		17/01/2023
PP is requested to submit GS Design Review for CP 1, & latest performance review completed by GS in order to address the FARs raised by sustain-cert. Kindly Submit.			
Project Participant's response		Date:	13/06/2023
Related documents submitted as per request.			
Documentation provided as evidence by Project Participant			
GS1013 Issuance Review Period 12.05.2016 Verification Report_4th monitoring period_01.01.2016 to 31.05.2017 Monitoring Report_4th monitoring period_01.01.2016 to 31.05.2017			
Auditor's assessment comment		Date:	15/06/2023
VVB team confirms that no FAR has been remaining from Design review and previous performance review. Thus, CL is closed.			

Type:	☐ CAR ☒ CL/CR ☐ FAR	Number:	03
Raised by:	Dr. Atul Takarkhede	Ref. to checklist in GS4GG PDD:	
Description of the audit finding	Date: 17/01/2023		
The project activity is registered with gold standard and thus demonstration of Ongoing Financial Need missing required during GS RCP with quantitative justification along with supporting documents in line with para 5.1.47 (e) of the PRINCIPLES & REQUIREMENTS, version 1.2. Thus, Corrective action sought.			
Project Participant's response	Date: 13/06/2023		
Carbon finance to be derived from the Gold Standard Certification is crucial to the financial sustainability and operational continuity of the project. Qualitative narrative for the carbon revenue cruciality and ongoing financial need of the project as per the GS Principles & Requirements (Version 1.2) are demonstrated in Section B.5.2-Ongoing Financial Need of RCP PDD in detail. Supportive confidential documentation is also provided. In addition to this, Section B.5 of RCP PDD has been updated in accordance with the active methodology ACM0001 v.19 and additionality of the project has been demonstrated.			
Documentation provided as evidence by Project Participant			
GS1013 Bank Credit Debt Details, Confidential RCP PDD			
Auditor's assessment comment	Date: 15/06/2023		
PP has submitted Bank Credit details to assessment team and as per section B.5 of RCP PDD VVB team observed the revenue derived from project activity is important for running the project activity. Thus, CAR is closed.			

Type:	☒ CAR ☐ CL/CR ☐ FAR	Number:	01
Raised by:	Dr. Atul Takarkhede	Ref. to checklist in GS4GG PDD:	
Description of the audit finding	Date: 17/01/2023		
In Section A.2 the geographic coordinates of the project location is missing. Thus, corrective action sought.			
Project Participant's response	Date: 13/06/2023		
Geographic coordinates of the project location are provided in Section A.2.			
Documentation provided as evidence by Project Participant			
RCP PDD			
Auditor's assessment comment	Date: 15/06/2023		
Geographic coordinates of the project location are now included in section A.2 of revised RCP PDD. Thus, CAR is closed.			

Type:	☒ CAR ☐ CL/CR ☐ FAR	Number:	02
Raised by:	Dr. Atul Takarkhede	Ref. to checklist in GS4GG PDD:	
Description of the audit finding	Date: 17/01/2023		

PP is requested to submit copy of ODA declaration in order to cross-check that the project activity does not have any public funding or Official Development Assistance (ODA) funding. Kindly Submit.		
Project Participant's response	Date:	13/06/2023
ODA is submitted.		
Documentation provided as evidence by Project Participant		
ODA declaration letter has been submitted submitted		
Auditor's assessment comment	Date:	15/06/2023
PP has submitted the ODA declaration VVB team confirms that the project activity does not receive any public funding or Official Development Assistance (ODA) funding. Thus, CAR is closed.		

Type:	☒ CAR ☐ CL/CR ☐ FAR	Number:	03
Raised by:	Dr. Atul Takarkhede	Ref. to checklist in GS4GG PDD:	
Description of the audit finding		Date:	17/01/2023
The start and end date of crediting year of the project activity given in Section B.6.2 in the Table 6, Table 7, Table 8, Table 12, Table 13, and Table 15 and in Section B.6.4 are not in line with the ER sheet. Thus, corrective action sought.			
Project Participant's response		Date:	13/06/2023
Typo mistakes in the start and end date of crediting year of the project activity given in Section B.6.2 in the Table 6, Table 7, Table 8, Table 12, Table 13, and Table 15 and in Section B.6.4 and ER sheet have been corrected.			
Documentation provided as evidence by Project Participant			
RCP PDD ER Sheet			
Auditor's assessment comment		Date:	15/06/2023
PP has now corrected the start and end date of crediting year of project activity given in B.6.2 in Table 6,7,8,12,13 and 15 in section B.6.4 and ER sheet. Thus, CAR is closed.			

Type:	☒ CAR ☐ CL/CR ☐ FAR	Number:	04
Raised by:	Dr. Atul Takarkhede	Ref. to checklist in GS4GG PDD:	
Description of the audit finding		Date:	17/01/2023
1. In Section B.6.2 of GS RCP PDD the source of Data/Parameter is not clearly mentioned and weblink to cross-check the mentioned values are also missing. Thus, corrective action sought. 2. In Section B.7.1 of GS RCP PDD the unit of Data/Parameter to be monitored is missing. Thus, corrective action sought.			
Project Participant's response		Date:	13/06/2023
1. Section B.6.2 is updated as per request. 2. Section B.7.1 is updated as per request.			
Documentation provided as evidence by Project Participant			

RCP PDD		
Auditor's assessment comment	Date:	15/06/2023
1. PP has now incorporated the weblink in to crosscheck section B.6.2 of GS RCP PDD. 2. PP has now updated unit of B.7.1 of GS RCP PDD Data/parameter to be monitored. Thus, CAR is closed.		

Type:	☐ CAR	☐ CL/CR	☒ FAR	Number:	01
Raised by:	Dr. Atul Takarkhede			Ref. to checklist in GS4GG PDD:	
Description of the audit finding				Date:	03/12/2024
FAR 01: During the review of the Performance Certification Review Feedback form for the fourth verification (01/01/2016 to 31/05/2017) below FAR was raised by GS/Sustain-Cert: <i>To meet GS site visit requirement, the contracted DOE shall conduct the next onsite verification prior to 20 June 2018.</i> Thus, above FAR remains open for the next performance certification of the project activity. FAR 02: Further, assessment team noted that PD has contacted for the Performance Review documents of 4 th verification with Sustain-cert on 14 th October 2024. However, the review documents were not available with Sustain-cert at this moment vide mail dated 17 th October 2024 & communicated that it will take more time to trace the documents. Thus, below FAR is raised by VVB for the next performance review of the project activity. <i>PD shall address any FAR other than above from the final version of 4th Verifications performance review.</i>					
Project Participant's response				Date:	DD/MM/YYYY
NA					
Documentation provided as evidence by Project Participant					
NA					
Auditor's assessment comment				Date:	DD/MM/YYYY
NA					

Appendix 2: Audit Team CVs

Name	SHORT CV. BACKGROUND INFORMATION
Mr. Atul Takarkhede	Dr. Atul Takarkhede is Ph.D. (Environmental Sciences) from Institute of Science, RTM Nagpur University, Nagpur, and he has already published different technical papers related to environmental sciences. He counts with more than 11 years of experience in field of Environmental Auditing, consulting and accreditation. He is an expert in ISO 9001-14001, CO2/GHG Reporting, Carbon Foot Print, Energy, Water and Waste Management reporting for organizations' environmental performance. His professional portfolio is mainly related with carrying out EIA, conducting QA/QC of EIA Reports; conducting environmental/water audits; NABET requirements appliance, functional area expert in Water Pollution & Solid & Hazardous Waste management among others. Furthermore, he counts with solid experience on CDM-VCS-GS consultancy and auditing. Currently he is associated with True Quality Certifications Private Limited and empanelled with Applus+ Certification to carry out GHG audits in the aforementioned schemes.
Dr. Yusuf Serengil	Dr. Yusuf Serengil is a Forest Engineer with a PhD in Watershed Management. He has experience in climate change at both policy and technical accounting (GHG inventory) levels. He has been involved in the UNFCCC process since 2010 as a technical land-use sector advisor. He participated in projects in Kyrgyzstan, Palestine, and USA and took part in review teams reviewing several countries' GHG inventories. He is a LULUCF expert with all the UNFCCC GHG expert certificates, including GHG inventory review expert, Biennial Report expert, Biennial Update Report expert, and National Communications. Dr. Yusuf Serengil is based in Istanbul. Currently he is associated with True Quality Certifications Pvt. Ltd. as Local Expert in Turkey.
Mr. Denny Xue	Mr. Denny Xue has a Bachelor's Degree on Thermal Energy Engineering and Master's Degree on Environmental Engineering. He has more than 10 years of experience on CDM project development. Before he joined Applus+ LGAI, he has been worked for Shanghai Chuanji Investment and Management which is a CDM consultancy company as a project manager for CDM project development. He is working with Applus+ since 2011 carrying out Validation and verification for CDM/GS/VCS project under scope 1 and 13 as auditor, lead auditor, technical expert and technical reviewer.