



**Verified Carbon
Standard**

AVCIKORU LANDFILL GAS TO ELECTRICITY PROJECT



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Summary:

LGA Technological Center S.A. (Applus+ Certification) (Hereafter referred as Applus+ Certification) has been appointed by “EKI Energy Services Limited” to perform the Joint validation and verification of the “Avcıkoru Landfill Gas to Electricity Project” is being implemented by “Körfez Enerji Sanayi ve Ticaret Anonim Şirketi” (VCS ID 3997¹)

The project activity is primarily aimed at generating electrical energy from landfill site and subsequently making a contribution towards mitigating greenhouse gas (GHG) emissions into the atmosphere through avoidance of same power generation by fossil fuel power plants along with decomposition of MSW (Municipal Solid Waste) in a solid waste disposal site that would have occurred in the absence of the project activity and anaerobic decomposition of organic matter through landfill gas to electricity generation process.

Validation Summary: The validation objective is an independent assessment by a Third Party of a proposed project activity against all defined criteria set for the registration under the VCS. In order to confirm that the project activity, as documented, is sound reasonable and meets the identified criteria, the validation involves the assessment of project conformance to VCS standards/programs, project conformance to the applied methodology, including the procedure for the demonstration of additionality specified in the methodology; and likelihood that methods and procedures set out in the Joint Project Description and Monitoring Report (hereafter refer to as “joint PD & MR”) will generate verifiable GHG data and information when implemented. Validation is a requirement and is seen as necessary to provide assurance to stakeholders of the quality of project and its intended generation of VCU. Validation is part of the VCS project cycle and will finally result in a conclusion by the executing VVB whether a project activity is valid to be submitted for registration to Verra registry. Validation is conducted using LGA Technological Center S.A. (Applus+ Certification) procedures in line with the requirements specified in the latest version of the VCS Validation and Verification Manual and applying auditing techniques. The assessment team assessed the project activity’s compliance against the VCS Standard Version 4.4, the selected CDM methodology and the joint PD & MR. The project is eligible under non-AFOLU project.

Validation purpose: The project is registered with VCS Project ID 3997. The start date of the project activity is the 18-June-2021. This is the earliest date of commissioning of the project activity. The First Crediting Period is from 18-June-2021 to 17-June-2028. The project activity is reducing GHG estimated emission reduction to the 812,501 tCO₂e/annum² for the entire crediting period of 07 years.

Verification Summary: LGA Technological Center S.A. (Applus+ Certification) has performed the verification of the emission reductions reported for the project activity “Avcıkoru Landfill Gas to Electricity Project” (VCS Project ID: 3997³) for the monitoring period 18-June-2021 to 31-October-2022 (inclusive both days) to review and determine the monitored reductions in GHG emissions that have occurred as a result of the project activity. These emission reductions are claimed as Verified Carbon Units (VCU) under the Verified Carbon Standard (VCS) version 4.5. The verification was performed on the basis of VCS Program Guide version 4.4 and VCS standard version 4.5 for the VCS projects, as well as criteria given to provide for consistent project operations, monitoring and reporting. The verification was conducted by means of document review, follow-up interviews and site inspections, and the resolution of outstanding issues.

Verification purpose: The main purpose of this verification activity is to have an independent third party for the assessment of the project design, monitoring report to ensure a thorough assessment of the proposed project activity against the applicable CDM and VCS requirements.

The monitoring period covered under this periodic verification is 18-June-2021 to 31-October-2022 (including both days) and the project activity achieved a total 631,603 tCO₂e emission reductions during this monitoring period from the generation-mix of power plants connected to the Grid, which is mainly dominated by thermal/fossil fuel-based power plant.

The scope of the verification is the independent and objective review of the Joint Project Description (PD) and Monitoring Report (MR). The joint PD & MR is reviewed against the relevant criteria (see above) and decisions by the CDM Executive Board and VCS executive board, including the approved baseline and monitoring methodology. The verification was based on the guidance given in the CDM validation and verification standard for project activities, version 03.0, review against previous registered project documents, VCS program guideline version 4.4 and VCS Standard version 4.5.

A risk-based approach has been followed to perform this validation and verification activity. In the course of verification, 08 Corrective Action request (CAR) and 02 Clarification Requests (CLs) were raised and successfully closed. No FAR was raised during this validation and verification. The review of the joint PD & MR and additional documents related to baseline and monitoring methodology; the subsequent background investigation, follow-up interviews and PP have provided LGAI Technological Center S.A. (Applus+ Certification) with sufficient evidence to verify the fulfilment of the stated criteria of VCS.

The assessment team has employed a risk-based approach to assess the completeness and accuracy of the claims and conservativeness of the assumptions in the MR. The main focus of the assessment team is to identify the significant risks for the project implementation and the generation of VCUs. The validation and verification are 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 PD-MR combined.

The only purpose of the verification is its usage during the issuance process as part of the VCS project cycle. Therefore, LGAI Technological Center S.A. (Applus+ Certification) can't be held liable by any party for decisions made or not made based on the verification opinion, which will go beyond that purpose.

The validation and verification have been planned and organized to achieve a Reasonable Level of assurance as per the requirement of VCS. No sampling procedure applied for document verifications. The entire documents checked/verification conducted to arrive at positive verification conclusions.

¹ <https://registry.terra.org/app/projectDetail/VCS/3997>

² Rounddown values|

³ <https://registry.terra.org/app/projectDetail/VCS/3997>

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1 INTRODUCTION

1.1 Objective

LGAI Technological Center S.A. (Hereafter referred as Applus+ Certification) has been appointed by “EKI Energy Services Limited”. to perform the validation and verification of the “Avcıkoru Landfill Gas to Electricity Project.” under guideline version 4.4 and VCS Standard version 4.5. The objective of this validation and verification activity is to have an independent third party for the assessment of the project design, Joint PD & Monitoring Report and Final Joint Validation and Verification report and to ensure a thorough assessment of the proposed project activity against the applicable CDM and VCS requirements. In particular,

- The project's baseline is assessed against ACM0001 Version 19.0/3/
- The projects compliance with the requirements of Article 12 of the Kyoto Protocol, the CDM Modalities and Procedures as agreed in the Marrakech Accords under decision 3/CMP.1, the annexes to this decision, subsequent decisions and guidance made by COP/MOP & CDM Executive Board and other relevant rules, including the Host Country legislation and sustainability criteria along with VCS guideline version 4.4 and standard version 4.5.
- CDM validation and verification standard for project activities, Version 03.0
- VCS program guideline v 4.4
- VCS standard v.4.5

Joint validation and verification are seen as necessary to provide assurance to stakeholders on the quality of the project and its intended generation of verified Carbon Units (VCUs) for the renewed crediting period & verification is a requirement for all VCS projects and is seen as necessary to provide assurance to stakeholders of the quality of the project and its intended generation of Verified Carbon Units (VCUs).

1.2 Scope and Criteria

The scope is defined as an independent and objective review of the Joint VCS PD and MR is prepared as per the approved methodology ACM0001 Flaring or use of landfill gas, Version 19.0. The Joint VCS PD and MR is reviewed against the criteria stated in Article 12 of the Kyoto Protocol, the CDM modalities and procedures as agreed in the Marrakech Accords and the relevant decisions by the CDM Executive Board and VCS standard Version v4.5. and guideline version 4.4 including the approved baseline and monitoring methodology, ACM0001, Version 19.0. The validation & verification was based on the requirements in the CDM validation and verification standard for project activities, Version 03.0. and VCS program guideline version 4.4. and VCS Standard version 4.5. The validation & verification 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 Joint VCD PD and MR. In line with Guidelines for Application of materiality in validation & verifications, the assessment team has conducted a complete verification of all the information presented in the Joint VCS PD and monitoring report and data presented ex-ante Emission reduction sheet and monitored data presented in the emission

reduction calculation spread sheet. There are no material errors, overestimation of ER, omission or misstatement. The validation/verification team has reviewed all the documents like commissioning certificates etc.

1.3 Reasonableness of Assumptions and Level of Assurance

The joint validation and verification report is based on the joint PD & MR, supporting evidences made available to the assessment team and information collected through performing interviews and during the on-site assessment. The validation conclusion is assured a reasonable level of assumption. The verification conclusion expresses a conclusion with a reasonable level of assurance about whether the reported GHG emissions reduction data is free from material misstatement. LGAI Technological Center S.A. (Hereafter referred as Applus+ Certification) applied a materiality threshold of 01% with respect to omission or misstatements concerning reported quantities as per VCS standard.

1.4 Summary Description of the Project

Avcıköru Landfill Gas to Electricity Project, where landfill gas from the landfill of Kömürçüoda used to generate renewable power. The Landfill Gas to Electricity power project has been developed using existing landfill site for the project activity. Electricity production is done by burning the landfill gas via Gas generator with an approved capacity of 38.205 MWe utilizes collected landfill gas for power generation. The landfill site is estimated to receive around average of 7,362 tonnes/day of waste will be stored in the landfill, and approximately 411,545,642 m³ of landfill gas will be generated in 7 years. About 59.58% of this waste consists of organic materials such as pulp, paper and cardboard, and food waste. The start date of the project activity is the 18-June-2021. This is the earliest date of commissioning of Gas engine -1. The expected emission reductions are 5,687,509 tCO_{2e} for the whole crediting period. In current monitoring period from 18-June-2021 to 31-October-2022 (First and last date included) the project activity has resulting in GHG emission reductions of 631,603 tCO_{2e}.

2 VALIDATION AND VERIFICATION PROCESS

2.1 Method and Criteria

Validation and Verification Scope: The scope is defined as an independent and objective review of the Joint PD & Monitoring report. The VCS PD and MR is reviewed against the criteria stated in Article 12 of the Kyoto Protocol, the CDM modalities and procedures as agreed in the Marrakech Accords and the relevant decisions by the CDM Executive Board and VCS standard, Version 4.5. and guideline version 4.4., including the approved baseline and monitoring methodology ACM0001: Flaring or use of landfill gas Version 19.0. The validation and verification were based on the requirements in the Validation and Verification Standard for project activities, version 03.0., and VCS guideline version 4.4. and standard, version 4.5.

The validation and verification are 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 combined project description and the Monitoring report.

Validation and Verification Process: The project assessment is based on the Clean Development Mechanism Validation and Verification Standard for project activities, version 03.0 and VCS Standard version 4.5 and VCS guideline, version 4.4 and is conducted using standard auditing techniques 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 VCS project activity are appointed.

Once the project is received by the assessment team, the members of the assessment team carried out:

- I. A desk review of the Joint PD and MR;
- II. Onsite Visit with project participant;
- III. The resolution of outstanding issues and the issuance of the final verification report and opinion.

The prepared Joint validation and verification report and other supporting documents then undergo an internal quality control before being submitted to the VCS executive board.

In order to ensure transparency, assumptions must be clear and stated explicitly and background material must also be referenced. LGAI Technological Center, S.A. (Applus+ Certification) has developed a specific checklist customized for the project. The checklist demonstrates, in a transparent manner, the project criteria (requirements), discussion on each criterion by the assessment team, and the results from verifying the identified criteria.

Appointment of the assessment team

According to the sectoral scope / technical area and experience in the sectoral or national business environment, LGAI Technological Center S.A. (Applus+ Certification) has composed a project assessment team in accordance with the appointment rules in the internal Quality Management System of LGAI Technological Center S.A. (Applus+ Certification).

The composition of audit team shall be approved by the LGAI Technological Center S.A. (Applus+ Certification) ensuring that the required skills are covered by the team.

The four qualification levels for team members that are assigned by formal appointment rules are as presented below:

- Lead Auditor (LA).
- Auditor (A) / Auditor in Training (AiT).
- Technical Expert (TE).
- Technical Reviewer (TR).

The sectoral scope / technical area knowledge linked to the applied methodologies /3/ shall be covered by the assessment team.

Name	Role	SS Coverage	TA Coverage	Financial aspect	Host country experience
Dr. Atul Takarkhede	LA/TE	YES	YES	YES	YES
Mr. Denny Xue	TR	YES	YES	YES	NA

The complete list of CVs is included as Appendix 3 of this report.

Document review

The Joint PD and Monitoring Report version 05 submitted by the PP 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 this report below in Appendix 1.

Onsite Visit

An onsite audit was conducted by assessment team of LGAI Technological Center S.A. (Applus+ Certification) who performed site visit on 14-Feb-2023 and 15-Feb-2023 with project stakeholders to confirm selected information and to resolve issues identified in the document review. The detail is provided in this report in the sections 2.3 and 2.4 below.

Resolution of Clarification and Corrective Action Request

The objective of this phase of the Joint Validation and Verification was to resolve the requests for corrective actions and clarification and any other outstanding issues which need to be clarified for Applus+ Certification positive conclusion on the Monitoring report. 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 verification process, the concerns raised and responses given are summarized below in the Appendix 2.

The final Joint PD and MR submitted by PP serves as the basis for the final assessment presented. Additional changes to the project during the verification process are not considered to be significant with respect to the main CDM/VCS objectives. The two CDM/VCS main objectives are the reduction of anthropogenic GHG emissions and the contribution of sustainable development to the host country.

Internal quality control

As final step of a Joint Validation & Verification of the final documentation including the final Joint validation & verification report and the checklist have to undergo an internal quality control by the technical review committee, i.e., each report has to be finally approved either by the head of the technical review committee or the deputy. In case one of these two persons is part of the assessment team approval can only be given by the other one to avoid any conflict of Interest.

After confirmation of the project owners the positive verification opinion and relevant documents are submitted to the VCS secretariat through the VCS web-platform.

2.2 Document Review

The joint PD & MR and supporting background documents related to the project implementation were reviewed. Documents review was conducted to ensure consistency with and identify any deviation from VCS program requirements. Desk review included an examination of the project design details, baseline scenario, additionality, ex ante and monitoring data and parameters, and ex-ante quantification of GHG emission reductions. The assessment team also used additional documentation by third parties like host party legislation, technical reports referring to the project design details, baseline scenario, additionality, monitoring or to the basic conditions and technical data. Furthermore, the joint PD & MR and emission reduction calculation spreadsheet of monitoring period from 18-June-2021 to 31-October-2022, relevant decisions, clarifications and guidance from the Verra, other information and references relevant to the project activity have also been assessed during the desk review.

The details of the document observed during the validation and verification process are listed in Appendix 1 of this report.

2.3 Interviews

Interviewee		Date	Subject	Team member
Name	Affiliation			
Tarik kalkanci	Korfez Energy, Manager	14-Feb-2023 and 15-Feb-2023	Project Implementation, procedure, TEAIS reports, calibration, grievance mechanism, Management practices, data storage, QA/QC	Dr. Atul Takarkhede
Aysergi Kilink	EKI Energy Services Ltd.		GHG calculations, MR and ER preparation, Data collection, data storage, QA/QC	
Ismail Simsek	Local Villager		Local Stakeholder Consultation	
Ahmet Simsek	Local Villager			
Ahmet Koka	Local Villager			

2.4 Site Visits

Duration of On-site inspection: 14-Feb-2023 and 15-Feb-2023				
No.	Activity performed on-site	Site location	Date	Team member
1.	Assessment team checked the implementation of the project, Location of the project activity, Baseline emission, Emission reduction calculation, technical description of the project and Monitoring. Assessment team also checked that whether the monitoring plan as described in the VCS joint PD & MR is actually practised onsite. Also, assessment team checked any change in host country criteria which may affect the baseline of the project activity.	Kömürçüoda Solid Waste Landfill Site, Şile District, Istanbul, Turkey	14-Feb-2023 and 15-Feb-2023	Dr. Atul Takarkhede

The interviewed personnel during on site visit and objective are listed in above table.

2.5 Resolution of Findings

The objective of this phase of the Validation and Verification was to resolve the requests for corrective actions and clarification and any other outstanding issues from previous validation which need to be clarified for Applus+ Certification's positive conclusion on the Joint PD and MR. 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 verification process, the concerns raised, and responses given are summarized below in the Appendix 2.

The final joint PD & MR submitted by PP serves as the basis for the final assessment presented. Additional changes to the project during the joint validation and verification process is not considered to be significant with respect to the main CDM/VCS objectives. The two CDM/VCS main objectives are the reduction of anthropogenic GHG emissions and the contribution of sustainable development to the host country.

Areas of validation and verification findings	No. of CL	No. of CAR	No. of FAR
Project design document and Monitoring report	00	00	00
Description of project activity	CL#01 & CL#02	CAR#01 & CAR#02	01
Application of selected baseline and monitoring methodology and selected standardized baseline			
Applicability of methodology and standardized baseline	00	00	00
Deviation from methodology	00	00	00
Clarification on applicability of methodology, Tool and/or standardized baseline	00	CAR#05	00
Project boundary	00	00	00
Establishment and description of baseline scenario	00	00	00
Demonstration of additionality	00	CAR#04	00
Emission reductions	00	CAR#08	00
Calibration details	00	CAR#07	00
Monitoring plan	00	00	00
No Net harm assessment	00	00	00
Local stakeholder consultation	00	CAR#03	00

Areas of validation and verification findings	No. of CL	No. of CAR	No. of FAR
Others (Participation under other GHG Programs)	00	CAR#06	00
Total	02	08	01

The list of findings and the resolution is presented in Appendix 2 of this report.

2.5.1 Forward Action Requests

This is initial validation + verification process hence No FAR was raised previously. However, FAR 01 is raised during this joint validation & verification of the project activity for project implementation. Please refer Appendix 2 of this report.

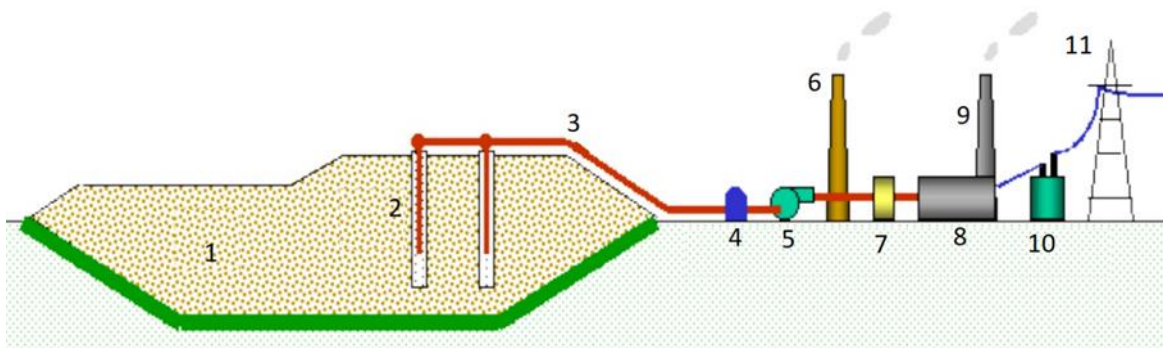
3 VALIDATION FINDINGS

3.1 Project Details

The project activity is Avcıkoru Landfill Gas to Electricity Project. It is a landfill gas to electricity power project which is utilizing landfill gas from Kömürcüoda landfill site to generate renewable power.

The expected average annual emission reductions are 812,501 tCO₂e/y by project activity. The generated electricity will be supplied to grid. The project activity help in greenhouse gas (GHG) emission reduction by using Landfill Gas for generating electricity which otherwise would have been generated using grid mix power plants, which is dominated by fossil fuel based thermal power plants.

The project is built within the premises of İSTAÇ Kömürcüoda Landfill Facility in Şile province of İstanbul city of Turkey. During Site visit, Geo coordinates checked on Google earth and assessment team conclude geo coordinates of project locations are consistent with Joint PD and MR. Landfill gas is named as the part of the stored organic waste that emerges because of microbiological decomposition or passes into the gas phase of the stored waste. Since there is no air entry into the body after the formation of the tank filling, anaerobic reaction begins in the body after the oxygen present in the environment is depleted. As a result of this reaction, organic substances in the environment are decomposed and H₂S, CO₂ and CH₄ (methane) gases emerge. The bottom floor of the solid waste landfill area is covered with an impermeable plastic plate (liner), and daily wastes are stored in this area. When the capacity of these sections, where the daily garbage cells are stored, is full, they are covered with a thick layer of soil and thus the methane gas formed in the garbage is prevented from mixing into the air. Vertical wells were drilled in the closed sections and perforated pipes were placed, and thus, the gases formed in the landfill were collected with a pipe network. These placed pipes go down 2-3 m from the impermeable layer. These pipes in the gas wells are connected to the main collection pipe in the facility. The gases are supplied to the system by being sucked from the landfill with a little negative pressure by means of the blower connected to the collection pipe and providing the suction power. Please see the figure below.



1-Landfil, 2-LFG collecting pipes, 3-Main gas collecting pipe, 4-Gas filtering system, 5-Blower, 6-Gas furnace, 7-Gas management system, 8-Gas motors, 9-Exhaust, 10-Transformer, 11-Distribution network

The main collection pipe from the landfill first passes through the coarse filter and dehumidifier system. From here, the gas enters the process system by coming to special pumps and is sent to the engine. Gas is burned in the gas engine, producing mechanical energy. Electricity is also produced by a generator connected to the engine. Exhaust gas is given to the atmosphere by a chimney. The generator output is connected to the distribution network by increasing the voltage by means of a transformer.

As per feasibility report submitted by PP to VVB, Project Participant considered gradual installation of engines and demonstrate financial planning accordingly. Therefore, Information regarding Capacity, number and commissioning date of the total installed 25 gas engines have been provided in the table below. Remaining 02 gas engines have not installed yet and are expected to be commissioned in July 2024.

Commissioning Date	Capacity	Quantity of Gas Engines
18-June-2021	1.451 MWm / 1.415 MWe	3
23-December-2021	1.451 MWm / 1.415 MWe	7
01-April-2022	1.451 MWm / 1.415 MWe	1
23-June-2023	1.451 MWm / 1.415 MWe	10
18-January-2024	1.451 MWm / 1.415 MWe	3
16-Februaty-2024	1.451 MWm / 1.415 MWe	1
Not commissioned yet Planned: July 2024	1.451 MWm / 1.415 MWe	2

	39.177 MWm / 38.205 MWe (Commissioned: 36.275 MWm / 35.375 MWe, To be commissioned: 2.830 MWe)	27 (25 commissioned, 2 to be commissioned)
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Technical lifetime of the project activity is 30 years. All 27 gas engines will be of GE Jenbacher J 420 GS (Out of 27 units, 25 units are commissioned on above mentioned dates) and their technical specifications are given below:

S.no.	Manufacturer	Units	GE Jenbacher
1.	Engine type	-	J 420 GS-B121
2.	Working principle	-	4-Stroke
3.	Configuration	degree	V 70°
4.	No.of cylinders	Nos	20
5.	Bore	mm	145
6.	Stroke	mm	185
7.	Piston displacement	lit	61.10
8.	Nominal speed	mm	1,500
9.	Mean piston speed	mis	9.25
10.	Length	mm	3,750
11.	Width	mm	1,580
12.	H eight	mm	2,033
13.	Weight dry	kg	7,200
14.	Weight filled	kg	7,900
15.	Moment of inertia	kgm ²	11.64
16.	Direction of rotation (from Fly wheel view)	-	Left
17.	Radio Interference level to VDE 0875	--	N
18.	Starter motor output	kW	13
19.	Starter motor voltage	V	24

Flare system: Project activity also consist of an enclosed Haase make flare system with capacity of 2500 m³/h to flare any excess gas and same is included in the project boundary.

The details of Project's commissioning and location are as follows:

Name of the Project Promoter	Location	Geographical Co- ordinates		Points	Earliest Commissioning Date
		Latitude	Longitude		
Körfez Enerji Sanayi ve Ticaret Anonim Şirketi	Kömürcüoda LFG Site, Şile District, İstanbul, Turkey.	41° 08'45.8487"N	29° 22'38.8630"E	1	18-June-2021
		41° 08'46.1597"N	29° 22'39.8780"E	24	

The project activity doesn't involve any GHG emission sources. This project adopts a first crediting period of 7 years. The expected average annual emission reductions are 812,501 tCO₂e/y. Accordingly, the project is expected to generate 5,687,509 tCO₂e emissions reduction throughout its first crediting period. The validation team confirmed that emission reduction forecast is reasonable if the underlying assumptions do not change.

The validation team confirms that the project activity falls under the category 2 'Project' as per para 3.10 of the VCS Standard version 4.5., as it has potential to reduce GHG emission more than 300,000 tCO₂e/year. The spatial extent of project boundary is till grid. The project activity will supply electricity to the Grid through transmission lines connected through sub-stations.

Since the project activity generates electricity through Landfill Gas, a clean renewable energy source it doesn't cause any negative impact on the environment and thereby contributes to climate change mitigation efforts.

Validation team confirmed that the project activity is not a grouped project.

The project activity is in compliance to Related laws and regulations to the proposed project activity are as followed:

- a. Electricity Market Law (⁴Law Number: 6446, ratified 14/03/2013, enacted 30/03/2013)
- b. Law on Utilization of Renewable Energy Resources for the Purpose of Generating Electricity Energy⁵ [Law Number: 5346 Ratification Date: 10.05.2005 Enactment Date: 18.05.2005]
- c. Environmental Law⁶ [Law Number: 2827 Ratification Date: 09.08.1983 Enactment Date: 11.08.1983]
 - i. Regulation on Solid Waste Control⁷ [Last updated on 05.04.2005]
 - ii. Regulation on Managed Waste Land Filling⁸ [Regulation number 27533 Enactment Date: 26.03.2010]

Assessment team during the desk review and on-site assessment confirms that in accordance with methodology ACM0001 "Flaring or Use of Landfill Gas" version 19.0.0 the project activity is an LFG power generation project, utilizing landfill gas consists of methane.

The scenario existing prior to the start of the implementation of the project activity is:

- LFG from Kömürcüoda Solid Waste Landfill Facility is released into the atmosphere.
- Equivalent electricity generated by the project is supplied by the grid, which is dominated by fossil fuel-based power plants.

The project ownership is the legal right to control and operate the project activities. Körfez Enerji Sanayi ve Ticaret Anonim Şirketi is the project proponent (PP) of project activity and they have the legal right to control and operate the project activities. Same has been confirmed through Generation license and EIA positive certificate, thus accepted.

⁴ <https://www.mevzuat.gov.tr/mevzuat?MevzuatNo=5346&MevzuatTur=1&MevzuatTertip=5>

⁵ <https://www.resmigazete.gov.tr/eskiler/2005/05/20050518-1.htm>

⁶ <https://www.mevzuat.gov.tr/mevzuatmetin/1.5.2872.pdf>

⁷ Reference: The official web page of the Ministry of Environment and Forestry;
<http://www.cyg.gov.tr/CYGM/Files/mevzuat/yonetmelik/kaky.doc>

⁸ <https://www.resmigazete.gov.tr/eskiler/2010/03/20100326-13.htm>

Assessment team checked the declaration provided by the PP and confirmed that the project has not been registered or is seeking registration under any other GHG programs i.e., CDM, GS & GCC. Further, Assessment team confirms that given project activity is not a supply chain project. Hence, scope 3 emissions are not applicable.

Assessment team checked onsite and confirms that the details of the project proponent areas below:

Organization name	Körfez Enerji Sanayi ve Ticaret Anonim Şirketi
Contact person	Mr. Ahmet Çiçekçi
Title	Investments and Business Development Manager
Address	Maltepe Mah. Yılanlı Ayazma Sk. Yeşil Holding Blok No:17 İç Kapı No:5 Zeytinburnu İstanbul - Türkiye
Telephone	+90 212 482 04 03
Email	ahmet.cicekci@yesilglobal.com

Assessment team also checked the details of other entity and found correct. The details are as below:

Organization name	EKI Energy Services Limited
Role in the project	Project Consultant
Contact person	Manish Dabkara
Title	MD/CEO
Address	Office No 201, Plot No 48, Scheme 78, Part 2, Vijay Nagar, Indore 452010, Madhya Pradesh, India
Telephone	+91 (0) 731 42 89 086
Email	manish@enkingint.org

18-June-2021 is the project start date which has been confirmed through Generation License issued by Government of Turkey. PP has chosen 07-year renewable crediting period. The 1st crediting period was 18-June-2021 to 17-June-2028. It was confirmed that current Joint PD & MR is being developed under the first crediting period which is started from 18-June-2021.

The project activity is not a part of grouped project.

No commercially sensitive information has been excluded from the public version of the project description.

Estimated average annual GHG emission reductions from the project activity are 812,501 tCO₂e per year, which is greater than 300,000 tCO₂e per year. Hence, the activity instances are classified as “Large Project”.

Project Scale

Project	
Large project	√

The estimated GHG Emission Reductions will depend upon the actual energy supplied to grid by the project activity. The tentative Emission Reduction for the project activity instances being included in the grouped project activity are as follows:

Year	Estimated GHG emission reductions or removals (tCO ₂ e)
Year 2021 (18/06/2021 - 31/12/2021)	299,372
Year 2022 (01/01/2022 - 31/12/2022)	692,606
Year 2023 (01/10/2023 - 31/12/2023)	777,184
Year 2024 (01/01/2024 - 31/12/2024)	833,190
Year 2025 (01/10/2025 - 31/12/2025)	846,013
Year 2026 (01/01/2026 - 31/12/2026)	859,783
Year 2027 (01/10/2027 - 31/12/2027)	872,768
Year 2028 (01/01/2028 - 17/06/2028)	506,593
Total estimated ERs	5,687,509
Total number of crediting years	7
Average annual ERs	812,501⁹

No commercially sensitive information has been excluded from the public version of the project description. The details are presented transparently to the assessment team for analysis which lead to positive conclusion for this validation.

The project proponent believes that the project activity has contributed to sustainable development in terms of the four indicators as follows:

Further, The Project is not rejected by other GHG programs, also not registered. A declaration for the same is checked and found correct by the assessment team. Also, assessment team checked the following registries to confirm the same. The details of the registries checked are as follows:

⁹ Rounddown values

1. <http://cdm.unfccc.int/>
2. <http://www.goldstandard.org/>
3. <https://verra.org/>
4. <https://www.globalcarboncouncil.com/framework/gcc-framework/>

The project promotes sustainable development through the following aspects:

Avcıkoru Landfill Gas to Power Generation Project is located at Kömürcüoda Landfill facility, Şile District, Türkiye. whose objective is to collect the landfill gas (LFG) from Kömürcüoda Landfill facility and utilize it to generate electricity. The project involves the installation of LFG collection, pre-treatment system, with subsequent electricity generation and grid connection system.

Social wellbeing: Setting up of the project activity has improved standard of living of local peoples, Infrastructure, created new job openings and thus reduce migration hence is supporting employment of the local people around.

Environmental wellbeing: Since the project activity leads to cleaner production of energy, it is leading to displacement of fossil fuel-based energy. Since the project activity leads to lesser GHG emission it results in better air quality. Further, contributing to the climate change fight by reducing CH₄ emissions.

- Constituting a new, clean and efficient technology model for the disposal and handling of waste.
- Generating and dispatching electricity from a renewable and sustainable energy source to a grid nowadays reliant on fossil.

Assessment team confirmed that the project makes positive contributions to at least three Sustainable Development Goals (SDGs). These are:

SDG 7: Affordable and Clean Energy

(7.2.1 Renewable energy share in the total final energy consumption)

The Proposed Project is a waste to power project that generates renewable energy by capturing methane from municipal waste and utilizing it to produce electric energy through gas engine systems. By supplying renewable energy generated at the plant to the national grid, the proposed Project will contribute to increasing the share of renewable energy in the global energy mix and the proportion of the population with primary reliance on clean fuels and technology. During current monitoring 107,375 MWh of renewable electricity to the grid, total contribution over project lifetime will be 2,027,995 MWh.

SDG 8: Decent Work and Economic Growth

8.5.2 Unemployment rate, by sex, age and persons with disabilities

The demand for food and electric energy is rapidly increasing in Turkey for various reasons, such as industrialization, urbanization, economic development, and population growth. The country's external dependence on agricultural products has intensified because the increasing demand cannot be met by a decreasing domestic agricultural production capacity which is due to several reasons, such as

shrinkage of agricultural land, increasing migration to urban spaces from rural areas where agricultural production is densely located, and dramatic increase in the cost of inputs for agricultural production. Therewithal, Turkey, which cannot meet its increasing electricity demand due to the deprivation of conventional resources used to generate energy, such as coal, oil, and natural gas, has also become foreign-dependent on energy. Through its implementation, the proposed project activity will contribute to reducing Turkey's foreign dependency by generating renewable energy out of municipal wastes. In addition, as an LFG-based renewable energy technology implementation, the proposed project activity will achieve higher levels of economic productivity; hence, increasing the annual growth rate of real GDP per employed person. Moreover, it will increase the region's employment capacity while decreasing the unemployment rate.

SDG 13: Climate Action

13.2.2 Total greenhouse gas emissions per year

The project activity reduces GHG emissions by capturing and utilizing methane, one of the most potent GHGs triggering climate change. It is estimated that the average annual emission reduction that the proposed Project will generate is around 812,501 tCO₂e, however GHG emission reduction in the current monitoring period is 631,603.

Thus, the project causes no negative impact on the surrounding environment contributing to environmental well-being. CL#01, CL#02, CAR#01 and CAR#02 was raised on this section and closed successfully. Please refer Appendix 2 for further details.

3.2 Participation under Other GHG Programs

The project was not registered under any other registry. Audit team checked the REC Mechanism database of India and GS4GG project database and found that the project activity is not registered under GHG mechanism. Assessment team checked the following registries to confirm the same.

1. <http://cdm.unfccc.int/>
2. <http://www.goldstandard.org/>
3. <https://www.globalcarboncouncil.com/framework/gcc-framework/>

Rejection by other GHG program: -

The Project is not rejected by other GHG programs. A declaration for the same is checked and found correct by the assessment team. Also, assessment team checked the following registries to confirm the same. The details of the registries checked are as follows:

1. <http://cdm.unfccc.int/>
2. <http://www.goldstandard.org/>
3. <https://verra.org/>
4. <https://www.globalcarboncouncil.com/framework/gcc-framework/>

The undertaking regarding the same is submitted by PP which is acceptable to the assessment team and assessment team also checked and found the declaration to be correct. Please refer Appendix 2 for further

details. Further, Assessment team confirms that given project activity is not a supply chain project. Hence, scope 3 emissions are not applicable.

Assessment team conclude that the project activity is eligible to participate under VCS program as per eligibility criterion given under VCS standard version 4.5.

3.3 Safeguards

3.3.1 No Net Harm

Since the waste dumping in the Kömürçüoda Landfill started in 1995, the project activity is not included in Annex: I of the Environmental Impact Assessment Regulation (List of Projects to be Applied Environmental Impact Assessment and Annex: II (List of Projects to which Selection and Screening Criteria will be Applied), which entered into force after being published in the Official Gazette dated 16.12.2003 and numbered 25318. VVB has cross verified the EIA exemption certificate (enclosed in appendix 1 of joint Pd and MR) and found to be in line with the details provided. However, PP has taken all necessary permits under the current legislation Through interview with local stakeholders during site visit, it is confirmed by the assessment team the implementation of the project will improve local socio-economic development and contribute to the sustainable development as described in section 2.1 of this joint Pd and MR. In conclusion, it is confirmed by the assessment team the project has no negative impacts on local environment and socio-economy. And no net harm on local environment and social community has been detected for the project.

3.3.2 Local Stakeholder Consultation

As per the VCS requirements, it is necessary to invite the relevant stakeholders, prior of the validation process. The assessment team checked the relevance of the dates during the validation site visit.

Local stakeholder consultation was conducted through distributing questionnaires to local stakeholders on 26-September-2022 (Photos of have been shared of meeting) by the project owner. The survey was conducted through distributing and collecting responses of questionnaires at the Avcıkoru Landfill Gas to Electricity Project site with the local stakeholders and head of the Karakiraz Village. During onsite visit interview with local s, VVB team assessed the questionnaire raised by Local stakeholder mentioned in section 2.2 pf Joint PD and MR, Same is found resolved appropriately by PP.

The questionnaire was reasonably designed to assess the project impacts on the local environment and social economic development. questionnaires were returned with a 100% response rate. By checking the questionnaires, the assessment te am confirm that the local stakeholder has no negative comments for the construction of the project activity. Furthermore, through site interview, the assessment team confirmed that communications with stakeholders were conducted at periodic intervals confirmed with grievance register.

The meeting started with opening speech by representative of project owner. All guests were introduced at the meeting. The representative of project owner explained how climate change occurs, what actions should be taken to prevent it and renewable energy basics. Further, he explained the technical aspects of project activity along with the harms of greenhouses gases especially methane, and how the project activity reduces the methane emissions and odour. The presentation continued with the comparison of unmanaged landfill sites and sanitary landfill. Then, the representative elaborated about carbon

mechanism and its requirement for the current project. He introduced the UNFCCC UN-SDGs to stakeholders, indicators of SDG #7, #8, and #13 and connection of these indicators with the project activity. The representative opened discussion regarding to these indicators with stakeholders and answered the uncertainties in stakeholders' minds. After the detailed discussions, the session was open for comments and suggestions from stakeholders.

The contact information of Company Executive of the company was given to mukhtar (head of the village) of the Karakiraz Village so that the local stakeholders will be able to reach company executive whenever they have any complaints, suggestions, or ideas about the project. Since mukhtar is the head of the village, he is the main contact person between the project owner and the local stakeholders. Mukhtar made sure that there is continuous communication between the two parties. Moreover, grievance register/logbook was delivered to the head of the Kale Village. This logbook will be checked in the next verifications to see whether there have been any complaints from the local stakeholders.

Assessment team verified the documents submitted by the PP like attendance sheet, invitation letter and feedback provided by the local stakeholder. It was confirmed that PP has placed grievance register at the project site which provides stakeholder opportunity to report any grievance they have. Thus, assessment team is of opinion that the local stakeholder consultation is adequate and appropriate.

Information regarding on-going communication:

There is a continuous communication mechanism between the Project Owner and local people. Furthermore, there is a grievance logbook available in the mukhtar's (Villagers head) office that in case of any complaints, people can easily reach out and declare their complaints in that logbook.

Grievances of local stakeholders is being handled via a structured and empathetic approach to ensure effective resolution and community satisfaction. The process regarding the same is given below:

1. People with grievances, register their complaint in the grievance logbook available in the mukhtar's (Villagers head) office.
2. The project representatives for the organization review grievances and prioritize the same based on severity.
3. The project representatives develop an action plan, assign responsibilities, and resolve the grievance given by the local stakeholder.
4. The senior project representatives review if the grievance has been resolved or not and make sure the grievance has been resolved completely as per the requirement of the stakeholder.
5. The whole process is documented and kept at Mukhtar's office and the organization's head office.

3.3.3 Environmental Impact

An Environmental Impact Assessment Positive Certificate has been provided by the project participants. The Law defines among others the general requirements of the Environmental Impact Assessment (EIA) states specific requirements according to the type of project, location, size and other characteristics. During desk review verification team observed that the Environmental Impact. The assessment of the "Avcikoru Landfill Gas to Electricity Power Plant Project" on the parcel no. 379 on the map section F22-

C2 regarding the EIA Regulation is carried out by the Çevre Norm Consultancy Engineering Ltd. Şti. and “EIA Exemption Decision” dated 22-January-2021 is issued by the Ministry.

In order to generate electrical energy from the gases to be collected from the solid waste stored on the land, whose coordinates have been given in the attached list and the EIA Positive Decision has been taken, "Production of Electrical Energy from the Methane Gas Coming from the Storage Area in the “Avcıkoru Landfill Gas to Electricity Project” project was evaluated as out of scope as it was less than the threshold value in the EIA Regulation Lists published in the Official Gazette dated 25-November-2014 and numbered 29186, and an additional report was prepared and added to the EIA Positive Decision in the “e-ÇED system”.

Considering the fact, that the project activity already obtained the mandatory regulation, it is therefore possible to claim that there is no net environmental impact linked to the project.

3.3.4 Public Comments

The Global Stakeholder Consultation commenting period had been completed before first crediting period. The assessment team noted that this project was open for public comment from 29-December 2022 and 28-January-2023. The detail was checked by the assessment team in the following web platform:

<https://registry.verra.org/app/projectDetail/VCS/3997>

During the period, no public comments were received.

3.3.5 AFOLU-Specific Safeguards

The project activity is not an AFOLU project.

For non-AFOLU projects, this section is not required.

3.4 Application of Methodology

3.4.1 Title and Reference

The following approved baseline & monitoring methodologies are applied: ACM0001: Flaring or use of landfill gas, Version 19.0.

Methodological Tools implemented:

- Tool 01- “Tool for the demonstration and assessment of additionality” Version 07.0.0¹⁰
- Tool 05-Tool to calculate baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation Version 03.0¹¹.
- Tool 04-Methodological Tool: Emissions from solid waste disposal sites, Version 08.1¹².

¹⁰ <https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-01-v7.0.0.pdf>

¹¹ <https://cdm.unfccc.int/methodologies/PAmethodologies/Tool/4/s/am-Tool/4/-05-v3.0.pdf>

¹² <https://cdm.unfccc.int/methodologies/PAmethodologies/Tool/4/s/am-Tool/4/-04-v8.1.pdf>

- Tool 07: “Tool to calculate the emission factor for an electricity system” Version 07.0¹³
- Methodological Tool: Tool 08: “Tool to determine the mass flow of a greenhouse gas in a gaseous stream” Version 03.0¹⁴
- Tool 27 “Investment Analysis” version 12.0¹⁵

3.4.2 Applicability

The project activity involves waste management technologies including LFG extraction, and utilization of the produced LFG for electricity generation. The applicability of the methodologies and Tools have been discussed below. The applicability of the project is validated against the current version of the methodology.

Applicability of ACM0001 V.19.0

For the landfill gas recovery component of the proposed VER project, the emission reductions resulting from the capture and utilization of landfill gas are calculated using ACM0001- Flaring or use of landfill gas Version 19.0. This methodology is applicable to landfill gas capture project activities, where the baseline scenario is the partial or total atmospheric release of the gas, and the project activities include activities such as:

Ref	Applicability Criteria	Justification	VVB Assessment
Para 3	The methodology is applicable under the following conditions: (a) Install a new LFG capture system in an existing or new (Greenfield) SWDS where no LFG capture system was or would have been installed prior to the implementation of the project activity; or (b) Make an investment into an existing LFG capture system to increase the recovery rate or change the use of the captured LFG, provided that: (i) The captured LFG was vented or flared and not used	The project includes installation of new LFG capture system in an existing SWDS where no LFG capture system was or would have been installed prior to the implementation of the project activity therefore the methodology condition 3.a is applicable to the project activity. The methodology includes installation of new LFG capture system and hence para 3.b is not applicable to the project activity. LFG captured is used for the purpose of generation of electricity and hence the	During the site visit, & document review, assessment team checked that project includes installation of new LFG capture system in an existing SWDS where no LFG capture system was installed prior to the implementation of the project activity. Also does not reduce organic waste that would be recycled in the absence of the project activity. therefore, the methodology

¹³ <https://cdm.unfccc.int/methodologies/PAmethodologies/Tool/4/s/am-Tool/4/-07-v7.0.pdf>

¹⁴ <https://cdm.unfccc.int/methodologies/PAmethodologies/Tool/4/s/am-Tool/4/-08-v3.0.pdf>

¹⁵ <https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-27-v12.pdf>

Ref	Applicability Criteria	Justification	VVB Assessment
	prior to the implementation of the project activity; and (ii) In the case of an existing active LFG capture system for which the amount of LFG cannot be collected separately from the project system after the implementation of the project activity and its efficiency is not impacted on by the project system: historical data on the amount of LFG capture and flared is available; (c) Flare the LFG and/or use the captured LFG in any (combination) of the following ways: (i) Generating electricity; (ii) Generating heat in a boiler, air heater or kiln (brick firing only) or glass melting furnace; and/or (iii) Supplying the LFG to consumers through a natural gas distribution network; (iv) Supplying compressed/ liquefied LFG to consumers using trucks; (v) Supplying the LFG to consumers through a dedicated pipeline; (d) Do not reduce the amount of organic waste that would be recycled in the absence of the project activity.	methodology condition 3.c is applicable to the project activity. The project does not result in reduction of organic waste that would be recycled in the absence of the project activity and hence the methodology condition 3.d is applicable to the project activity.	condition 3.a, 3c and 3d are applicable to the project activity.

Ref	Applicability Criteria	Justification	VVB Assessment
Para 4	The methodology is only applicable if the application of the procedure to identify the baseline scenario confirms that the most plausible baseline scenario is: (a) Atmospheric release of the LFG or capture of LFG and destruction through flaring to comply with regulations or contractual requirements, to address safety and odour concerns, or for other reasons; and (b) In the case that the LFG is used in the project activity for generating electricity and/or generating heat in a boiler, air heater, glass melting furnace or kiln: (i) For electricity generation: that electricity would be generated in the grid or in captive fossil fuel fired power plants; and/or (ii) For heat generation: that heat would be generated using fossil fuels in equipment located within the project boundary; (c) In the case of LFG supplied to the end-user(s) through natural gas distribution network, trucks or the dedicated pipeline, the baseline scenario is assumed to be displacement of natural gas.	In the baseline situation, the municipal waste was deposited and left for decay at the – uncovered – landfill site, leading to the generation and release of large amounts of landfill gas. Landfill gas is one of the largest sources of methane emissions to the atmosphere and typically contains approximately 50% methane, which is a potent greenhouse gas. Thus, the baseline scenario to the project activity is atmospheric release of the LFG and hence complies to the applicability condition of the methodology.	In the baseline scenario there was no LFG collection system was installed. Thus, fulfil requirement.

Ref	Applicability Criteria	Justification	VVB Assessment
	(d) In the case of LFG from a Greenfield SWDS, the identified baseline scenario is atmospheric release of the LFG or capture of LFG in a managed SWDS and destruction through flaring to comply with regulations or contractual requirements, to address safety and odour concerns, or for other reasons.		
Para 5	This methodology is not applicable: (a) In combination with other approved methodologies. For instance, ACM0001 cannot be used to claim emission reductions for the displacement of fossil fuels in a kiln or glass melting furnace, where the purpose of the CDM project activity is to implement energy efficiency measures at a kiln or glass melting furnace; (b) If the management of the SWDS in the project activity is deliberately changed during the crediting in order to increase methane generation compared to the situation prior to the implementation of the project activity.	The project does not include claim of emission reductions for the displacement of fossil fuels in a kiln or glass melting furnace, where the purpose of the CDM project activity is to implement energy efficiency measures at a kiln or glass melting furnace Under the project activity there has been no change in the management of the SWDS in the project activity during the crediting in order to increase methane generation compared to the situation prior to the implementation of the project activity. Since the project does not applies the stated non-applicability conditions the project is considered applicable for the methodology.	Conditions as stipulated are fulfilled as no claim of emission reductions for the displacement of fossil fuels, no change in SWDS management.

The baseline scenario of the proposed project is total atmospheric release of the gas (see section B.4) and the captured gas is used to produce energy. Thus, the VER project activity corresponds to ACM0001 Flaring or use of landfill gas Version 19.0, is applicable to the project activity.

Applicability of “Tool for the demonstration and assessment of additionality”, TOOL01 Version 07.0:

The tool for demonstration and assessment of additionality provides a general framework demonstrating and assessing additionality and is applicable to a wide range of project types. As referred in the methodologies ACM0001, the additionality tool is applicable for the proposed project activity.

Applicability of “Project emissions from flaring” TOOL06 Version 04.0

In line with ACM0001 “Flaring or Use of Landfill Gas” version 19.0.0”, the project activity is eligible to claim emission reductions from its flaring activities. Within the project activity, there is an enclosed flare system installed to flare any excess of LFG which is included in the project boundary. However, the project participant will not claim any emission reductions from the flaring activities (if any) within the crediting period, since the flare system is observed/envisaged to work none or for insignificant durations throughout the operational lifetime.

The exclusion of the emission reductions from flaring activities is conservative since it will result in no change (if there is no flaring activity) or decrease in the total emission reductions (if flaring activity is observed). In accordance with the above explanation, the “Project emissions from flaring” version 04.0, is not applied to the proposed project activity and no emission reductions will be claimed from the flaring activity throughout the crediting period.

Applicability of “Emissions from solid waste disposal sites” TOOL04 Version 08.1

The tool provides procedures to calculate baseline, project or leakage emissions of methane from solid waste disposed or prevented from disposal at a solid waste disposal site (SWDS). The tool is applicable as the solid waste disposal site where the waste would be dumped can be clearly identified and the proposed project is not a stockpile, and no hazardous waste is processed.

The applicability of the tool is discussed as follows:

Ref	Applicability Criteria	Justification	VVB assessment
The tool can be used to determine emissions for the following types of applications:			
Application A	The CDM project activity mitigates methane emissions from a specific existing SWDS.	Since the methane emissions are mitigated by capturing and flaring or combusting the methane, “Application A” implies to the proposed project activity. The methane is generated from waste disposed in the past, including prior to the start of the CDM project activity. In line with the requirements, this tool is only applied for an ex-ante estimation of emissions in the CDM-PDD. The emissions will be monitored during	The project adopts Application A. By checking relevant clearances and interview with the PP, the assessment team confirmed that the project activity mitigates methane emissions from Landfill site. Methane emissions are mitigated by capturing for power generation (e.g. "ACM0001: Flaring or use of landfill gas"). The

		the crediting period using the applicable approaches in the relevant methodologies (ACM0001 in this case).	methane is generated from waste disposed in the past, including prior to the start of the project activity. The tool is only applied for an ex-ante estimation of emissions in the project description. The emissions will then be monitored during the crediting period using the applicable approaches in the relevant methodologies (e.g. measuring the amount of methane captured from the SWDS).
Application B	The CDM project activity avoids or involves the disposal of waste at a SWDS.	Since the MSW is not treated with an alternative option such as composting or anaerobic digestion, "Application B" is not relevant to the proposed project activity.	

The tool "Emissions from solid waste disposal sites" TOOL04 version 08.1 is applicable since the proposed project activity mitigates methane emissions from a specific existing SWDS.

Applicability of **"Tool to calculate the emission factor for an electricity system" TOOL07 Version 07.0**:

This methodological tool determines the CO₂ emission factor for displacement of electricity generated by power plants in an electricity system, by calculating the "combined margin" emission factor (CM) of the electricity system. This tool may be applied to estimate the OM, BM and/or CM when calculating baseline emissions for a project activity that substitutes grid electricity. As the proposed project activity supplies electricity to the national grid, the "Tool to calculate the emission factor for an electricity system" version 07.0 is applicable to the project activity.

Applicability of **"Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation" TOOL05 version 03.0**:

This tool provides procedures to estimate the baseline, project and/or leakage emissions associated with the consumption of electricity. The tool is only applicable if certain scenario applies to the sources of electricity consumption. Three possible scenarios have been discussed as follows:

Ref	Applicability Criteria	Justification	VVB Assessment
A	If emissions are calculated for electricity consumption, the tool is only applicable if one out of the following three scenarios applies to the	In the proposed project activity, the electricity is purchased from the grid only and no captive power plant is installed at the site of electricity	By checking relevant clearances and interview with the PP, the assessment team confirmed that the Emissions are calculated for electricity consumption, Scenario A "Electricity consumption from the grid" applies to the sources of

Ref	Applicability Criteria	Justification	VVB Assessment
	sources of electricity consumption: (a) Scenario A: Electricity consumption from the grid. The electricity is purchased from the grid only, and either no captive power plant(s) is/are installed at the site of electricity consumption or, if any captive power plant exists on site, it is either not operating or it is not physically able to provide electricity to the electricity consumer; (b) Scenario B: Electricity consumption from (an) off-grid fossil fuel fired captive power plant(s). One or more fossil fuel fired captive power plants are installed at the site of the electricity consumer and supply the consumer with electricity. The captive power plant(s) is/are not connected to the electricity grid; or (c) Scenario C: Electricity consumption from the grid and (a) fossil fuel fired captive power plant(s). One or more fossil fuel fired captive power plants operate at the site of the electricity consumer. The captive power plant(s) can	consumption (Scenario A).	electricity consumption for the project activity. Thus accepted.

Ref	Applicability Criteria	Justification	VVB Assessment
	provide electricity to the electricity consumer. The captive power plant(s) is/are also connected to the electricity grid. Hence, the electricity consumer can be provided with electricity from the captive power plant(s) and the grid.		
B	This tool can be referred to in methodologies to provide procedures to monitor amount of electricity generated in the project scenario, only if one out of the following three project scenarios applies to the recipient of the electricity generated: (a) Scenario I: Electricity is supplied to the grid; (b) Scenario II: Electricity is supplied to consumers/electricity consuming facilities; or (c) Scenario III: Electricity is supplied to the grid and consumers/electricity consuming facilities	The projects entail compliance with Scenario I: Electricity is supplied to the grid.	By checking relevant clearances and interview with the PP, the assessment team confirmed that the scenario I is applicable to the proposed project activity as generated electricity is exported to host country's national grid. Thus accepted.
C	This tool is not applicable in cases where captive renewable power generation technologies are installed to provide electricity in the project activity, in the baseline scenario or to sources of leakage. The tool only	No captive renewable power generation technologies are installed to provide electricity in the project activity, in the baseline scenario or to sources of leakage.	By checking relevant clearances and interview with the PP, the assessment team confirmed that the assessment team confirmed that no captive renewable power generation technologies are installed to provide electricity in the project activity, in the baseline scenario or to sources of leakage.

Ref	Applicability Criteria	Justification	VVB Assessment
	accounts for CO ₂ emissions.		

Based on the above arguments it can be concluded that the “Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation’ version 03.0 is applicable to the project activity.

Applicability of Tool 08 “Tool to determine the mass flow of a greenhouse gas in a gaseous stream” Version 03.0.0:

This tool provides procedures to determine the mass flow of CH₄ in the LFG in time interval “t”. As referred in methodology ACM0001, the “Tool to determine the mass flow of a greenhouse gas in a gaseous stream” version 03.0.0 is applicable for the proposed project activity.

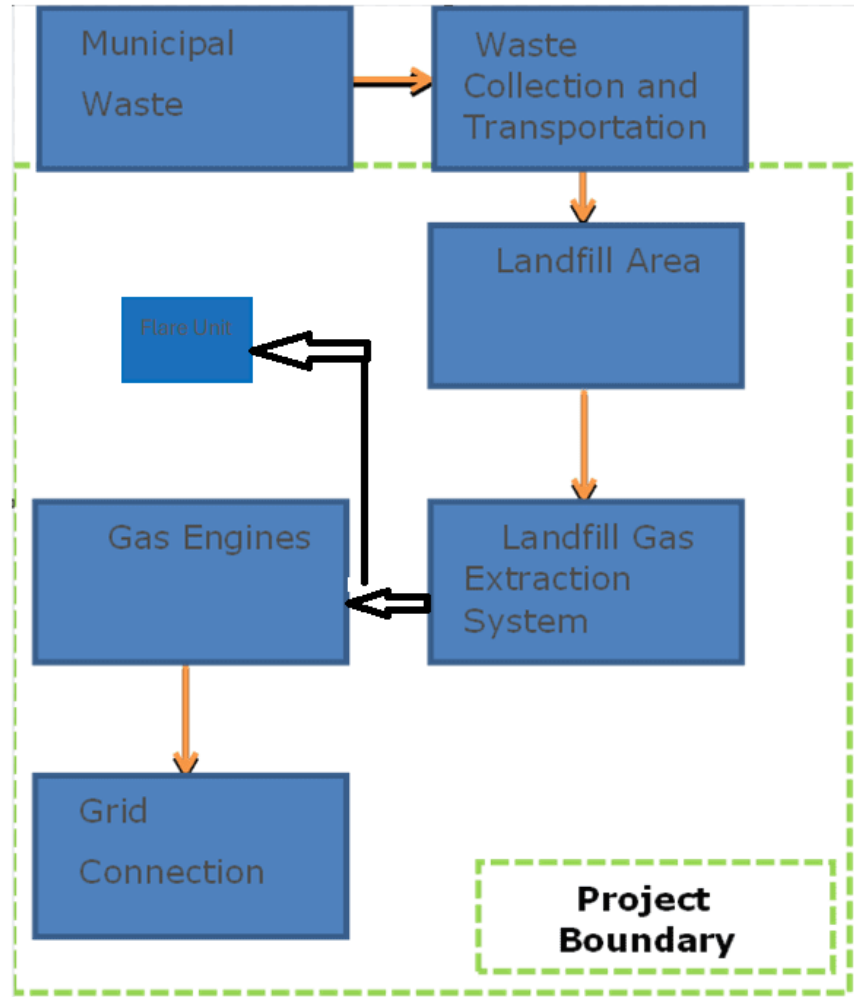
3.4.3 Project Boundary

The spatial boundary includes the power plant/unit and all power plants/units connected physically to the electricity system that the project power plant is connected to as verified from the applied methodology ACM0001 Flaring or use of landfill gas Version 19.0. VVB could confirm this during the onsite audit, also from the commissioning certificates. The assessment team was able to confirm that all the identified emission sources which are impacted by the project activity are addressed by the approved methodology and can be seen in the Table below.

Source		Gas	Included?	Justification/Explanation
Baseline Emission	Emissions from decomposition of waste at the SWDS site	CO ₂	No	CO ₂ emissions from the decomposition of organic waste are not accounted for since the CO ₂ is also released under the project activity
		CH ₄	Yes	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 is conservative.
	Emissions from electricity generation	CO ₂	Yes	Major emission source if power 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
	Emission From heat generation	CO ₂	No	Excluded as no heat generation has been performed in baseline.
		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

	Emissions from the use of natural gas	CH ₄	No	Excluded since there is no 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 Emission	Emissions from fossil fuel consumption for purposes other than electricity generation or transportation due to the project activity	CO ₂	Yes	Included. This System is used when the grid cannot be utilized in case of power failures.
		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
	Emissions from electricity consumption due to the project activity	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
	Emissions from flaring	CO ₂	No	Emissions are considered negligible
		CH ₄	Yes	May be an important emission source
		N ₂ O	No	Emissions are considered negligible
	Emissions from distribution of LFG using trucks and dedicated pipelines	CO ₂	No	Excluded for simplification since LFG captured at the project site is utilised via gas engines to generate electricity which is directly fed to the national grid.
		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.

As presented by the below figure, the physical boundary of the proposed project are the components of the proposed project activity in which the gas will be captured and utilized/destroyed (including landfill gas collection system, gas engines) and their connection to the Turkish National Grid.



The assessment team confirms that the Joint PD & MR has correctly described the project boundary, including the physical delineation of the project activity and complies with VCS Standard version 4.5

3.4.4 Baseline Scenario

As per the ACM0001, Version 19.0 baseline scenario is that the electricity delivered to the grid by the project activity would have otherwise been generated by the operation of grid-connected power plants and by the addition of new generation sources into the grid. Since the project activity is a greenfield project activity, the baseline scenario for greenfield power plant is applicable to the project activity.

Therefore, the baseline scenario for the project activity is in the absence of the project activity, LFG is emitted to the atmosphere, and the electricity delivered to the grid by the project activity would have otherwise been generated by the operation of grid-connected power plants and by the addition of new generation sources into the grid.

Baseline Emission Factor

Developing the baseline emission factor and calculation of the emission reductions for electricity generated under the proposed project activity is calculated according to Tool 07 “Tool to calculate the emission factor of an electricity system” version 07.0.

Emission factor has been calculated in a conservative manner as proposed by the methodology. Basic assumptions made are:

1. Emission factor remains same over the crediting period,
2. Emission factor of fuels sources is “0” or the lowest value in the references when there is no information.

According the “Tool to calculate the emission factor for an electricity system v 07.0”, Option 1 has been selected.

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

As described in tool “For determining the electricity emission factors, identify the relevant project electricity system. Similarly, identify any connected electricity systems”. It also states that “If the DNA of the host country has published a delineation of the project electricity system and connected electricity systems, these delineations should be used”.

Keeping this into consideration the delineation of the national grid of Turkey by "TÜRKİYE ELEKTRİK İLETİM A.Ş. GENEL MÜDÜRLÜĞÜ" is considered for estimation.

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:

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 ($EF_{grid,OM\ simple,y}$) 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.

In accordance to Electricity Market Production Capacity Projections List¹⁶

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%
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

¹⁶ EMRA | Energy Market Regulatory Authority (epdk.gov.tr)

- 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

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 $EF_{grid,OM,y}$ ¹⁷:

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

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

As per Methodological tool 07: “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:

- 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 VVB 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 $EF_{grid,BM,y}$ ¹⁸ chronological order of power generation plants from TEİAŞ Load Dispatch Department with

¹⁷<https://enerji.gov.tr/Media/Dizin/EVCED/tr/%C3%87evreVe%C4%B0klım/%C4%B0klımDe%C4%9Fi%C5%9Fikl%C4%9Fi/TUESEmisyonFktr/Belgeler/Bform2020.pdf>

¹⁸ https://enerji.enerji.gov.tr/Media/Dizin/BHIM/tr/Duyurular/Bilgi_Formu_Web_Sitesi_2019_202110071443.pdf

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:

- Weighted average CM; or
- 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 TOOL07 Version 07.0 formula below:

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

Where:

$EF_{grid,BM,y}$	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;

$$W_{OM} = 0.50 \text{ and } W_{BM} = 0.50$$

Then:

$$EF_{grid,CM,y} = 0.7424 \text{ tCO}_2/\text{MWh} * 0.50 + 0.3680 \text{ tCO}_2/\text{MWh} * 0.50 = 0.5552 \text{ tCO}_2/\text{MWh}$$

$$EF_{grid,CM,y} = 0.5552 \text{ tCO}_2/\text{MWh}$$

3.4.5 Additionality

The Step 0: Demonstration whether the proposed project activity is the first-of-its-kind

The project activity includes capture and utilization of LFG for power generation. This is not the first such project to be installed in the country or in the region and therefore project activity does not meet this criterion.

Step 1: Identification of alternatives to the project activity consistent with current laws and regulations

Sub-step 1a: Define alternatives to the project activity- Identify realistic and credible alternative(s) available to the project participants or similar project developers that provide outputs or services comparable with the proposed CDM project activity.

In line with ACM0001 Flaring or use of landfill gas - Version 19.0, alternative scenarios that a) are available to the project participant, b) cannot be implemented in parallel to the proposed project activity, and c) provide outputs and with comparable quality, properties and application areas as the proposed project activity. In line with the requirements of ACM0001, these alternatives are defined as follows:

LFG 1: The project activity implemented without being registered as a VER project activity;

LFG 2: Atmospheric release of the LFG or capture of LFG and destruction through flaring to comply with regulations or contractual requirements, or to address safety and odour concerns;

LFG 3: LFG is partially not generated because part of the organic fraction of the solid waste is recycled and not disposed in the SWDS;

LFG 4: LFG is partially not generated because part of the organic fraction of the solid waste is treated aerobically and not disposed in the SWDS;

LFG 5: LFG is partially not generated because part of the organic fraction of the solid waste is incinerated and not disposed in the SWDS.

Since LFG is used for generating electricity for export to the grid, the following alternatives have been also analysed:

E1: Electricity generated from LFG undertaken without being registered as a VER project activity;

E2: Electricity generation in existing or new renewable or fossil fuel based captive power plant;

E3: Electricity generation in existing and/or new grid connected power plants;

As the proposed project does not involve thermal energy generation, all the alternatives for heat generation are not included in the analysis.

Alternatives LFG 3, 4 and 5 as well as E 2 has been excluded from further consideration as a realistic alternative, which is explained as follows:

Reference	Alternative	Justification
LFG 3	LFG is partially not generated because part of the organic fraction of the solid waste is recycled and not disposed in the SWDS.	It is not realistic to consider recycling of solid waste which has been subject to decomposition for over 15 years as a realistic and credible alternative. Alternative LFG 3 has been excluded from further evaluation.

Reference	Alternative	Justification
LFG 4	LFG is partially not generated because part of the organic fraction of the solid waste is treated aerobically and not disposed in the SWDS.	It is not realistic to consider aerobic treatment of solid waste which has been subject to decomposition for over 15 years as a realistic and credible alternative. Alternative LFG 4 has been excluded from further evaluation.
LFG 5	LFG is partially not generated because part of the organic fraction of the solid waste is incinerated and not disposed in the SWDS.	It is not realistic to consider incineration of solid waste which has been subject to decomposition for over 15 years as a realistic and credible alternative. Alternative LFG 4 has been excluded from further evaluation.
E 2	Electricity generation in existing or new on-site or off-site renewable based captive power plant.	There is no existing electricity generation in the SWDS. Also, there are no available renewable energy resources (hydro, geothermal, wind etc.) in or close to the vicinity of the SWDS. Alternative E 2 has been excluded from further evaluation.

Outcome of Step 1a:

Considering that there is no regulation or law mandating the capture and utilization of the LFG in SWDS in Turkey, the most plausible baseline scenario to the implementation of the proposed Project is the continuation of atmospheric release of the LFG generated at the landfill. In other words, LFG 1, LFG 2, E1 and E3 represent the baseline scenario. VVB has confirmed the same by document review and interview with the personals. As the selected large-scale methodology clearly mention the baseline scenario and the same has been opted in the project, therefore, no further analysis on baseline is required. The assessment team confirms that the VCS Joint PD and MR confirms to the guidance given by Verra via VCS standard version 4.5. The assessment team confirms that the Project has been approved by Turkey government by checking the Project approval and relevant environmental clearances. By checking laws and regulation, it is confirmed that the project is in complicate with all laws and regulations in Turkey.

Scenario	Alternatives			Description of situation
	Landfill Gas	Electricity	Heat	
1	LFG 1	E 1	N/A	Project activity including power generation from LFG without being registered as a VER project activity.
2	LFG 2	E 3	N/A	Atmospheric release of the LFG and electricity would have been generated by the existing grid

Scenario	Alternatives			Description of situation
	Landfill Gas	Electricity	Heat	
				connected power plants as continuation of the situation before the project activity.

Step 1.b: Consistency with mandatory laws and regulations

Related laws and regulations to the proposed project activity are as followed:

Electricity Market Law¹⁹ [Law Number: 4628 Ratification Date: 20/02/2001 Enactment Date: 03/03/2001]

- Law on Utilization of Renewable Energy Resources for the Purpose of Generating Electricity Energy²⁰ [Law Number: 5346 Ratification Date: 10/05/2005 Enactment Date: 18/05/2005]
- Environmental Law²¹ [Law Number: 2872 Ratification Date: 09/08/1983 Enactment Date: 11/08/1983]

Regulation on Waste Management²² [Last updated on 23-March-2017]

Regulation on the Landfill of Waste²³ [Last updated on 24-June-2022]

The majority of landfill areas in Turkey are actually ‘waste dumps’ where no waste management (including covering of the landfill) implemented.

Outcome of Step 1b:

Both Scenario 1 and Scenario 2 as defined under table 5 “Alternative scenario combinations applicable to the project activity” are in consistency with mandatory laws and regulations and remain as credible and realistic alternative scenarios to the proposed project activity for further evaluation on identification of the baseline scenario.

Step 2: Investment analysis

Investment analysis is carried out to determine on whether the proposed project activity is economically or financially less attractive than at least one other alternative, identified in step 1, without the revenue from the sale of emission reductions credits. This is demonstrated in line with the Tools for sections as per “Investment Analysis” (TOOL27 - Ver 12)

¹⁹ <https://www.mevzuat.gov.tr/mevzuatmetin/1.5.6446.pdf>

²⁰ <https://www.mevzuat.gov.tr/mevzuatmetin/1.5.5346.pdf>

²¹ <https://www.mevzuat.gov.tr/mevzuatmetin/1.5.2872.pdf>

²² <https://www.mevzuat.gov.tr/mevzuat?MevzuatNo=20644&MevzuatTur=7&MevzuatTertip=5>

²³ <https://www.mevzuat.gov.tr/mevzuat?MevzuatNo=13887&MevzuatTur=7&MevzuatTertip=5>

Sub-step 2a: Determine appropriate analysis method

The project activity envisages capture and utilization of LFG for power generation and treatment of organic fraction of solid waste for power generation. The power generated from the project activity is to be exported to the national grid of Turkey and the revenues from the sale would be generated in accordance with the terms and tariffs established in the Agreement with the grid authority. Thus, simple cost analysis (Option I) cannot be used as the analysis method as the sale of the units of generated electricity shall result in a revenue stream during the operations of the Project activity.

In the absence of the project activity continued use of grid electricity would have been the best plausible options and it does not require an investment. Hence investment comparison analysis (Option II) is also not appropriate for the project activity.

After eliminating Option, I and Option II, the use of Benchmark analysis (Option III) is the method of analysis that has been selected as the most suitable method. This method determines the attractiveness of the project activity for the investors, as well as provides a measure of the viability of the investment to generate revenues during its operation, as compared with other avenues and investment options. Hence, the Benchmark analysis method is to be employed for analysis of the said project.

Sub-step 2b (Option III): Apply benchmark analysis

The investment analysis using Benchmark analysis approach (Option III) has been chosen. Further, this method illustrates that the evaluation of the project by the project owner was carried out before the decision to undertake the project was taken and management approval had been granted.

Choice of Financial Indicator:

According to the “Tool for demonstration and assessment of Additionality” Version 07.0.0, the financial indicator can be based either on (1) project IRR or (2) equity IRR. There is no general preference between the approaches (1) or (2). The benchmark chosen for analysis shall be fully consistent with the choice of approach. Therefore, in accordance with the guidance, the relevant financial indicator for project activity has been chosen as post tax equity IRR.

Benchmark estimation:

The data defined by World Bank for similar project types in Türkiye are used for benchmark analysis. It is given as 20% for post-tax equity IRR in table 3.3 of the report generated in May 2017. This report has been widely used as reference in the registered Turkish carbon finance projects.

Report Link:
<https://documents1.worldbank.org/curated/en/799701498842988254/pdf/ICR00004069-06192017.pdf>

In accordance with the aforesaid report financial barriers exists for renewable energy project and desired thresholds (Return on Equity) were assessed as 20%.

Project	Date of Investment Decision	Start / Commissioning Date
Avcıkoru Landfill Gas to Electricity Project	1-January-2020	18-June-2021

The choice of this benchmark is justified by the inherent similarities between biomass gas and landfill gas projects, particularly in their financial and technical structures. Both biomass gas and landfill gas projects are fundamentally waste-to-energy processes and no separate benchmark available for Landfill to gas projects. Thus, VVB accepted the same in light of comparable financial performance.

b) Parameters and assumptions used:

The project activity is a renewable source of electricity generation and supplies the electricity to the Turkish Electricity grid. The Post tax Equity IRR is evaluated for the entire lifetime of the project activity till the end of the licence and calculated based on the cash outflows from and cash inflows into the project activity. The project will not continue after 2030, the end of the municipality agreement, and the assets will be dismantled. The IRR and Benchmark analysis is calculated in excel spreadsheet and is also summarized below. The key parameters which determine the Equity IRR of the project activity are project cost, production, tariff rate, and operating expenses. These parameters in USD were based upon the feasibility study of the project proponent on 1 January 2020. The analysis was carried out in nominal USD terms.

Parameters	Unit	Value on feasibility	Value on feasibility (with the period 2021-2022 realized)
Project Start Date	-	18-June-2021	
Production ²⁴	MWH	267,748 (10 Years average value)	148,624 (10 Years average value)
OM ²⁵	\$	22,111,922	9,264,436
Total Investment	\$	43,000,000	34,931,717
Buildings and underground/overland plants	\$	13,000,000	2,016,713
Electromechanical Equipment	\$	28,000,000	20,915,004
Gas Engine Generator Sets	\$	15,000,000	Feasibility Study

²⁴ Average of 10 years in operation

²⁵ Average of 10 years in operation

Step-up Transformer	\$	5,000,000	Feasibility Study
Booster-Blower-Chiller Systems	\$	5,000,000	Feasibility Study
MV Cells (35 units)	\$	3,000,000	Feasibility Study
Transmission line	\$	2,000,000	2,000,000
Other	\$	0	10,000,000
Tariff ²⁶	USD/MWH	133	133
Tax rate ²⁷	%	25	25
Depreciation rate ²⁸	%	10% for electromechanical equipment; 2.5% for buildings; 3.33% for transmission line	10% for electromechanical equipment 2.5% for buildings 3.33% for transmission line

Assessment:

The key assumptions used to calculate the Equity IRR of the proposed project are presented in above table. The assessment team compared the values stated in the joint PD & MR with values determined in the FSR and was able to confirm that the input values are applied correctly in the joint PD & MR.

Total Investment:

During the PP's Board Meeting, dated 01-October-2020, PP decided to invest for the 38.205 MWe landfill gas power generation project activity in turkey. Same has been verified by VVB team via Board Resolution Letter. At the time investment decision making, total investment cost for the project activity was estimates as USD 43 Million as per FSR prepared by 3rd party entity. However, during implementation of the project, the total investment cost is taken USD 34.93 million, which is based on the actual purchase order. Further, additional investment was planned inline with revised

²⁶ Tariff rate is fixed by the energy market regulatory authority (YEKDEM).
<https://www.mevzuat.gov.tr/mevzuatmetin/1.5.5346.pdf>

²⁷ Tax Rate in 2021 defined by the State revenue administration: <https://www.gib.gov.tr/yararli-bilgiler/gecici-vergi-oranlari>

²⁸ Depreciation rates have been taken from the state revenue administration's official web site below. It is included in the IRR calculation in the IRR page of the excel. It is included in the parameters table. The depreciation rates are found in the below link as the following; Electromechanical equipment: page 2, in item 3.8.13; Transmission line: page 21 in item 45.2.1; Buildings on page 1 in item 1.2.1.
https://www.gib.gov.tr/sites/default/files/fileadmin/user_upload/Yararli_Bilgiler/amortisman_oranlari.pdf

feasibility carried out vide report dated 01-January-2020. There's no loan in the project activity. By checking the FSR prepared by the 3rd party entity, the assessment team confirmed that the investment cost of the project activity was assumed USD 43 million, which is higher than the value of feasibility (with the period 2021-2023 realized). However still equity IRR lower than the benchmark. Therefore, the assessment team was able to confirm that the feasibility (with the period 2021-2023 realized) value was acceptable as the equity IRR with respect to realized investment cost is 13.582%. Therefore, the assessment team was able to confirm that the total investment in the IRR calculation was appropriate and will not breach benchmark value i.e., 20% in future.

O & M Cost: The Operation and Management Costs was estimated as USD 9.66 million in Feasibility report, which accounts for about 21% of fixed asset investment which was available with PP during investment decision. Further, O&M cost is derived from the feasibility report, which projects an annual increase in O&M costs. This increase is attributed to the expected rise in energy production over time as the plant operates and generates more energy, the need for additional maintenance, operational support, and technical services increases, leading to higher O&M expenses. This correlation between energy production and O&M costs suggests that as the plant's output grows, more resources are required to ensure efficient operation and maintenance. However, the feasibility report does not mention annual inflation rate considered for these annual O&M cost provided. As there is no inflation rate separately provided in feasibility report for O&M cost, it has been not reflected in the IRR calculations however PP has used annual values provided in the feasibility report. As these values are sourced from the feasibility report which was available with PP during investment decision, assessment team accepted the same. Moreover, as the project is already commissioned from 18-June-2021 and currently 11 Gas Engines are in operation. Assessment team verified through O&M financial documents and Realized IRR Sheet (2020 -2023) and observed that actual O&M Cost (Annual Average cost) is 10.19 million USD, which is on higher side than estimated amount and accordingly equity IRR i.e., 13.58% does not breaching benchmark value i.e., 20%, thus found conservative and accepted.

Tariff: The electricity generated by the LFG generators will be sold to the national grid. The same has been validated by the assessment team against the Commercial Contract for sale of electricity signed between the project owner and Turkish electricity authority. In the PPA, the purchasing price of electricity was estimated as the electricity tariff for financial analysis. Therefore, it's confirmed that the electricity tariff in the project activity is not under estimated. Also, PPA is signed for fixed 10 years and after that in general tariff rate is below USD 133/MWh. Therefore, the assessment team was able to confirm that the tariff considered for IRR calculation was reasonable.

Electricity Production: The total installed capacity of the LFG generators is 38.205 MWe and as per feasibility report per year estimated electricity generation is evaluated as 267,748 MWh/yr which is as per feasibility report given as per below table: -

Year	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
------	------	------	------	------	------	------	------	------	------	------

Electricity Generation (MWh)	16,980	1,32,303	2,55,000	3,24,743	3,24,743	3,24,743	3,24,743	3,24,743	3,24,743	3,24,743
Annual Average	267,748 MWh									

Above table has been verified using Pre-Feasibility report completed by an independent and qualified 3rd party. Also further verified via electricity generation license. Therefore, the assessment team considers that the determination of the electricity production rate is correct.

It's considered by the assessment team that the annual operational hours of the project activity are not under estimated, since PP has considered electricity generation values mentioned in above table for IRR calculation and post-tax equity IRR is 12.28%, still lower than benchmark. Further, Assessment team verified electricity production as per realized values (2020 - 2022) and found that annual average electricity production for 10 years is calculated as 1,486,236 MWh, due to same equity IRR calculated to 14.62%, still below than the benchmark value i.e., 20%. Thus, found acceptable by VVB team.

Taxes: The Taxes applied in the financial assessment are listed as:

Corporate income tax rate ²⁹	25.00%	As per income tax rule
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As income tax of 25% is consistent with the income tax law of the Turkey.

Lifetime (30 Years): The lifetime of the project activity was estimated to be 30 years in the FSR. The lifetime of the project activity has been crosschecked with the technical specification of generators, in which the lifetime of the LFG generators is 20 years. Therefore, the assessment team was able to confirm that the lifetime estimated in FSR is conservative. However, As Project Proponent got generation license for 10 years only. Thus only 10 years lifetime is considered for the IRR calculation.

Fair values of assets:

Back Fair Value calculation follows the guidelines set by Turkish accounting regulations, particularly the **Tax Procedure Law (VUK)** and **Turkish Financial Reporting Standards (TFRS)**:

1. Depreciation Method:

The depreciation of assets such as buildings, machinery, and transmission lines has been calculated using the straight-line method, in line with **VUK Article 313**. This article outlines that fixed assets with an economic life exceeding one year must be depreciated over time. The depreciation rates were taken from **VUK Article 315**, which provides the applicable rates for different asset classes.

²⁹ Tax Rate in 2021 defined by the State revenue administration: <https://www.gib.gov.tr/yarlim-ve-kaynaklar/yararli-bilgiler/gecici-vergi-oranlari>

1. Back Fair Value Calculation:

The Back Fair Value calculation for the landfill project was determined by progressively reducing the asset values based on their depreciation and reinvestment schedules. This approach aligns with **TFRS 13**, which defines fair value as a market-based measurement (Article 2). This method estimates the remaining value of the assets by considering the fair market price at which these assets would be sold in an ordinary transaction between market participants.

For instance, machinery, which starts at a value of 15,000,000 TL, is depreciated over 10 years, reaching 0 TL by 2030. The same applies to buildings, which are depreciated annually and reinvested periodically. These figures were derived based on **TFRS 13, Articles 61-62**, which require that observable inputs and market conditions at the time of valuation be considered.

Reinvestment Approach:

PP has accounted for periodic reinvestment in the buildings (e.g., 25,000 TL reinvestments every 2-4 years) to reflect maintenance and upgrades. This reinvestment prolongs the useful life of the assets, ensuring that they retain operational value, a practice that aligns with Turkish investment policies encouraging sustainable asset management.

In summary, the Back Fair Value calculation method is based on the gradual depreciation of assets in line with Turkish regulations and international standards (TFRS), and it includes reinvestment to maintain asset values, ensuring compliance with both local and global accounting practices.

Here are the references:

Tax	Procedure	Law	(VUK)	:
				https://www.mevzuat.gov.tr/anasayfa/MevzuatFihristDetayIframe?MevzuatTur=9&MevzuatNo=12689&MevzuatTertip=5
Turkish	Financial	Reporting	Standard	13:
				https://www.kgk.gov.tr/Portalv2Uploads/files/DynamicContentFiles/T%C3%BCrkiye%20Muhasebe%20Standartlar%C4%B1/TMSTFRS2018Seti/TFRS/TFRS_13_2018.pdf

Depreciation Rate: Depreciation period for electromechanical equipment installed in the project activity has been taken as 10% years whereas for construction is 2.5% and 2.33% for transmission line based on the assumptions taken by the project developer sourced from turkey state revenue administration official webpage ³⁰ i.e., https://www.gib.gov.tr/sites/default/files/fileadmin/user_upload/Yararli_Bilgiler/amortisman_oranlari.pdf. The depreciation value has been added back to the annual cash flow. Further, depreciation for mentioned investment figures is considered for the 2nd year of investment. The depreciation is found inline with the Turkish regulations and appropriately justified by PP with supporting evidences

³⁰ https://www.gib.gov.tr/sites/default/files/fileadmin/user_upload/Yararli_Bilgiler/amortisman_oranlari.pdf

in the VCSPD&MR. As depreciation considered inline with Turkish accounting practices & sourced from official government revenue administration department, accepted by VVB

Conclusion: Based on the information verified, the assessment team confirms that all the input values for investment analysis are in reasonable ranges. In addition, the assessment team was able to confirm that the input parameters used in the financial analysis are reasonable and adequately represent the economic situation of the project

Based on result of IRR excel spreadsheets, equity IRR is assessed to be less than Benchmark. This substantiates that the investment is not financially attractive (Equity IRR for the project activity is less than the Benchmark). Thus, it can be easily concluded that project activity is additional & is not business as usual scenario.

Sensitivity analysis:

Addressing “Investment Analysis” (TOOL27 - Ver 12), following factors has been subjected to sensitivity analysis:

1. Production
2. O&M Cost
3. Project Cost
4. Tariff

The results of sensitivity analysis show that even with a variation of +10% & -10% in project cost, O&M cost, Energy Yield/Production and Tariff Rate Equity IRR are lower than the benchmark. And it is evident from the results given above; the project remains additional even under the most favourable conditions.

Sensitivity results for Avcıkoru LFG based on the feasibility values:

Sensitivity Analysis	Equity IRR			
Variation %	-10%	Normal	10%	Breaching Value (the change)
Production	6.20%	13.58%	19.60%	6.20%
O&M	17.87%	13.58%	8.70%	17.87%
Project Cost	15.56%	13.58%	11.83%	15.56%
Tariff Rate	6.20%	13.58%	19.60%	6.20%

Sensitivity results for Avcıkoru LFG based on the feasibility values (with the period 2020-2022 realized):

Sensitivity Analysis	Equity IRR			
Variation %	-10%	Normal	10%	Breaching Value (the change)
Production	9.15%	14.62%	19.48%	11.10%
O&M	17.22%	14.62%	11.86%	-21.22%

Project Cost	15.96%	14.62%	13.36%	-36.86%
Tariff Rate	9.15%	14.62%	19.48%	11.10%

Probability to breach the benchmark:

Sensitivity Parameter 1: Production

Variation in PLF of more than 10% is unlikely to happen. It is to be noted that deposition of waste in the SWDS has been stalled since 2017, and the SWDS will not receive any further waste in future. Since the SWDS site will not receive additional waste therefore there is no likelihood of increase in gas volume to the obtained from the SWDS and its utilisation for power generation.

Sensitivity Parameter 2: O&M

The sensitivity analysis reveals that O&M will breach the benchmark at -18% change and is hypothetical case. Further, VVB team confirmed with the realized value (2020-2022) and observed that after the commissioning of 11 Gas Engines (16 engines are yet to commissioned), O&M cost getting higher due to higher inflation and high labour cost in host country. Moreover, such a reduction in the O&M cost is highly unlikely as no design change forecasted in project activity. Thus accepted.

Sensitivity Parameter 3: Project Cost

Project Cost for financial analysis is considered based on the information received from selected vendors, being available at the time of investment decision making to go ahead with the project activity. However, the Sensitivity is carried out for 10% variation and for threshold level below which benchmark is not breached. Same has been confirmed the VVB team with Realized value (2020-2022) and found that project Thus, it is unlikely that project cost will getting lower side as currently CAPEX has been raised to 43 million USD, verified with financial evidence submitted by PP to VVB team. Thus accepted.

Sensitivity Parameter 4: Tariff Rate

The tariff is fixed by the energy market regulatory authority (YEKDEM). Hence, there is no probability to get variation for the same. Same has been confirmed with latest EPIAS records and found that actual tariff rate is inline with fixed during the investment decision i.e., 133 USD/MWh. Thus, accepted.

Outcome of Step 2:

Final Result

Equity IRR	Equity IRR (with the period 2020-2022 realized)	Benchmark (Equity IRR)
13.58%	14.62%	20%

Based on the above result, the equity IRR of 13.58% (estimated) and 14.62% (as per realized) is less than the Benchmark of 20%. This substantiates that, the investment is not financially attractive (Equity IRR for the project activity is less than the Benchmark). Thus, it can be easily concluded that, the project activity is additional & is not business as usual scenario.

Common practice analysis:

As per para 57 of Tool for demonstration and assessment of additionality” (Version 07.0.0), Step 2 analysis shall be complemented with an analysis of extent to which the proposed project type (e.g., technology or practice) has already diffused in the relevant sector and region. This test is a credibility check to complement the investment analysis.

Common Practice Analysis – 38.205 MWe LFG based power generation project

- **Step (1):** Calculate applicable capacity or output range as +/-50% of the total design capacity or output of the proposed project activity.

Range	Capacity	Unit
+ 50%	57.30750	MWe
Capacity of the proposed project activity	38.205	MWe
- 50%	19.10250	MWe

Step (2): Identify similar projects (both CDM and non-CDM) which fulfil all of the following conditions:

- The projects are located in the applicable geographical area;
- The projects apply the same measure as the proposed project activity;
- The projects use the same energy source/fuel and feedstock as the proposed project activity, if a technology switch measure is implemented by the proposed project activity;
- The plants in which the projects are implemented produce goods or services with comparable quality, properties and applications areas (e.g., clinker) as the proposed project plant;
- The capacity or output of the projects is within the applicable capacity or output range calculated in;
- The projects started commercial operation before the project design document (CDM-PDD) is published for global stakeholder consultation or before the start date of proposed project activity, whichever is earlier for the proposed project activity.

Analysis of Step 2

Identification of the similar projects (CDM and non-CDM) is carried out as per sub-steps of Step (2) as follows:

As the project is located Turkey, therefore, projects in the geographical area of Turkey have been chosen for analysis. As the project is located in Turkey, the policy applicable for the LFG based power generation project is applicable.

The project activity is a green-field power project and uses measure (b) “Switch of technology with or without change of energy source including energy efficiency improvement as well as use of

renewable energies”. Therefore, projects applying same measure (b) are candidates for similar projects.

The energy source used by the project is LFG. Hence, only energy generation projects using same fuel have been considered for analysis.

The project produces electricity; therefore, all power plants that produce electricity are candidates for similar projects.

The capacity range of the projects is within the applicable capacity range from 19.103 MW to 57.308 MW.

As per the methodological Tool the projects that have started commercial operation before the project design document (CDM-PDD) is published for global stakeholder consultation or before the start date of proposed project activity, are to be selected for consideration. The start date however resembles to start date definition of CDM project activity which is “the date on which the project participants commit to making expenditures for the construction or modification of the main equipment or facility (e.g., gas engine), or for the provision or modification of a service (e.g., distribution of energy-efficient light bulbs, change of transport management system), for the CDM project activity or CPA. Where a contract is signed for such expenditures, it is the date on which the contract is signed. Gas engines supply agreement for the project was signed on 23-January-2021, Same has been confirmed by assessment team thus accepted.

Findings of analysis of Step 2

Company Name	COD	Project Name	Installed Capacity (MWe)	GS/VC/GC C ID
Ortadoğu Enerji Sanayi ve Ticaret Anonim Şirketi	16-October-2012	Kömürcüoda Çöp Gazı Santrali	19.810	GS707
İstanbul Enerji Sanayi ve Ticaret Anonim Şirketi	04-September-2020	Seymen Enerji Üretim Tesisi	36.764	GS7728

Step (3): Within the projects identified in Step 2, identify those that are neither registered CDM project activities, project activities submitted for registration, nor project activities undergoing project verification. Note their number, Nall.

Project activities, which have got registered or are under project verification with CDM/VCS/GS/GCC have been excluded in this step. After excluding the registered and under project validation projects the total number of projects.

Nall = 0

Step (4): Within similar projects identified in Step 3, identify those that apply technologies that are different to the technology applied in the proposed project activity. Note their number Ndiff,

As per the Tool on Common Practice, the project activities have been separated from the different technologies on the basis two criteria:

Different technologies - are technologies that deliver the same output and differ by at least one of the following (as appropriate in the context of the measure applied in the proposed clean development mechanism (CDM) project activity and applicable geographical area):

- (a) Energy source/fuel (example: energy generation by different energy sources such as wind and hydro and different types of fuels such as biomass and natural gas);
- (b) Feed stock (example: production of fuel ethanol from different feed stocks such as sugar cane and starch, production of cement with varying percentage of alternative fuels or less carbon-intensive fuels);
- (c) Size of installation (power capacity)/energy savings:
 - (i) Micro (as defined in paragraph 24 of decision 2/CMP.5 and paragraph 39 of decision 3/CMP.6);
 - (ii) Small (as defined in paragraph 28 of decision 1/CMP.2);
 - (iii) Large.
- (d) Investment climate on the date of the investment decision, inter alia:
 - (i) Access to technology;
 - (ii) Subsidies or other financial flows;
 - (iii) Promotional policies;
 - (iv) Legal regulations.
- (e) Other features, inter alia:
 - (i) Nature of the investment (example: unit cost of capacity or output is considered different if the costs differ by at least 20%).

$$N_{\text{diff}} = 0$$

Step (5): Calculate factor $F = 1 - N_{\text{diff}}/N_{\text{all}}$ representing the share of similar projects (penetration rate of the measure/technology) using a measure/technology similar to the measure/technology used in the proposed project activity that deliver the same output or capacity as the proposed project activity.

Calculate

$$F = 1 - N_{\text{diff}} / N_{\text{all}}$$

$$F = 1$$

So, F is greater than 0.2

$$N_{\text{all}} - N_{\text{diff}} = 1$$

So, $N_{\text{all}} - N_{\text{diff}}$ is not greater than 3

As per the Tool for common practice analysis, version 03.1, the proposed project activity is a common practice within a sector in the applicable geographical area if both the following conditions are fulfilled:

(a) the factor F is greater than 0.2, and

(b) $N_{all} - N_{diff}$ is less than 3.

Since the value of factor $N_{all} - N_{diff}$ for the proposed project activity is 0 which is not greater than 3, the project activity is not a “common practice” within sector in the applicable geographical area.

VVB has verified number of projects commissioned in host country before start date of VCS project activity from the Electricity production facility website³¹ which is owned by Turkey Government hence can be considered as reliable public available source. The assessment is found as per Step 4 of CDM Methodological Tool for demonstration and assessment of additionality

3.4.6 Quantification of GHG Emission Reductions and Removals

Quantification of Baseline emissions

The proposed project activity has applied methodology ACM0001 Version 19.0. As per the paragraph 29 of the methodology: “Baseline emissions are determined according to equation (1) and comprise the following sources:

- (a) Methane emissions from the SWDS in the absence of the project activity;
- (b) Electricity generation using fossil fuels or supplied by the grid in the absence of the project activity;
- (c) Heat generation using fossil fuels in the absence of the project activity; and
- (d) Natural gas used from the natural gas network in the absence of the project activity.”

$$BE_y = BE_{CH_4,y} + BE_{EC,y} + BE_{HG,y} + BE_{NG,y} \quad \text{Equation 1 in ACM0001 V19}$$

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. The baseline emissions are calculated as follows:

$$BE_y = BE_{CH_4,y} + BE_{EC,y} \quad (\text{Equation 1})$$

Where:

BE_y = Baseline emission in year y (tCO₂e)

$BE_{CH_4,y}$ = Baseline emissions of methane from the SWDS in year y (t CO₂e/yr)

$BE_{EC,y}$ = Baseline emission associated with electricity generation in year y (tCO₂/yr).

Calculation of the emission factor

Following the “Tool to calculate the emission factor for an electricity system, version 07.0”, the baseline grid emission factor has been updated as per “Turkey National Grid Emission Factor Information Form”.

The updated operating margin (OM) emission factor in the Joint PD and MR is 0.7424 tCO₂/MWh and the build margin (BM) emission factor is 0.3680 tCO₂/MWh. The assessment team has confirmed that this is the most recent data publicly available at the time of the validation of the crediting period.

³¹ <https://www.epdk.gov.tr/Detay/Icerik/3-0-0-122/yenilenebilir-enerji-kaynaklari-destekleme-mekanizmasi-yekdem>

According to the Tool 07 “Tool to calculate the emission factor for an electricity system, version 07.0”, the default weights: $W_{OM} = 0.50$ for Operating Margin and $W_{BM} = 0.50$ for Build Margin, in the crediting period of power generation projects are adopted.

The combined margin emissions factor is calculated as follows:

$$EF_{grid,CM,y} = EF_{grid,OM,y} \times W_{OM} + EF_{grid,BM,y} \times W_{BM}$$

Where:

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

$$EF_{grid,CM,y} = 0.7424 \times 0.50 + 0.3680 \times 0.50$$

$$= 0.5552 \text{ (tCO}_2\text{/MWh)}$$

The calculation of the $EF_{grid,CM,y}$ has been checked by the assessment team and was found consistent with the latest emission factor calculation Tool .

The baseline emissions for the proposed project activity were calculated as follow:

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

$$BE_{CH_4} = \left((1 - OX_{top_layer}) \times F_{CH_4,PJ,y} - F_{CH,BL,y} \right) \times GWP_{CH_4}$$

Equation 2 in
ACM0001

Where:

$ER_{y,calculated}$	tCO ₂ e/yr	Baseline emissions of methane from the SWDS in year y
OX_{top_layer}	dimensionless	Fraction of methane in the LFG that would be oxidized in the top layer of the SWDS in the baseline
$F_{CH_4,PJ,y}$	tCH ₄ /yr	Amount of methane in the LFG which is flared and/or used in the project activity in year y
$F_{CH_4,BL,y}$	tCH ₄ /yr	Amount of methane in the LFG that would be flared in the baseline in year y

GWP_{CH4}

tCO₂e/tCH₄

Global Warming Potential for methane

Ex-post determination of $F_{CH4,PJ,y}$

During the crediting period $F_{CH4,PJ,y}$ is determined as the sum of quantities of methane flared and used in power plant(s) as follows:

$$F_{CH4,PJ,y} = F_{CH4,flared,y} + F_{CH4,EL,y} + F_{CH4,HG,y} + F_{CH4,NG,y} \quad \text{--Equation 3 in ACM0001 V19}$$

Where:

$F_{CH4,PJ,y}$: Amount of methane in the LFG which is flared and/or used in the project activity in year y (tCH₄/yr)

$F_{CH4,flared,y}$: Amount of methane in the LFG which is destroyed by flaring in year y (tCH₄/yr)

$F_{CH4,EL,y}$: Amount of methane in the LFG which is used for electricity generation in year y (tCH₄/yr)

$F_{CH4,HG,y}$: Amount of methane in the LFG which is used for heat generation in year y (t CH₄/yr)

$F_{CH4,NG,y}$: Amount of methane in the LFG which is sent to the natural gas distribution network and/or dedicated pipeline and/or to the trucks in year y (tCH₄/y)

Since there is no heat generations or natural gas usage therefore Ex-post determination of $F_{CH4,PJ,y}$ will be limited to methane emissions from SWDS (A) and electricity generation (B) will be taken into account.

$$F_{CH4,PJ,y} = F_{CH4,flared,y} + F_{CH4,EL,y} \quad \text{--Equation 3 in ACM0001 V19}$$

$F_{CH4,EL,y}$ is determined using the “Tool to determine the mass flow of a greenhouse gas in a gaseous stream” TOOL08 version 03.0.0 and monitoring the working hours of the power plant, so that no emission reduction are claimed for methane destruction during non-working hours. This is taken into account by monitoring the hours that the equipment utilizing the LFG is operating in year y ($Op_{j,h,y}$).

$F_{CH4,PJ,y}$ is determined using the “Tool to determine the mass flow of a greenhouse gas in a gaseous stream” TOOL08 version 03.0.0.

The project utilizes the LFG only for power generation and no destruction of LFG gas done by flaring. Therefore:

$$F_{CH4,PJ,y} = F_{CH4,EL,y} \quad \text{---Equation 3 in ACM0001 V19}$$

Amount of the methane used for power generation ($F_{CH4,EL,y}$) The “Tool to determine the mass of a greenhouse gas in a gaseous stream” provides following 6 options for measuring mass flow of a greenhouse gas i in a gaseous stream.

Option	Flow of Gaseous Stream	Volumetric Fraction
A	Volume flow-dry basis	Dry or wet basis
B	Volume flow-wet basis	Dry basis

Option	Flow of Gaseous Stream	Volumetric Fraction
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

For the project activity, the flow of gaseous stream is Volume flow dry basis, and the volumetric fraction is dry basis, thus, as per the “Tool to determine the mass flow of a greenhouse gas in a gaseous stream”, Option A will be applied. Since option B and E has not been selected as an option, the absolute humidity of the gaseous stream will not be determined. Same has been found correct, thus accepted.

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

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

Equation 5 in TOOL08

with

$$\rho_{i,t} = \frac{P_t \times MM_i}{R_u \times T_t}$$

Equation 6 in TOOL08

where

Parameter	Unit	Description
$F_{CH_4,t}$	kg gas/h	Mass flow of greenhouse gas i in the gaseous stream in time interval t
$V_{t,db}$	m ³ dry gas/h	Volumetric flow of the gaseous stream in time interval t on a dry basis
$v_{CH_4,t,db}$	m ³ gas i/m ³ dry gas	Volumetric fraction of greenhouse gas i in the gaseous stream in a time interval t on a dry basis
$\rho_{CH_4,t}$	kg gas CH ₄ / m ³ gas CH ₄	Density of greenhouse gas i in the gaseous stream in time interval t
P_t	Pa	Absolute pressure of the gaseous stream in time interval t
MM_{CH_4}	kg/kmol	Molecular Mass of greenhouse gas i
R_u	Pa.m ³ /kmol.K	Universal ideal gases constant
T_t	K	Temperature of gaseous stream in time interval t

Parameter	Unit	Description
i	-	Greenhouse gas i (in this case, it is CH_4)

All parameters about the LFG which is fed into the gas engines are converted automatically to normal conditions during the monitoring process. Therefore, P_t and T_t don't need to be monitored.

The amount of methane destroyed by flaring ($F_{\text{CH}_4, \text{flared}, y}$)

An ex-ante estimate of $F_{\text{CH}_4, \text{PJ}, y}$ is required to estimate baseline emission of methane from the SWDS (according to equation (2) of ACM0001) in order to estimate the emission reductions of the proposed project activity in the joint VCS PD & MR. It is determined as follows:

$$F_{\text{CH}_4, \text{PJ}, y} = \eta_{\text{PJ}} \times BE_{\text{CH}_4, \text{SWDS}, y} / GWP_{\text{CH}_4} \quad \text{Equation 5 in ACM0001 V19}$$

Where:

Parameter	Unit	Description
$F_{\text{CH}_4, \text{PJ}, y}$	tCH ₄ /yr	Amount of methane in the LFG which is flared and or used in the project activity in year y
$BE_{\text{CH}_4, \text{SWDS}, y}$	tCO ₂ e/yr	Amount of methane in the LFG that is generated from the SWDS in the baseline scenario in year y
η_{PJ}	Dimensionless	Efficiency of the LFG capture system that will be installed in the project activity
GWP_{CH_4}	tCO ₂ e/tCH ₄	Global Warming Potential of CH ₄

$BE_{\text{CH}_4, \text{SWDS}, y}$ is determined using the methodological tool “Emissions from solid disposal sites” TOOL04 version 08.1. The following guidance should be taken into account when applying the tool:

(a) f_y in the tool shall be assigned a value of 0 because the amount of LFG that would have been captured and destroyed is already accounted for in equation

(2) of methodology

ACM0001;

(b) In the tool, x begins with the year that the SWDS started receiving wastes (e.g., the first year of SWDS operation); and

(c) Sampling to determine the fractions of different waste types is not necessary because the waste composition can be obtained from previous studies.

For the project, the amount of methane generated from disposal of waste at the SWDS for year y ($BE_{\text{CH}_4, \text{SWDS}, y}$) is calculated using first order decay (FOD) model as follows:

$$\left. \begin{matrix} BE_{CH_4,SWDS,y} \\ PE_{CH_4,SWDS,y} \\ LE_{CH_4,SWDS,y} \end{matrix} \right\} = \varphi_y \times (1 - f_y) \times GWP_{CH_4} \times (1 - OX) \times \frac{16}{12} \times F \times DOC_{f,y} \\ \times MCF_y \times \sum_{x=1}^y \sum_j (W_{j,x} \times DOC_j \times e^{-k_j \times (y-x)} \times (1 - e^{-k_j}))$$

Parameter	Unit	Description
BE _{CH₄,SWDS,y} PE _{CH₄,SWDS,y} LE _{CH₄,SWDS,y}	tCO ₂ e/yr	Baseline, project or leakage methane emissions occurring in year y generated from waste disposal at a SWDS during a time period ending in year y
x	Dimensionless	Years in the time period in which waste is disposed at the SWDS, extending from the first year in the time period (x = 1) to year y (x = y)
y	Dimensionless	Year of the crediting period for which methane emissions are calculated (y is a consecutive period of 12 months)
φ	Dimensionless	Model correction factor to account for model uncertainties in year y
f	Dimensionless	Fraction of methane captured at the SWDS and flared, combusted or used in another manner
GWP _{CH₄}	tCO ₂ e/tCH ₄	Global Warming Potential of methane valid for the commitment period
OX	Dimensionless	Oxidation factor (reflecting the amount of methane from SWDS that is oxidized in the soil or other material covering the waste)
F	Dimensionless	Fraction of methane in the SWDS gas (volume fraction)
DOC _{f,y}	Dimensionless	Fraction of degradable organic carbon (DOC) that decomposes under the specific conditions occurring in the SWDS for year y (weight fraction)
MCF _y	Dimensionless	Methane correction factor for year y
W _{j,x}	tonnes	Amount of solid waste type j disposed or prevented from disposal in the SWDS in the year x (t)
DOC _j	Dimensionless	Fraction of degradable organic carbon (by weight) in the waste type j

Parameter	Unit	Description
k	1/yr	Decay rate for the waste type j
j	Dimensionless	Type of residual waste or types of waste in the MSW

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 08.1, and under section B.2 “Applicability of the tool” in the PD.

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 0.8		
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)
			DRY (MAP/PET < 1)
	Slowly degrading	Pulp, paper, cardboard / textiles	0.04
		Wood, wood products and straw	0.02
	Moderately degrading	Other (non-food) organic putrescible garden and park waste	0.05

Parameter	Value		
	Rapidly degrading	Food, food waste, sewage sludge, beverages and tobacco	0.06
W _{j,x}	Estimated once.		
	Waste type j	DOC _j (in % wet waste)	
	Wood and wood products	0%	
	Pulp, paper and cardboard	10.38%	
	Food, food waste, beverages and tobacco	48.17%	
	Textiles	5%	
	Garden, yard and park waste	0%	
	Other organic waste	13.76%	
	Inorganic, other inert	23.00%	
DOC _j	The following values for the different waste types have been applied as a default value:		
	Waste type j	Unit	
	Wood and wood products	tCH ₄ /yr.	
	Pulp, paper and cardboard	tCO ₂ e/yr.	
	Food, food waste, beverages and tobacco	Dimensionless	
	Textiles	tCO ₂ e/tCH ₄	
	Garden, yard and park waste		
	Glass, plastic, metal, other inert		
f _y	A default value of 0		

Determining the model correction factor (Φ_y)

In line with the requirements of the tool “Emissions from solid waste disposal sites” TOOL04 version 08.1, a default value: $\Phi_y = \Phi_{\text{default}}$ will be used. Φ_{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 waste disposal sites" TOOL04 version 08.1, $W_{j,x}$ is based on the waste characterization of the Province.

Waste Type	Fraction of the waste type ³²
Pulp, paper and cardboard	10.38%
Wood and wood products	0%
Textiles	5%
Other (non-food) organic waste	13.76%
Food, food waste, beverages and tobacco	48.17%
Glass, plastic, metal, other inert	23%

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

In line with the requirements of the tool "Emissions from solid waste disposal sites" TOOL04 version 08.1, 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 waste disposal sites" TOOL04 version 08.1, a default value: $MCF_y = MCF_{default}$ will be used. $DOC_{f,default}$ is set as 0.8, which corresponds to the value for deep unmanaged solid waste disposal sites .

Determination of $F_{CH_4,BL,y}$

This section provides a procedure to determine the amount of methane that would have been captured and destroyed (by flaring) in the baseline due to regulatory or contractual requirements, to address safety and odour concerns, or for other reasons (collectively referred to as requirement in this section). The four cases in the following table are distinguished. The appropriate case should be identified, and the corresponding instructions followed;

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

³² https://webdosya.csb.gov.tr/db/ced/icerikler/-istanbul_2020_-cdr-20220110121837.pdf

Situation at the start of the project activity:	Requirement to destroy methane	Existing LFG capture and destruction system
Case 3: No requirement to destroy methane exists and an LFG capture system exists	No	Yes
Case4: 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:

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

a. Baseline emissions associated with electricity generation ($BE_{EC, y}$)

The baseline emissions associated with electricity generation in year y ($BE_{EC, y}$) shall be calculated using the "Methodological tool: Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation". When applying the tool:

- (a) The electricity sources k in the tool correspond to the sources of electricity generated identified in the selection of the most plausible baseline scenario; and
- (b) $EC_{BL, k, y}$ in the tool is equivalent to the net amount of electricity generated using LFG in year y ($EG_{PJ, y}$).

$$BE_{EC, y} = \sum_k EC_{BL, k, y} \times EF_{EF, k, y} \times (1 + TDL_{k, y})$$

where:

Parameter	Unit	Description
$BE_{EC, y}$	tCO ₂ e/yr	Baseline emissions from electricity consumption in year y. However, in accordance to paragraph 54 the methodology ACM0001, $BE_{EC, y}$ is considered as "The baseline emissions associated with electricity generation in year y" therefore $BE_{EC, y}$ of Equation 2 of tool 5 is defined as The baseline emissions associated with electricity generation in year y.
$EC_{BL, k, y}$	MWh/yr	Quantity of electricity that would be consumed by the baseline electricity consumer k in year y As per paragraph 54.a of the ACM0001- Flaring or use of landfill gas, version 19.0, electricity sources k in the tool correspond to the sources of electricity generated identified in

Parameter	Unit	Description
		the selection of the most plausible baseline scenario; Since grid is the most plausible baseline scenario therefore $k = \text{grid}$. In accordance to paragraph 54.b of the ACM0001- Flaring or use of landfill gas, version19.0, $EC_{BL,k,y}$ is equivalent to $EG_{PJ,y}$. In accordance to Data / Parameter table 13 of the methodology ACM0001- Flaring or use of landfill gas, version19.0, $EG_{PJ,y}$ is defined as Amount of electricity generated using LFG by the project activity in year y. Since the entire amount of electricity generated by the project power plant is supplied to grid therefore $EG_{PJ,y}$ is equivalent to $EG_{PJ,grid,y}$. In accordance to Tool 5- Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation, version 03.0, $EG_{PJ,grid,y}$ is the electricity generated and supplied by the project power plant to the grid. The electricity consumed is sourced/imported from the grid and is monitored separately as $EC_{PJ,j,y}$.
$EF_{EF,k,y}$	tCO ₂ e/MWh	Emission factor for electricity generation source k in year y
$TDL_{k,y}$	Dimensionless	Average technical and transmission and distribution losses for providing electricity to source k in year y
k	Dimensionless	Sources of electricity consumption in the baseline

Determination of the emission factor for electricity generation ($EF_{EL,k,y}$);

The calculation of the emission factor of the National Grid, Power Grid ($EF_{EL,k,y}$) is provided in Annexes, and is based on the official report on the emission factor of the national interconnected electricity system of Turkey “Turkish National Electricity Network Information Factor Emissions 2019”³³. Detailed calculation over emission factor for electricity generation ($EF_{EL,k,y}$) is given under section 3.4.4 above of this report.

Values for the fixed ex-ante for the crediting period;

Start Date	End Date	$BE_{CH4SWDS,y}$	$F_{CH4,PJ,y}$	$1 - OX_{top_layer}$	$F_{CH4,BL,y}$	$(1 - OX_{top_layer}) \times F_{CH4,BL,y}$	GW_{PCH4}	BE_{CH4}
		tCO ₂ e	tCH ₄		tCH ₄	tCH ₄		
18-06-2021	31-12-2021	644,323	11,506	0.9	0	0.00	28	289
01-01-2022	31-12-2022	1,375,893	24,570	0.9	0	0.00	28	619

³³ Informing the Turkish national electricity grid emission factor calculated annually. TÜRKİYE ULUSAL ELEKTRİK ŞEBEKESİ EMİSYON FAKTÖRÜ BİLGİ FORMU (2020), EVÇED, Çevre ve İklim Daire Başkanlığı, İklim Grubu Telefon: +90 312 212 64 20 – 6992 e-posta: cevre.iklim@enerji.gov.tr

01-01-2023	31-12-2023	1,412,463	25,223	0.9	0	0.00	28	635
01-01-2024	31-12-2024	1,450,874	25,908	0.9	0	0.00	28	652
01-01-2025	31-12-2025	1,479,370	26,417	0.9	0	0.00	28	665
01-01-2026	31-12-2026	1,509,969	26,964	0.9	0	0.00	28	679
01-01-2027	31-12-2027	1,538,827	27,479	0.9	0	0.00	28	692
01-01-2028	17-06-2028	725,103	12,948	0.9	0	0.00	28	326

Start Date	End Date	Total Approved Capacity of Plant	Annual Generation $EC_{BL,y}$	Emission Factor $EF_{grid,CM,y}$	Baseline Emission $BE_{EC,y}$
		MW	MWh	tCO ₂ /MWh	tCO _{2e}
18-06-2021	31-12-2021	38.205	16,980	0.5552	9,427
01-01-2022	31-12-2022	38.205	132,303	0.5552	73,454
01-01-2023	31-12-2023	38.205	255,000	0.5552	141,576
01-01-2024	31-12-2024	38.205	324,743	0.5552	180,297
01-01-2025	31-12-2025	38.205	324,743	0.5552	180,297
01-01-2026	31-12-2026	38.205	324,743	0.5552	180,297
01-01-2027	31-12-2027	38.205	324,743	0.5552	180,297
01-01-2028	17-06-2028	38.205	324,743	0.5552	180,297

Start Date	End Date	BE_{CH_4}	Baseline Emission $BE_{EC,y}$	Estimation of baseline emissions (tCO _{2e}) BE_y
		tCO _{2e}	tCO _{2e}	tCO _{2e}
18-06-2021	31-12-2021	2,89,946	9,427	2,99,372
01-01-2022	31-12-2022	6,19,152	73,454	6,92,606
01-01-2023	31-12-2023	6,35,608	1,41,576	7,77,184
01-01-2024	31-12-2024	6,52,893	1,80,297	8,33,190
01-01-2025	31-12-2025	6,65,716	1,80,297	8,46,013
01-01-2026	31-12-2026	6,79,486	1,80,297	8,59,783
01-01-2027	31-12-2027	6,92,472	1,80,297	8,72,768
01-01-2028	17-06-2028	3,26,296	1,80,297	5,06,593
	TOTAL	45,61,569	11,25,943	56,87,509

Quantification of Project emissions (PE_y)

Project emissions includes two parts, which are calculated as per ACM0001 “Flaring or Use of Landfill Gas” version 19.0.0, the project emissions are calculated as follows:

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

Equation 22 in ACM0001 V19

Where:

PE_y	=	Project emissions in year y (t CO ₂ /yr)
$PE_{EC,y}$	=	Emissions from consumption of electricity due to the project activity in year y (t CO ₂ /yr)
$PE_{FC,y}$	=	Emissions from consumption of fossil fuels due to the project activity, for purpose other than electricity generation, in year y (t CO ₂ /yr)
$PE_{DT,y}$	=	Emissions from the distribution of compressed/liquefied LFG using trucks, in year y (t CO ₂ /yr)
$PE_{SP,y}$	=	Emissions from the supply of LFG to consumers through a dedicated pipeline, in year y (t CO ₂ /yr)

Since there are no consumption of fossil fuels or no distribution of compressed/liquified LFG using trucks or no supply of LFG to consumers through a dedicated pipeline due to the project activity, 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:

$$PE_{EC,y} = \sum_j EC_{PJ,j,y} \times EF_{EL,j,y} \times (1 + TDL_{j,y})$$

Equation 1 in TOOL05 V3

Where:

Parameter	Unit	Description
$PE_{EC,y}$	tCO ₂ e/yr.	Project emissions from electricity consumption in year y
$EC_{PJ,y}$	MWh/year	Quantity of electricity consumed by the project electricity consumption source j in year y
$EF_{EL,j,y}$	tCO ₂ e/MWh	Emission factor for electricity generation for source j in year y
$TDL_{j,y}$	Dimensionless	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.

Quantification of Leakage emissions;

The project does not need to consider leakage. The validation team deems this consideration is correct and in line with methodology ACM0001, version 19.0.

Emission Reductions

According to ACM0001, Version 19.0, emission reductions are calculated as follows:

$$ER_y = BE_y - PE_y$$

Where:

ER_y = Emission reductions in year y (tCO₂e/yr)

BE_y = Baseline emissions in year y (tCO₂e/yr)

PE_y = Project emissions in year y (tCO₂e/yr)

Hence for the project activity, the estimated amount of GHG emission reductions (ER_y) is 6,942,599 tCO₂e during the crediting period from 18-June-2021 to 17-June-2028, resulting in estimated average annual emission reductions of 812,501 tCO₂e.

Year	Baseline estimate	Project estimate	Leakage	Net benefit
	tCO ₂ e	tCO ₂ e	tCO ₂ e	tCO ₂ e
18/06/2021 - 31/12/2021	299,372	0	0	299,372
01/01/2022 - 31/12/2022	692,606	0	0	692,606
01/10/2023 - 31/12/2023	777,184	0	0	777,184
01/01/2024 - 31/12/2024	833,190	0	0	833,190
01/10/2025 - 31/12/2025	846,013	0	0	846,013
01/01/2026 - 31/12/2026	859,783	0	0	859,783
01/10/2027 - 31/12/2027	872,768	0	0	872,768
01/01/2028 - 17/06/2028	506,593	0	0	506,593
Total tCO₂e	5,687,509	0	0	5,687,509
Average	812,501	0	0	812,501

3.4.7 Methodology Deviations

The assessment team confirms that the Joint PD and MR complies with the requirements in the applied methodology /3/ ACM0001 V19. Hence, there is no any methodology /3/ deviation applicable for the project activity.

3.4.8 Monitoring Plan

The project monitoring plan is in compliance with the monitoring ACM0001 version 19. Since the project is energy generation activity through landfill gas, no indicators have been defined regarding project emissions. The monitor-able action plan for the same has been included in section 6.3 of the Joint PD and MR. Validation team confirms that the project participant is able to implement the monitoring plan.

Parameters determined ex-ante

1. **Oxidation factor (OX_{top_layer})**: the project selects Option 1 : PP has chosen a default value for Oxidation factor. The same is as per the methodology AMS-III.G. (version 10.0). The justification was accepted by the validation team. The default value is 0.1.

2. **Efficiency of the LFG capture system that will be installed in the project activity (η_P):** value applied is 50% as per applied methodology ACM0001 and fixed for throughout the crediting period. Found appropriate thus accepted.
3. **Universal ideal gases constant (R_u)** with the unit as 'Pa.m³/kmol.K' value used is 8.314 sourced from Tool to determine the mass flow of a greenhouse gas in a gaseous stream. Value for this ex-ante parameter is fixed for whole crediting period. Found appropriate thus accepted.
4. **Molecular mass of CH₄ (MM_{CH_4})** value applied is 16.04, sourced from Tool to determine the mass flow of a greenhouse gas in a gaseous stream. Value for this ex-ante parameter is fixed for whole crediting period. Found appropriate thus accepted.
5. **Density of greenhouse gas i (methane) in the gaseous stream ($\rho_{i,t}$)** value applied is 0.71566 kg/m³, sourced from Tool to determine the mass flow of a greenhouse gas in a gaseous stream. Value for this ex-ante parameter is fixed for whole crediting period. Found appropriate thus accepted.
6. **Default value for the model correction factor to account for model uncertainties ($\phi_{default}$):** The project selects Option 1: Use a default value to determine $\phi_{default}$ in the tool "Emissions from solid waste disposal sites" (version 08.0), and the project belongs to the situation of Application A: The VCS project activity mitigates methane emissions from a specific existing SWDS, thus 0.75 is chosen for $\phi_{default}$. The justification is acceptable by the validation team.
7. **Oxidation factor (OX):** This parameter reflects the amount of methane from SWDS that is oxidized in the soil or other material covering the waste) value considered as 0.1 sourced from Emissions from solid disposal sites. Based on extensive review of published literature on this subject, including the IPCC 2006 Guidelines for National Greenhouse Gas Inventories. Value for this ex-ante parameter is fixed for whole crediting period. Found appropriate thus accepted.
8. **Fraction of Methane in the SWDS (volume fraction) (F):** This parameter reflects the fraction of methane in the SWDS organic waste that is converted to a mixture of methane and carbon dioxide after biodegradation. The value considered as 0.5 sourced from IPCC 2006 Guidelines for National Greenhouse Gas Inventories. Value for this ex-ante parameter is fixed for whole crediting period. Found appropriate thus accepted
9. **Default value for the fraction of degradable organic carbon ($DOC_{f,default}$)** in MSW that can decompose in the SWDS ($DOC_{f,default}$) unit is 'Weight fraction', PP has chosen a default value for fraction of degradable organic carbon in the waste type j (weight fraction) according to IPCC 2006 guidelines for national greenhouse gas inventories. The same is as per TOOL 04 "Emissions from solid waste disposal sites." The justification was accepted by the validation team. The value is 0.5 and same value fixed for whole crediting period. Found appropriate thus accepted.
10. **Methane correction factor ($MCF_{default}$):** PP has chosen a default value for the Methane correction factor according to IPCC 2006 guidelines for national greenhouse gas inventories. The same is as per TOOL 04 "Emissions from solid waste disposal sites." The justification was accepted by the assessment team. The value is taken as 0.8 and is fixed for whole crediting period. Found appropriate thus accepted.

11. **Fraction of degradable organic carbon in waste type j (weight fraction) (DOC_j)** PP has chosen a default value for fraction of degradable organic carbon in the waste type j (weight fraction) according to IPCC 2006 guidelines for national greenhouse gas inventories. The same is as per TOOL 04 “Emissions from solid waste disposal sites.” The justification was accepted by the validation team. It is sourced from IPCC 2006 Guidelines for National Greenhouse Gas Inventories (adapted from Volume 5, Table 2.4 and Table 2.5) as below:

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

Above Value for this ex-ante parameter is fixed for whole crediting period. Found appropriate thus accepted.

12. **Type of Organic Waste (Waste type j):** values were sourced from Annual İstanbul Environmental Status Report which presents waste amount, characteristics, and landfill data in İstanbul annually. The parameter is only used for estimation of ex-ante emission reduction. The parameter is only used for estimation of ex-ante emission reduction:

Waste type j	DOC _j (in % wet waste)
Wood and wood products	0%
Pulp, paper and cardboard	10.38%
Food, food waste, beverages and tobacco	48.17%
Textiles	5%
Garden, yard and park waste	0%
Other organic waste	13.76%
Inorganic, other inert	23.00%

Above Value for this ex-ante parameter is fixed for whole crediting period. Found appropriate & sourced from authentic source thus accepted.

13. **Decay rate for the waste type j (k_j)** unit is ‘1/yr’ PP has chosen a default value for Decay rate for the waste type j according to IPCC 2006 guidelines for national greenhouse gas inventories. The same is as per TOOL 04 “Emissions from solid waste disposal sites.” The justification was accepted by the validation team.

14. **Total amount of solid waste disposed in the SWDS (W_x)**: The data is obtained from Landfill gas power generation report of Landfill gas project. Unit is ton, its values are mentioned in section 6.1 of joint PD-MR. Found appropriate thus accepted.
15. **Amount of solid waste type j disposed in the SWDS ($W_{j,x}$)**: The data is obtained from Landfill gas power generation report of Landfill gas project. Unit is ton, its values are mentioned in section 6.1 of joint PD-MR. Found appropriate thus accepted.
16. **$TDL_{k,y}$** value is sourced from Republic of Turkey, Energy Market Regulatory Authority (EMRA) (as 1.89%) in line with “Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation” version 03. Will be estimated for the distribution and transmission networks of the electricity grid of the same voltage annually or in absence of data from the relevant year, most recent figures should be used, but not older than 5 years. Found appropriate thus accepted.
17. **Operating margin CO_2 emission factor for the project electricity system in year y (tCO_2/MWh)** as 0.7424 default value, sourced from The Ministry of Energy and Natural Sources. Value for this ex-ante parameter is fixed for whole crediting period. Found appropriate thus accepted.
18. **Build margin CO_2 emission factor for the project electricity system in year y ($EF_{grid,BM,y}$)** default value is 0.3680 sourced from The Ministry of Energy and Natural Sources. Value for this ex-ante parameter is fixed for whole crediting period. Found appropriate thus accepted.
19. **Combined margin CO_2 emission factor for the project electricity system in year y ($EF_{grid,CM,y}$)** value calculated as 0.5552 using the combined margin formula to estimate baseline emissions and found correct by the assessment team.

Parameters determined ex-post

1. **Operation of the equipment that consumes the LFG ($Op_{j,h}$)** in the project activity is sourced from Project participant and it is measured as follows:

For each equipment unit j using the LFG monitor that the plant is operating in hour h by the monitoring any one or more of the following three parameters:

- (a) Temperature. Determine the location for temperature measurements and minimum operational temperature based on manufacturer’s specifications of the burning equipment. Document and justify the location and minimum threshold in the PDD;
- (b) Flame. Flame detection system is used to ensure that the equipment is in operation;
- (c) Products generated. Monitor the generation of steam for the case of boilers and air-heaters and glass for the case of glass melting furnaces. This option is not applicable to brick kilns.

$Op_{j,h}=0$ when:

- (a) One of more temperature measurements are missing or below the minimum threshold in hour h (instantaneous measurements are made at least every minute);
- (b) Flame is not detected continuously in hour h (instantaneous measurements are made at least every minute);

(C) No products are generated in hour h

Otherwise $O_{pj,h}=1$

2. **The management of the solid waste disposal site (SWDS)** in the project activity is not changed in order to increase methane generation compared to the situation prior to the implementation of the project activity.
3. **Amount of methane in the LFG which is flared due to a requirement in year y ($F_{CH_4,BL,R,y}$):** Project participant will refer to the Regulation during the lifetime of the project activity and follow any update if there is any and operate accordingly. However, there is no regulation/ Environmental Law for flaring of methane therefore methane in the LFG is not flared during the monitoring period and hence the amount of methane flared is considered as zero. Same is checked with the Turkish regulations and plant records.
4. **Fraction of LFG that is required to be flared due to a requirement in year y ($p_{reg,y}$):** Since there is no regulation/ Environmental Law for flaring of methane therefore methane in the LFG is not flared during the monitoring period and hence the amount of methane flared is considered as zero. Same is checked with the Turkish regulations and plant records.
5. **Volumetric flow of the gaseous stream in time interval t on a dry basis ($V_{t,db}$)** The flowmeter works continuously and the volumetric flow is archived electronically. Cumulative flow is monitored and archived on monthly basis. The flow meters are subject to a regular maintenance and testing. As per national regulation the flowmeter is required to be calibrated once in 10 years. Since, the volumetric flow is converted to normal conditions during the monitoring process, temperature and pressure monitoring is not required to be monitored for adjusting the volume.
6. **Volumetric fraction of CH_4 in a time interval t on a dry basis ($V_{CH_4,t,db}$)** - The flowmeter works continuously and the volumetric flow is archived electronically ($V_{CH_4,t,db}$) value is recorded in normal conditions. Cumulative flow is monitored and archived on monthly basis. The flow meters are subject to a regular maintenance and testing. As per national regulation the flowmeter is required to be calibrated once in 6-12 months. Since the volumetric flow is converted to normal conditions during the monitoring process, temperature and pressure monitoring is not required to be monitored for adjusting the volume.
7. **Quantity of electricity consumed by the project electricity consumption source j in year y ($EG_{PJ,j,y} = EG_{PJ,Grid,y}$)** is sourced from the direct measurements from bi-directional electricity meter(s). The amount of electricity consumed by the project activity which is measured continuously by electricity meters operated by the Turkish grid company who is the owner of the meter. The amount of electricity export can be obtained from Monthly Meter reading protocols (TEIAS Records). According to the legislation the electricity meters are subject to periodic maintenance every 10 years. In accordance with the "Regulation on Measurement and Measuring Tools"³⁴ – Article 9, electricity meters and gas/flow meters have to be calibrated within a frequency of once per 10 years. Grid company is responsible for the calibration of electricity meters.
8. **Amount of electricity consumed by the project activity in year y ($EG_{EC,y} = EC_{PJ,j,y}$):** Amount of electricity consumed by the project activity in year y ($EG_{EC,y}$) is imported from the grid therefore it

³⁴ <https://www.mevzuat.gov.tr/anasayfa/MevzuatFihristDetayIframe?MevzuatTur=7&MevzuatNo=6381&MevzuatTertip=5>

is equivalent to Quantity of electricity consumed by the project electricity consumption source j in year i i.e the project facility ($EC_{PJ,j,y}$). y There is no separate monitoring of auxiliary load during engine running. Electricity generated from engine is used for auxiliary power and rest energy is feed to the grid. This parameter will be monitored using bi-directional energy meter(s) installed at project site and under the custody of grid authority. TEIAS OSF/OSOS forms (Electricity imported from the grid and consumed by the project electricity consumption source is measured using more than one electricity meters (main and spare) are reflected in the TEIAS OSF/OSOS forms). The value of electricity import is cross-checked with records of electricity sale (EPIAS). According to the legislation the electricity meters are subject to periodic maintenance every 10 years. In accordance with the "Regulation on Measurement and Measuring Tools"³⁵ – Article 9, electricity meters and gas/flow meters must be calibrated within a frequency of once per 10 years. Grid company is responsible for the calibration of electricity meters. Calibration year of electricity meter(s) is most of the time stated by the Grid Company in the meter replacement protocols.

3.5 Non-Permanence Risk Analysis

No.	Risk that could lead to material errors, omissions or misstatements	Assessment of the risk		Response to the risk in the verification plan and/or sampling plan
		Risk level	Justification	
NA	NA	NA	NA	NA

4 VERIFICATION FINDINGS

4.1 Accuracy of GHG Emission Reduction and Removal Calculations

Means of verification	The verification team assessed whether the data and calculations of GHG emission reductions achieved resulting from the Joint VCS PD & MR. The verification team has checked whether calculations of baseline GHG emissions, project GHG emissions and leakage GHG emissions have been carried out in accordance with the formulae and methods described in the monitoring plan of the Joint VCS PD & MR.		
Findings	CAR#08 raised on this section and closed successfully.		
Conclusion	Below Parameters are monitored during current monitoring period: -		
	Parameter	Op _{j,h} - Operation of the equipment that consumes the LFG	
	Monitoring Procedure	This parameter measured on hourly basis. Monitoring of this parameter is done through the SCADA system.	

³⁵ <https://www.mevzuat.gov.tr/anasayfa/MevzuatFihristDetayIframe?MevzuatTur=7&MevzuatNo=6381&MevzuatTertip=5>

	During current monitoring period, the value of operation Equipment is 109,880 hours. The unit of this parameter is hour 'h'. The measured value is sourced from difference of operation hours mentioned in Daily reports of 18-June-2021 (first date of MP) and 31-October-2022 (last date of monitoring period). Vintage Breakup: <table><tr><th>Period</th><th>Op_{j,h} (hours) – Gas Engine</th></tr><tr><td>18-June-2021 to 31-December-2021</td><td>17,850</td></tr><tr><td>01-January-2022 to 31-October-2022</td><td>92,030</td></tr><tr><td>Total</td><td>109,880</td></tr></table> Above mentioned values are sourced from project daily reports dated 18-June-2021 and 31-October-2022. Same has been checked by assessment team and confirmed that measured value is correct through daily records and also site visit. Also, during site visit, review of SCADA records it was noted that flare was not used during this complete monitoring period and thus operational hours are zero for the flare.	Period	Op _{j,h} (hours) – Gas Engine	18-June-2021 to 31-December-2021	17,850	01-January-2022 to 31-October-2022	92,030	Total	109,880
Period	Op _{j,h} (hours) – Gas Engine								
18-June-2021 to 31-December-2021	17,850								
01-January-2022 to 31-October-2022	92,030								
Total	109,880								
Parameter	Management of SWDS								
Monitoring Procedure	The management of SWDS is monitored on annual basis and recorded under register maintained on the site. Same has been verified by assessment team. Thus, accepted. During current monitoring period, the management of the solid waste disposal site (SWDS) in the project activity is not changed in order to increase methane generation compared to the situation prior to the implementation of the project activity. Found correct, thus accepted.								
Parameter	Amount of methane in the LFG which is flared due to a requirement in year y (F _{CH4,BL,R,y})								
Monitoring Procedure	Since there is no regulation/ Environmental Law for flaring of methane therefore methane in the LFG is not flared during the monitoring period and hence the amount of methane flared is considered as zero. Further, same is also checked onsite and from plant logbooks.								

	Parameter	Fraction of LFG that is required to be flared due to a requirement in year y ($p_{reg,y}$)											
	Monitoring Procedure	Since there is no regulation/ Environmental Law for flaring of methane therefore methane in the LFG is not flared during the monitoring period and hence the amount of methane flared is considered as zero. Further, same is also checked onsite and from plant logbooks.											
	Parameter	$V_{i,t,db}$ - Volumetric flow of the gaseous stream in time interval t, on a dry basis											
	Monitoring Procedure	This parameter is measured on continuously with the volumetric flow meter and same data has been verified through the data log sheet provided by the PP and found consistent. The unit used is, 'm³ dry gas/h'. Total value measured for this parameter are as follows; For 2021 - 10,971,715 m³/hour For 2022 – 50,695,086 m³/hour During current monitoring period, above valued measured using the monitoring equipment is below <table><tr><td>Equipment Type</td><td>Flowmeter</td></tr><tr><td>Manufacturer</td><td>INC Endüstriyel Ürünler A.Ş.</td></tr><tr><td>Location</td><td>On site</td></tr><tr><td>Accuracy</td><td>+/- 1%</td></tr><tr><td>Serial Number</td><td>211001-39077</td></tr><tr><td>Calibration Date</td><td>20-August-2020</td></tr></table> VVB team checked confirm that the records of calibration checked onsite and calibration date found in line with the calibration certificate.	Equipment Type	Flowmeter	Manufacturer	INC Endüstriyel Ürünler A.Ş.	Location	On site	Accuracy	+/- 1%	Serial Number	211001-39077	Calibration Date
Equipment Type	Flowmeter												
Manufacturer	INC Endüstriyel Ürünler A.Ş.												
Location	On site												
Accuracy	+/- 1%												
Serial Number	211001-39077												
Calibration Date	20-August-2020												
	Parameter	$V_{CH_4,t,db}$ - Volumetric fraction of CH ₄ in a time interval t on a dry basis											

	Monitoring Procedure	This parameter is measured and recorded Continuously using gas analyzer which operating in dry basis. The unit used is, 'm³ gas CH₄/m³ dry gas'. The gas analyzers are subject to a regular maintenance and testing. As per national regulation the gas analyzers are required to be calibrated once in 10 years. The value achieved during the monitoring period is 51.73 % (<i>Average value however, monthly values provided in ER sheet</i>) Calibration frequency of the Gas Analyzer for this monitoring period is 6-12 months. The details of Gas Analyzer calibration and monitoring equipment mentioned below: <table><tr><td>Equipment Type</td><td>Gas Analyser</td></tr><tr><td>Manufacturer</td><td>Siemens Ultramat 23</td></tr><tr><td>Location</td><td>On site</td></tr><tr><td>Accuracy</td><td>± 0.5%</td></tr><tr><td>Serial Number</td><td>N1-M3-096</td></tr><tr><td>Calibration Date</td><td>29-September-2022 30-March-2022 16-July-2021</td></tr></table> VVB team checked confirm that the records of calibration checked onsite and calibration date found in line with the calibration certificate.	Equipment Type	Gas Analyser	Manufacturer	Siemens Ultramat 23	Location	On site	Accuracy	± 0.5%	Serial Number	N1-M3-096	Calibration Date	29-September-2022 30-March-2022 16-July-2021
	Equipment Type	Gas Analyser												
	Manufacturer	Siemens Ultramat 23												
	Location	On site												
Accuracy	± 0.5%													
Serial Number	N1-M3-096													
Calibration Date	29-September-2022 30-March-2022 16-July-2021													
Parameter	EG_{PJ,y} = EG_{PJ,grid,y} - Amount of electricity generated using LFG by the project activity in year y													
Monitoring Procedure	This parameter measured on monthly basis. The unit used is, 'MWh'. This parameter will be monitored using bi-directional energy meter(s) as per TOOL05 and Turkish legislation. During current monitoring period, the quantity of electricity generated and supplied to the grid by the project plant will be continuously monitored based on the main meter (also referred as TEİAŞ meters) readings. The electricity meters are used to measure the electricity supplied to the grid and used for billing purposes. Therefore, the meters are sealed by TEİAŞ (Turkish Electricity Transmission Company) (TEIAS Records) and is crosschecked with the electricity sale data (e.g., EPIAS Records).													

³⁶ As the manufacture date of main and back-up electricity meters are 2020, calibration is valid until 2030 as per the “Regulation on Measurement and Measuring Tools”³⁶ – Article 9.

		Manufacturer	ITRON SL7000	ITRON SL7000
		Location	On site	On site
		Serial Number	84500212	84500190
		Manufacture Date / Calibration Date	2020 / 19-February 2020	202037 /19-February 2020
		VVB team checked confirm that the records of calibration checked onsite and calibration date found in line with the calibration certificate.		

Baseline Emission Calculations,

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

Since there is 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. The baseline emissions are calculated as follows:

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

$$BE_y = 631,621 \text{ tCO}_2\text{e (Rounddowned)}$$

Project Emission Calculation,

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

$PE_{DT,y}$, $PE_{FC,y}$ and $PE_{SP,y}$ are equal to "0" and has not been included in equation: $PE_y = PE_{EC,y}$

$$PE_{EC,y} = \sum_j EC_{PJ,j,y} \times EF_{EF,j,y} \times (1 + TDL_{j,y})$$

$$PE_y = 18.00 \text{ tCO}_2\text{e}$$

Leakage emission calculation,

Since there is no transfer of equipment, therefore, leakage emission is considered as zero '0'

$$ER = BE_y - PE_y - LE_y$$

$$ER = 631,621 - 18 - 0$$

$$= 631,603 \text{ tCO}_2\text{e}$$

³⁷ As the manufacture date of main and back-up electricity meters are 2020, calibration is valid until 2030 as per the "Regulation on Measurement and Measuring Tools"³⁷ – Article 9.

Year	Baseline emissions or removals (tCO ₂ e)	Project emissions or removals (tCO ₂ e)	Leakage emissions (tCO ₂ e)	Net GHG emission reductions or removals (tCO ₂ e)
Year 1 (18-June-2021-31-December-2021)	114,593	8.00	0	114,585
Year 2 (01-January-2022 to 31-October-2022)	517,028	10.00	0	517,018
Total	631,621	18.00	0	631,603

4.2 Quality of Evidence to Determine GHG Emission Reductions and Removals

As a result of verification of the ER calculation process, the assessment team confirmed that all the parameters required for the determination of the emission reductions have been included in the joint PD & MR and ER Calculation Spreadsheet of this monitoring period and are consistent with the applied methodology ACM0001 Version 19.0 and the monitoring plan contained in the joint PD & MR. The parameters are complete in this monitoring period. After verifying the reported figures with the data sources, it's confirmed that the values of the parameters from the data sources are consistent with those quoted in the ER Calculation Spreadsheet of this monitoring period and joint PD & MR. the verification process for the same has been clearly described above in section 4, of the report. All necessary documentations are collected, referenced and aggregated, which is easily accessible in hard-copy or electronic format. Measurements are performed by calibrated equipment, and the key data can also be cross-checked via other sources, such as records, receipts and inventory data. No assumptions are used that have any material influence on reported emission reductions. LGAI Technological Center S.A. (Applus+ Certification) concludes that during this monitoring period, the evidences for determination of emission reductions are sufficient and reasonable, and the calculation of emission.

Means of verification	The verification team checked monitoring equipment's for the monitoring period. During the verification site visit, the location Energy meter and Gas flow analyser of the project is also checked. The Calibration details of the meters and analyser are also checked with calibration certificates. Calibration details of all relevant meters, analysers checked and found to be ok. Details of calibration provided in Annex. 5 of the report.
Conclusion	CAR #07 was raised on the section and closed successfully.
Conclusion	All parameters which need to be monitored for verification such as amount of electricity generated, amount of gas flared and other parameters sourced from plant records/ log book also cross checked with stores. The meters installed at plant are controlled and supervision of state utility officials. Similarly, Site

	operator is responsible for monitoring of relevant parameters at plant. It is reported that the data will be kept for 2 years following the end of the crediting period or till the last issuance of VERs for the project activity whichever occurs later. The responsibilities and authorities of project management, data handling and recording, measurement methods and QA/QC procedure have been systematically established and formalized and the same was verified during the site visit. During onsite audit with O&M personnel also confirms that the operational and organizational chart as mentioned in Joint VCS PD & MR is as per the site practice and thus assessment team confirms that the details are correct. The actual emission reduction has been observed to be 48% lower (Overall project) in comparison with the ex-ante estimations due to the baseline estimation of methane avoidance (ex-ante) is carried out with consideration of efficiency of the gas collection system as 50% (methodology default), however the actual gas collection efficiency is much higher resulting in higher gas capture and its utilization. Same was confirmed with PP during onsite assessment. During site visit, assessment team noted that all of the collected landfill gas (LFG) is sent to the gas engines for electricity generation, and no collected gas is sent for flaring which was confirmed through SCADA daily/monthly records. The facility ensures that all collected gas is fully utilized. Facility is designed to install & operate gas engines with increased gas production and thus additional gas engines will be installed based on the increased quantity of the LFG. During this monitoring period, no gas was flared which was verified through plant SCADA records. Thus, the ex-post baseline emissions were calculated solely based on the amount of gas utilized for electricity generation. The monitoring plan is followed at the project site. The Energy meters and Gas analysers were calibrated in line with the registered monitoring plan and there was no delay in calibration observed. Thus, assessment team concluded that the evidences are sufficient in quantity, and appropriate for the quality, to determine the GHG reductions and removals.
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5 VALIDATION AND VERIFICATION OPINION

Validation Conclusion:

Applus+ Certification has been engaged by Körfez Enerji Sanayi ve Ticaret Anonim Şirketi and EKI Energy Services Limited for the Validation and verification of the “Avcıkoru Landfill Gas to Electricity Project”.

The management of the project participant/owner is responsible for the preparation of the GHG emissions data and the reported/estimated GHG emissions reductions on the basis set out within the project's Monitoring Plan in the Joint VCS PD & MR and the applied methodology; ACM0001 Version 19.0.

Our Validation approach was based on the requirements as defined under the Kyoto Protocol, as well as those defined by the CDM Executive Board and VCS board. Our approach is risk-based, drawing on an understanding of the risks associated with estimated GHG emissions data and the controls in place to mitigate these. Applus also confirm that the project activity, as documented, is found reasonable and meets the identified criteria, the validation involves the assessment of project conformance to VCS standards/programs, project conformance to the applied methodology, including the procedure for the demonstration of additionality specified in the methodology; and likelihood that methods and procedures set out in the Joint Project Description and Monitoring Report (hereafter refer to as "joint PD & MR") will generate verifiable GHG data and information when implemented. Further, The assessment team can confirm that:

- The projects description compliance with, the requirements of Article 12 of the Kyoto Protocol, the CDM Modalities and Procedures as agreed under decision 3/CMP.1, the annexes to this decision, subsequent decisions and guidance made by COP/MOP & CDM Executive Board and other relevant rules, including the Host Country legislation and sustainability criteria along with VCS guideline version 4.4 and standard version 4.5
- The project's baseline and additionality are assessed against ACM0001 Version 19.0 for first CP.
- The project's monitoring plan is assessed against ACM0001 Version 19.0 for first CP.
- A risk-based approach has been followed to perform this validation activity. The review of the project description and additional documents related to baseline and monitoring methodology; the subsequent background investigation, follow-up interviews with Project Owner have provided LGAI Technological Center S.A. (Applus+ Certification) with sufficient evidence for positive validation opinion as per the requirement of VCS.

The project is expected to generate 812,501 tCO₂e per year during the length of entire 1st crediting period (18-June-2021 to 17-June-2028).

Year	Estimated GHG emission reductions or removals (tCO ₂ e)
Year 2021 (18-June-2021-31-December -2021)	299,372
Year 2022 (01-January-2022-31-December -2022)	692,606
Year 2023 (01-January-2023-31-December-2023)	777,184
Year 2024 (01-January-2024-31-December-2024)	833,190

Year	Estimated GHG emission reductions or removals (tCO _{2e})
Year 2025 (01-January-2025-31-December-2025)	846,013
Year 2026 (01-January-2026-31-December-2026)	859,783
Year 2027 (01-January-2027-31-December-2027)	872,768
Year 2028 (01-January-2028-17-June-2028)	506,593
Total estimated ERs	5,687,509
Total number of crediting years	7
Average annual ERs	812,501

Verification Conclusion:

Our Verification approach was based on the requirements as defined under the Kyoto Protocol, Marrakesh accord, as well as those defined by the CDM Executive Board. Our approach is risk-based, drawing on an understanding of the risks associated with reporting GHG emissions data and the controls in place to mitigate these. The verification concludes and expresses a conclusion with a reasonable level of assurance about reported GHG emissions reduction data is free from material misstatement. The verification can confirm that:

- The project is operated as planned and described in the VCS joint PD & MR (1st CP);
- The monitoring plan is as per the applied methodology;
- The monitoring process in Monitoring Report is as per the joint PD & MR.
- The development and maintenance of records and reporting procedures are in accordance with the monitoring plan;
- The installed equipment being essential for generating emission reduction runs reliably and is calibrated appropriately
- The monitoring system is in place and generates GHG emission reductions data;
- The GHG emission reductions are calculated without material misstatements.
- No limitation observed for the present verification

Verification period: 18-June-2021 to 31-October-2022 (first and last date included) under 1st CP. Verified GHG emission reductions and removals in the above verification period are reported the final Joint PD & MR found correct.

Verified GHG emission reductions and removals in current periodic verification:

Net Emission Reduction from 18-June-2021 to 31-October-2022 (Monitoring Period under First Crediting Period):

Year	Baseline emissions or removals (tCO ₂ e)	Project emissions or removals (tCO ₂ e)	Leakage emissions (tCO ₂ e)	Net GHG emission reductions or removals (tCO ₂ e)
Year 2021 (18-June-2021-31-December-2021)	114,593	8	0	114,585
Year 2022 (01-January-2022 to 31-October-2022)	517,028	10	0	517,018
Total	631,621	18	0	631,603

Year	Ex-ante emissions reductions /removals	Achieved emissions reductions /removals	Percent difference	Justification for the difference
Year 1 (18-June-2021 to 31-December-2021)	299,372 tCO ₂ e	114,585 tCO ₂ e	-62%	The decrease in the emission reduction during the monitoring period relates to: 1. Out of total approved 27 gas engines, only 11 is commissioned during the monitoring period, 16 is yet to be commissioned. 2. As more than half (59%) of the gas engines are not yet working, not all of the LFG in the landfill can be utilized. In the ex-ante emissions reductions/removals, the waste amount and respective LFG and methane in it is considered on the baseline emissions of methane from the SWDS. However, as the project is not yet in full capacity (59% less), not all of the LFG can be utilized, therefore achieved emissions of methane from
Year 2 (01-January-2022 to 31-October-2022)	577,171 tCO ₂ e	517,018 tCO ₂ e	-10%	

				SWDS are smaller in line with the plant gas engines capacity. Further, the collected landfill gas (LFG) is sent to the gas engines for electricity generation and no quantity of the collected gas is flared or have any other utilization at the project site. Same has been verified from the SCADA records. The facility ensures that all collected gas is fully utilized. Moreover, facility will install remaining gas engines over time with increase in the LFG quantity. As verified from the monitoring records, no gas was flared during the whole monitoring period; thus, the ex-post baseline emissions were calculated solely based on the amount of gas collected & utilized for electricity generation. As estimated ERs are calculated on the planned capacity of the power plant, project activity generated 28% lesser ERs during this monitoring period.
Total	876,543	631,603	-28% (Overall difference)	

APPENDIX 1: DOCUMENTS REVIEWED OR REFERENCED (VERIFICATION)

No.	Author	Title	References to the document	Provider
1.	VCS	VCS webpage for the project, VCS ID 3997.	https://registry.verra.org/app/projectDetail/VCS/3997	-
2.	PP	VCS Joint PD-MR version 01(Initial) VCS Joint PD-MR version 07 (Final)	02-June-2023 12-September-2024	PP
3.	PP	ER Sheet version 07 (Final)	12-September-2024	PP
4.	PP	IRR Sheet (Estimated) IRR Sheet Realized 2020 -2022	12-September-2024 18-August-2023	PP
5.	Energy and Natural Resource Ministry	Commissioning Certificate	18-June-2021 01-April-2022 23-December-2021	PP
6.	UNFCCC/CDM	Applied Methodologies - ACM0001: Flaring or use of landfill gas	Version 19.0	CDM
7.	UNFCCC/CDM	Applied Tools – a) “Tool for the demonstration and assessment of additionality” TOOL01 b) “Emissions from solid waste disposal sites” TOOL 04 c) “Tool to calculate the emission factor for an electricity system” TOOL 07 d) “Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation” TOOL05 e) “Tool to determine the mass flow of a greenhouse gas in a gaseous stream” TOOL08	Version 07.0.0 Version 08.1 Version 07.0 Version 03.0 Version 03.0	UNFCCC/CDM
8.	NA	Provincial Environmental Status Reports	2013 to 2020	PP
9.	NA	EIA exemption decision	22-January-2021	PP

No.	Author	Title	References to the document	Provider
10.	NA	The operational lifetime of the project activity from the manufacturer = (Technical specifications of gas engines)	Manufacturer technical specifications	PP
11.	NA	Calibration Certificates of energy meters	08-February-2020 30-MARCH-2022	PP
12.	NA	Declaration regarding no participation in other GHG program for the concerned monitoring period	11-November-2022	PP
13.	NA	Local Stakeholder Consultation	26-September-2022	PP
14.	NA	Power Purchase Agreements (PPAs)	-	PP
15.	NA	Breakdown details for the monitoring period	-	PP
16.	NA	Grievance Register maintained at site	-	PP
17.	NA	World Bank Turkey Report	-	PP
18.	NA	Connection agreement System usage agreement Gas engines supply agreement	-	PP
19.	NA	EPIAS screenshots TEIAS records Daily Reports	-	PP
20.	Verra	VCS Standard VCS guidelines	Version 4.5 Version 4.4	Publicly available
21.	NA	Feasibility report for the project activity by "Korfez Enerji San. ve Tic. A.S." conducted the study	Date: 01-January-2020	PP

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

CL ID	01	Section no.	3.1	Date: 16-March-2023
Description of CL				
PP is requested to submit pre-feasibility study report for the basis of the daily waste collection & its composition considered for the emission reduction calculations. Further, PP is requested to justify any deviation during the monitoring period as project activity is operational since June 2021. Kindly clarify & submit evidences.				
Project participant response				Date: 18-August-2023
Ministry of Environment, Urbanization and Climate Change, İstanbul Provincial Directorate publishes annual Provincial Environmental Status Reports. These reports are comprehensive and includes environmental data on waste (amount and composition of waste collected – Section C. Waste), landfill facilities, air, water, land use and various other environmental aspects. As these reports are official status reports and presents waste collection and composition data, these are taken as the basis for the ex-ante emission reduction calculations. Corresponding links have been also integrated into Ip_LFG sheet, M column of ER Sheet_v2. Reports also submitted. PP confirms that there has been no deviation during the monitoring period.				
Documentation provided by project participant				
ER Sheet Provincial Environmental Status Reports				
VVB assessment				Date: 22-August-2023
PP has provided the İstanbul Provincial Directorate publishes annual Provincial Environmental Status Reports from 2013 to 2020 as supporting document. The verification team observed that in section C.1 of the report gives details about waste collection and its composition. Also, PP states that there is no any deviation in during monitoring period and found inline with VCS Project standard 4.4. Hence, CL #1 is closed.				

CL ID	02	Section no.	3.1	Date: 16-March-2023
Description of CL				
PP requested to clarify the commissioning dates of the landfill facility & each Gas Engine installed till date along with supporting documents and thus start date of the project activity in line with the VCS Version 4.5. Kindly clarify.				
Project participant response				Date: 18-August-2023
The project start date is taken as the start date of electricity generation by the project so that project activity began reducing or removing GHG emissions. Therefore, project start date is 18-June-2021, as this date is the start date for electricity generation stated as in line with the VCS Version 4.5. There are 11 gas engines operating in the facility and their commissioning dates are as follows: • 3 gas engines: 18-June-2021 • 7 gas engines: 23-December-2021 • 1 gas engine: 01-April-2022				
Documentation provided by project participant				
Commissioning certificates Joint PD-MR				
VVB assessment				Date: 22-August-2023

PP has submitted the commissioning certificates for 21 gas engines as supporting document. During verification team observed that, 3 gas engines commission on 18-June-2021, 7 gas engines commission on 23-December-2021 and 1 gas engine commission on 01-April-2022, 10 gas engines on 23-June-2023. Same details are mention in section 1.11 of revised PDMR and found inline with VCS Standard 4.4. Hence, **CL #2 is closed.**

CAR ID	01	Section no.	3.1	Date: 16-March-2023
Description of CAR				
1. During the review of the VCS joint PD-MR, various missing information/non-compliances observed as per the guidelines to complete VCS joint PD-MR and same are commented in applicable sections of the VCS joint PD-MR. 2. PP is requested to update the template of the joint PD-MR to the latest version and submit the updated Joint PD-MR.				
Project participant response				Date: 18-August-2023
1. Joint PD-MR is updated as per the latest guideline and comments in related sections. 2. Joint PD-MR is updated using the latest PD-MR template (Version 4.2).				
Documentation provided by project participant				
Joint PD-MR				
VVB assessment				Date: 22-August-2023
1. Revised PDMR is submitted by PP to verification team. During verification, team observed that all comments are resolved by PP as per template guideline and VCS standard. 2. PP has submitted the latest version 4.2 of PDMR to verification team as per the VCS template guideline.				
Hence, CAR #1 is closed.				

CAR ID	02	Section no.	3.1	Date: 16-March-2023
Description of CAR				
During review of joint PD-MR following inconsistencies observed: 1. PP is requested to submit commissioning certificate for the project activity. 2. PP is requested to submit the technical specifications of project activity including LFG facility & gas engines etc. Kindly submit. 3. Weblinks provided under various sections of PDD found not working. Corrective action requested. 4. PP is requested to submit the EIA positive decision in the 'e-CED system'. Kindly submit. 5. PP request to submit net metering agreements, O&M agreements, Project ownership documents & lifetime evidence of the complete project activity to the assessment team. Kindly Submit. Corrective action sought				
Project participant response				Date: 18-August-2023
1. Commissioning certificates have now been submitted to the assessment team. 2. Technical documents have now been submitted to the assessment team. 3. All weblinks have now been rectified and updated. 4. The assessment of the "Avcıkoru Landfill Gas to Electricity Project" regarding the EIA Regulation is carried out executed by the Ministry of Environment, Urbanization and Climate Change (Ministry) and "EIA Exemption Decision" dated 22-January-2021 is issued by the Ministry. This decision shows that the project meets all necessary regulatory requirements and "EIA Exemption Decision" submitted as evidence document. 5. Requested agreements, ownership documents, lifetime evidence and other evidences have now been submitted to the assessment team. Operation and maintenance activities have been carried out by the internal technical team of the company regularly.				
Documentation provided by project participant				

<i>Commissioning certificates</i> <i>Joint PD-MR</i> <i>Technical single line diagram</i> <i>Technical description of gas engines</i> <i>EIA exemption decision</i> <i>Generation licence</i> <i>Connection agreement</i> <i>System usage agreement</i> <i>Gas engines supply agreement</i> <i>Jenbacher gas engines lifetime 3rd party report</i>	
VVB assessment	Date: 22-August-2023
1. PP has provided the commissioning certificates of 11 gas engines installed in 3 stages and found inline with VCS template guideline. 2. Verification team observed that PP has submitted the technical specification of LFG facility and gas engines such as SLD, Lifetime etc. as per requirement of verification team and same mentioned in section 1.11 of revised PDMR found inline with VCS template guideline 3. PP has submitted revised PDMR. During verification team observed that weblinks provided by PP in revised PDMR are working. 4. Verification team observed that PP has submitted the EIA positive decisions dated on 25-January-2021 and same is mentioned in section 2.3. It found inline with PDMR template guideline. 5. PP has submitted the net metering agreement dated on 10-December-2021, Project ownership document and Lifetime and O and M certificate as evidence.	
All above comments are closed. Thus CAR#02 is closed.	

CAR ID	03	Section no.	3.3.2	Date: 16-March-2023
Description of CAR				
PP is requested to submit records of Local stakeholder consultation carried out including grievance mechanism/ongoing stakeholders' consultation & supporting documents. Corrective action sought.				
Project participant response				Date: 18-August-2023
Documents regarding the local stakeholder consultation have been submitted to the assessment team.				
Documentation provided by project participant				
LSC records, documents, photographs				
VVB assessment				Date: 22-August-2023
PP has submitted the LSHM invitation letter, Email invitation, Photos during meeting and Attendance sheet to the verification team as per requirement by verification team. It is found inline with VCS standard 4.4. Hence, CAR #3 is closed.				

CAR ID	04	Section no.	3.4.5	Date: 16-March-2023
Description of CAR				
PP requested to submit supporting documents for the justification of the additionality of the project activity. Further, investment analysis found not inline with the applicable/latest version of Methodological tool "Investment analysis, Version 12.0".				
Moreover, Benchmark (Equity IRR) value is found very high for the project activity. Corrective action sought.				
Project participant response				Date: 18-August-2023

- Supporting documents have been provided. - The version of the investment analysis has been updated and section is inline with this latest version. - The benchmark value is taken from the report of the World Bank that was specifically prepared for the plants in Türkiye. It has been extensively used in the Turkish carbon finance projects, in various voluntary carbon market standards. In Table 3.3 on page 40, of World Bank Turkey report (which is submitted as evidence document), the benchmark for biomass and for LFG is stated as 20%. Therefore, the benchmark is applicable to the project.	
Documentation provided by project participant	
Joint PD-MR IRR Sheet Feasibility Study World Bank Turkey Report	
VVB assessment	Date: 22-August-2023
PP has provided the IRR sheet, Income statement and financial feasibility statement. and the World Bank Turkey Report as supporting document. During verification, the VVB team observed that, the World Bank report was specifically prepared for the plants in Turkey, mentioned in Table 3.3 on page 40 of report, the benchmark for biomass and for LFG is stated as 20%. Therefore, the benchmark is applicable to the project. Hence, CAR #4 is closed.	

CAR ID	05	Section no.	3.4.4	Date: 16-March-2023
Description of CAR				
The assessment team found that some of the formulas applied in section 4, of the PDD found not inline with the applied methodology and tools applied. Corrective action sought.				
Project participant response				Date: 18-August-2023
Section 4 has been updated in line with the latest versions of the applied methodologies/tools.				
Documentation provided by project participant				
Joint PD-MR				
VVB assessment				Date: 22-August-2023
Verification team observed that PP has submitted revised PDMR with updated version 4.2. according to latest version of template in section 5, PP have used all the relevant formulas as per the applied methodology and tool and found inline. Hence, CAR #5 is closed.				

CAR ID	06	Section no.	3.2	Date: 16-March-2023
Description of CAR				
PP request to submit no double counting certificate for the project activity.				
Project participant response				Date: 18-August-2023
Double counting certificate has been submitted.				
Documentation provided by project participant				
No double counting certificate				
VVB assessment				Date: 22-August-2023
PP has submitted the no double counting letter, dated on 11- November- 2022, as per requirement of verification team. Also, same details are mentioned in revised PDMR in section 1.16.2 which is inline with the PDMR guidelines. Hence, CAR #6 is closed.				

CAR ID	07	Section no.	4.2	Date: 16-March-2023
Description of CAR				

Joint VCS PD & MR found missing complete information of metering equipment like serial number, make, accuracy class, calibration date and validity of calibration and calibration frequency in Monitoring report. Further, to verify, calibration dates supporting documents of electricity meters for current monitoring period under this verification found missing. Corrective action sought.	
Project participant response	Date: 18-August-2023
Joint PD-MR is updated with the information regarding the equipment and calibration details. Supportive documents have been submitted to the assessment team.	
Documentation provided by project participant	
Joint PD-MR Electricity meters inspection and sealing report Main and back up meter calibration report	
VVB assessment	Date: 22-August-2023
Verification team observed that PP has submitted the Meter calibration certificate and revised PD-MR. PP has mentioned the details about the meter calibration in section 6.1 dated on 19- Feb – 2023 and same details verified with calibration certificate. Both documents are found inline with the VCS template guideline. Hence, CAR #7 is closed.	

CAR ID	08	Section no.	4.1	Date: 16-March-2023
Description of CAR				
1. PP has submitted the Emission Reduction sheet, however to verify same EPIAS & TEIAS records of project activity to verify net electricity generated by the project activity during this monitoring period found missing. Thus, Corrective action sought for the same. 2. PP request to submit Breakdown details in monitoring report and verify the same PP requested to provide breakdown log sheet, kindly submit.				
Project participant response				Date: 18-August-2023
1. EPIAS and TEIAS records submitted. 2. Breakdown details with respective log sheets have been submitted for the current monitoring period and stated in the Joint PD-MR.				
Documentation provided by project participant				
Joint PD-MR EPIAS screenshots TEIAS records Log sheets				
VVB assessment				Date: 22-August-2023
1. PP has submitted the ER sheet, EPIAS and TEIAS reports as supporting document to verification team to verify net electricity generated by the project activity during this monitoring period. 2. PP has submitted the Log sheet as supporting document to verification team. During verification, team observed that same data is mention in section 7.1 of PD-MR and found inline with VCS template guidelines Hence CAR #8 is closed.				

FAR ID	01	Section no.	3.1	Date: 16-March-2023
Description of CAR				

The project activity gas engines are to be installed in a phased manner. This, PP has provided the details of the 11 engines installed till date i.e capacity, number, and commissioning dates etc. Remaining 16 gas engines yet to be installed. Thus, verifying VVB to check the project implementation of the project activity gas engines inline with project description.

Project participant response

Date: DD-Month-YYYY

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Documentation provided by project participant

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VVB assessment

Date: DD-Month-YYYY

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APPENDIX 3: COMPETENCE OF TEAM MEMBERS AND TECHNICAL REVIEWERS

Verification team member

No.	Role	Type of resource	Last name	First name	Affiliation (e.g. name of central or other office of VVB or outsourced entity)	Involvement in			
						Desk review	On-site inspection	Interview(s)	Verification findings
1.	Lead Auditor/Technical Expert	OR	Takarkhede	Dr. Atul	TQC-Outsourced entity	Yes	Yes	Yes	Yes

Technical reviewer and approver of the verification and certification report

No.	Role	Type of resource	Last name	First name	Affiliation (e.g. name of central or other office of VVB or outsourced entity)
1.	Technical reviewer (TR) / Technical Expert (TE)	EI	Xue	Denny	Applus+ Certification
2.	Approver	IR	Calle de Miguel	Agustin	Applus+ Certification

Short CVs of the Team:

- Dr. 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. Atul Takarkhede is based in Nagpur, India Dr. Atul Takarkhede may participate as part of the Audit Team as the Lead Auditor and Technical Expert for the assessment.
- 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.

APPENDIX 4: ABBREVIATIONS

Abbreviations	Full texts
BM	Build Margin
CAR	Corrective Action Request
CDM	Clean Development Mechanism
CER	Certified Emission Reduction(s)
CEA	Central Electricity Authority
CL	Clarification request
CM	Combined Margin
CMS	Central Monitoring system
CO ₂	Carbon dioxide
CO ₂ e	Carbon dioxide equivalent
DNA	Designated National Authority
VVB	Validation and Verification body
DR	Document Review
EF	Emission Factor
EIA	Environmental Impact Assessment
ER	Emission Reductions
FAR	Forward Action Request
GHG	Greenhouse gas(es)
GWP	Global Warming potential
PP	Project Participant
VCUs	Verified Carbon Unit
SWDS	Solid waste Disposal Site
LFG	Land Fill gas