



**Verified Carbon
Standard**

AVCIKORU LANDFILL GAS TO ELECTRICITY PROJECT

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1 PROJECT DETAILS

1.1 Summary Description of the Project

To develop a municipal solid waste management system that will be environmentally friendly and sustainable, Avcıkoru Landfill Gas to Electricity Project is being implemented by Körfez Enerji Sanayi ve Ticaret Anonim Şirketi.

Summary description of the technologies/ measures implemented by the project: Electricity production will be done by burning the landfill gas in gas engines. 400 V electrical energy will be obtained from the ends of the generator coupled to gas engines. 400 V will be increased to 34.5 kV medium voltage level in transformers and given to the interconnected system. The project activity is a Landfill Gas (LFG) Power Generating Plant with an approved capacity of 38.205 MWe¹ with 27 gas engines (each with a capacity of 1.415 Mwe). The project started its electricity production activity on 18-June-2021, which is regarded as project start date. Within the crediting period of 18-June-2021 and 17-June-2028, LFG will be extracted, and electrical energy will be obtained. It has been determined that an average of 7,362 tonnes/day of waste will be stored in landfill, and approximately 411,545,642 m³ of LFG will be generated in 7 years.

Explanation on how the project is expected to generate GHG emission reductions: Generation of electricity using captured LFG and supply of it to national grid, will avoid electricity generation in fossil fuel-based power plant, and avoidance of equivalent emission. Project also reduces greenhouse gas (GHG) emissions by preventing GHG emissions, methane in particular, from being emitted directly to atmosphere from waste at the SWDS that would be otherwise left to be decomposed. Before the project, solid waste has been dumped into landfill since 1995, unattended with uncontrolled liberation of methane into the atmosphere.

A brief description of the scenario existing prior to the implementation of the project: The baseline scenario for the project is disposal of municipal solid waste and its decay at landfill site, resulting in atmospheric release of methane (landfill gas). The baseline scenario for renewable based (LFG) power generation and supplying of electricity to the grid is generation of equivalent quantum of electricity in exiting and upcoming grid connected power plant and its supply to grid.

Location of the project: The project is built within the premises of İSTAÇ Kömürcüoda Landfill Facility in the Şile province of Istanbul city. The Landfill Site is located on a total area of 384,617 m², of which 374,617 m² is a landfill area and 9,860 m² of electricity generation plant area.

Estimate of annual average and total GHG emission reductions and removals: The expected average annual emission reductions are 812,501 tCO₂e/y. The project is expected to generate 6,942,599 tCO₂e emissions reduction throughout its first 7 years crediting period. Actual

¹ Generation licence also includes 2 units of ORC turbine (each with 2.8 Mwe). As waste heat recovery are not covered within the scope of VCS, they are not included in this PD-MR and no emission reduction regarding them will be claimed.

emission reductions achieved during the first monitoring period (from 18-June-2021 to 31-October-2022) are 631,603 tCO_{2e}.

Audit Type	Period	Program	VVB Name	Number of years
Validation	18-June 2021 -- 17-June-2028	VCS	LGAI Technological Center S.A. (Applus+ Certification)	7 years (First Crediting Period)
Verification	18-June 2021 -- 31-October-2022	VCS	LGAI Technological Center S.A. (Applus+ Certification)	1 years and 136 days (First Monitoring Period)
Total	18-June 2021 -- 17-June-2028	VCS	LGAI Technological Center S.A. (Applus+ Certification)	7 years (First Crediting Period)

1.2 Sectoral Scope and Project Type

The project implements firstly Landfill methane recovery. The project falls into sectoral scope 01: Energy industries (renewable - / non-renewable sources) (Type I Component), sectoral scope 13: Waste handling and disposal (Type III Component)

The project is not a grouped project.

1.3 Project Eligibility

The project consists of power generation, utilizing landfill gas (LFG) for electricity generation, which is eligible under the scope of the Version 4.5 of VCS Standard². Additionally, the project is supported by methodology approved under CDM program. Therefore, the project is eligible under scope of VCS program.

1.4 Project Design

The project has been designed to include a single location or installation only and the project is not a grouped project.

Eligibility Criteria

The project is not a grouped project and hence not applicable.

² <https://verra.org/wp-content/uploads/2023/08/VCS-Standard-v4.5.pdf>

1.5 Project Proponent

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

1.6 Other Entities Involved in the Project

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

1.7 Ownership

The project ownership is with Körfez Enerji Sanayi ve Ticaret Anonim Şirketi.

The ownership of the project is demonstrated through (a) Approval issued by the Ministry of Environment, Urbanization and Climate Change of Turkey that the project does not require of Environmental Impact Assessment (EIA Exemption Certificate) in the name of the project proponent, and the (b) Electricity Generation License (EGL) issued by the Energy Market Regulatory Authority (EMRA) of Turkey.

The above document issued in the name of the project proponent established the project ownership of Avcıkoru Landfill Gas to Electricity Power Plant Project to Körfez Enerji Sanayi ve Ticaret Anonim Şirketi. These official documents are accordingly establishing the property and contractual right both in the plant and equipment that generate GHG emission reductions.

1.8 Project Start Date

The project start date is 18-June-2021. (The date of electricity generation of commissioning is referred to as the start date)³.

1.9 Project Crediting Period

This project adopts a renewable crediting period of seven years which can be renewed for maximum 2 times. Being renewable crediting period, total crediting period of the project activity is 21 years.

The first and current crediting period starts at 18-June-2021 and ends at 17-June-2028.

1.10 Project Scale and Estimated GHG Emission Reductions or Removals

Project Scale	
Project	
Large project	√

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 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

³ Please refer to the commissioning certificate document

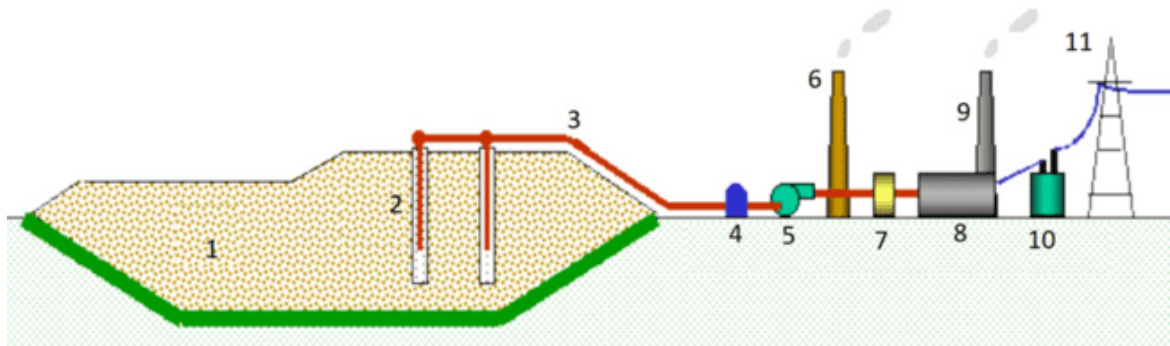
Average annual ERs

812,501

1.11 Description of the Project Activity

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 H_2S , CO_2 and CH_4 (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.

Capacity, number, and commissioning date information of the total installed 25 gas engines have been provided in the table below. Technical lifetime of the gas engines is 30 years. Remaining 2 gas engines have not installed yet and planned to be commissioned in July 2024.

During the monitoring period of 18-June-2021 to 31-October-2022, 11 gas engines were commissioned ($11 * 1.415 \text{ MWe} = 15.565 \text{ MWe}$).

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-February-2024	1.451 MWm / 1.415 MWe	1
Not commissioned yet Planned: July 2024	1.451 MWm / 1.415 MWe	2
TOTAL	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)

All 25 commissioned gas engines and to be commissioned, 2 gas engines are/will be GE Jenbacher J 420 GS and their technical specifications are given below:

Manufacturer		GE Jenbacher
Engine type		J 420 GS-B121
Working principle		4-Stroke
Configuration		V 70°
No. of cylinders		20
Bore	mm	145
Stroke	mm	185
Piston displacement	lit	61.10
Nominal speed	rpm	1,500
Mean piston speed	m/s	9.25
Length	mm	3,750
Width	mm	1,580
Height	mm	2,033
Weight dry	kg	7,200
Weight filled	kg	7,900
Moment of inertia	kgm ²	11.64
Direction of rotation (from flywheel view)		left
Radio interference level to VDE 0875		N
Starter motor output	kW	13
Starter motor voltage	V	24

Within the project activity, there is an enclosed flare system installed to flare any excess of LFG which included in the project boundary.

Flare Unit:

Brand: Haase

Capacity: 2500 m³/h

1.12 Project Location

The project was implemented over an area of roughly 9,860 m² within Kömürcüoda Solid Waste Landfill Facility in Şile district of İstanbul city. The facility is located approximately 4 km north-east of Avcıkoru Village and south-west of Karakiraz Village, which are the closest settlements to the facility. The GPS coordinates of the project location are given below.,

Table 1. Avcıkoru Landfill Gas to Electricity Power Plant Area Corner Coordinates

Points ⁴	Latitude	Longitude
1	41°08'45.8487"N	29°22'38.8630"E
24	41°08'46.1597"N	29°22'39.8780"E

Please see below the maps showing the location of the project activity in Turkey and the locations of the project area:



Figure 1. Location of Avcıkoru Landfill Gas to Electricity Power Plant, İstanbul

⁴ Avcıkoru Landfill Gas to Electricity Power Plant Project Generation License – 15-April-2021 presents 24 corner coordinates of the plant area, first and final coordinates are given in the Table 1.

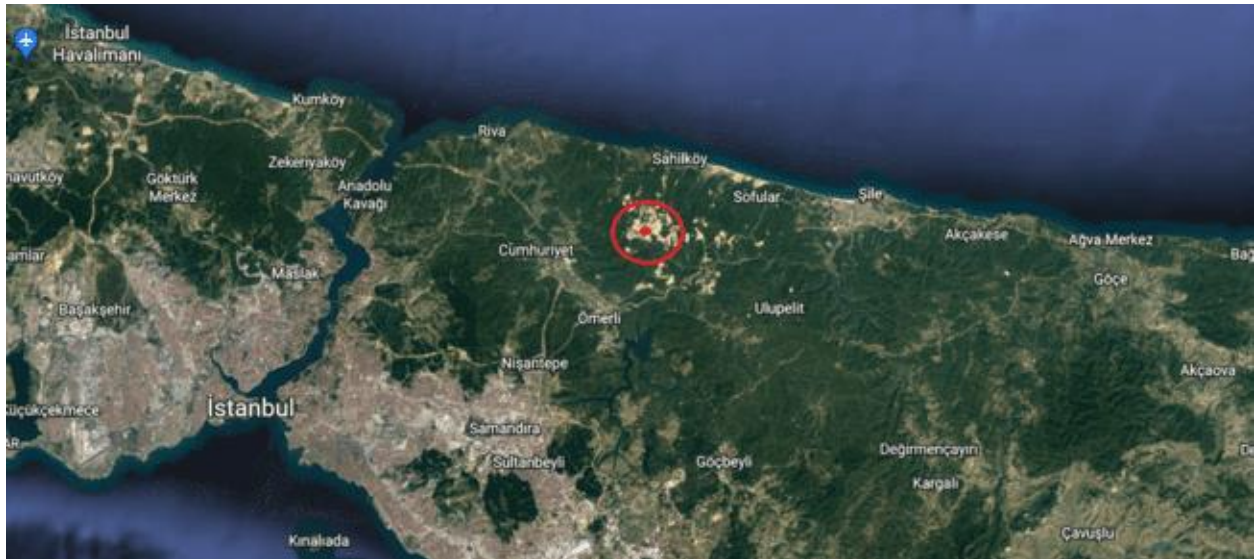


Figure 2. Location of Avcikoru Landfill Gas to Electricity Power Plant, İstanbul



Figure 3. Location of Avcikoru Landfill Gas to Electricity Power Plant, İstanbul

1.13 Conditions Prior to Project Initiation

Before the project activity, solid waste has been dumped into landfill since 1995, unattended with uncontrolled liberation of methane into the atmosphere. In addition, the quantity of electricity produced using LFG would have been produced by power plants connected to the national grid in Turkey which is heavily dependent on fossil fuel resources.

The baseline scenario is the same as the scenario existing prior to the start of the implementation of the project activity. Please refer to Section 3.4 (Baseline Scenario) for details.

1.14 Compliance with Laws, Statutes and Other Regulatory Frameworks

Related laws and regulations to the project activity are as follows and the project meets all necessary regulatory requirements with these related laws and regulations:

- Electricity Market Law⁵ [Law Number: 6446 Ratification Date: 14-March-2013 Enactment Date: 30-March-2013]: The purpose of this Law is to ensure the development of financially sound and transparent electricity market operating in a competitive environment under provisions of civil law and the delivery of sufficient, good quality, low cost, and environment-friendly electricity to consumers and to ensure the autonomous regulation and supervision of this market. Among others, the scope of the law also covers generation of electricity. As one of the important aspects of the proposed project activity is electricity generation, the Electricity Market Law is one of the regulating legislations regarding the project activity.
- Law on Utilization of Renewable Energy Resources for the Purpose of Generating Electricity Energy⁶ [Law Number: 5346 Ratification Date: 10-May-2005 Enactment Date: 18-May-2005] : The purpose of this Law is to expand the utilization of renewable energy resources for generating electrical energy, to benefit from these resources in secure, economic and qualified manner, to increase the diversification of energy resources, to reduce greenhouse gas emissions, to assess waste products, to protect the environment and to develop the related manufacturing sector for realizing these objectives. At the time of the investment decision, the law guaranteed a tariff range of 5 – 5.5 €cent/kWh for 10 years. On 29-December-2010 the Law has been revised and the guaranteed tariff has been amended as 13.3 \$cent/kWh for electricity production based on biogas. As one of the important aspects of the proposed project activity is electricity generation from renewable energy sources the “Renewable Energy Law” is one of the regulating legislations regarding the project activity.
- Environmental Law⁷ [Law Number: 2872 Ratification Date: 09-August-1983 Enactment Date: 11-August-1983] : This law outlines Turkey’s environmental policy in general terms. It aims to protect the environment and Turkey’s natural resources for the benefit of future generations. It includes the polluter pays principle. Regulations have been issued on air quality protection, water pollution control, environmental impact assessment, waste control, noise control, and the control of hazardous materials. Environmental Law is one

⁵ <https://www.mevzuat.gov.tr/mevzuat?MevzuatNo=6446&MevzuatTur=1&MevzuatTertip=5>

⁶ <https://www.mevzuat.gov.tr/mevzuat?MevzuatNo=5346&MevzuatTur=1&MevzuatTertip=5>

⁷ <https://www.mevzuat.gov.tr/mevzuat?MevzuatNo=2872&MevzuatTur=1&MevzuatTertip=5>

of the main legislations regarding project activity as it relates to waste management activities. The following two sub regulations of this law are specifically related to the Project Activity:

- Regulation on Waste Management⁸ [Last updated on 23-March-2017]: Summarizing, the regulation ensures the management of waste from generation to disposal without harming the environment and human health. Regulation also aims to reduce the use of natural resources and ensuring waste management through ways such as reducing waste generation, reuse, recycling and recovery of waste. It is stated in this regulation that provisions of Regulation on Landfill of Waste are applied in the disposal of wastes with the landfill method.
- Regulation on the Landfill of Waste⁹ [Last updated on 24-June-2022] : Regulation aims to (a) minimize the negative impact of leachate and LFG on soil, air and water quality; (b) make appropriate technical designs and construction of sanitary storage facilities according to the type of waste; (c) regulate waste acceptance to the landfill area; (d) prevent the negative effects that may pose a risk to the environment and human health during the operation, shutdown and post-closure maintenance processes, and (e) provide procedures for rehabilitation, shutdown and post-closure maintenance of landfill areas/facilities.

1.15 Participation under Other GHG Programs

1.15.1 Projects Registered (or seeking registration) under Other GHG Program(s)

Project has not been registered, nor is seeking registration under any other GHG programs.

1.15.2 Projects Rejected by Other GHG Programs

The project has not been rejected by any other GHG programs.

1.16 Other Forms of Credit

1.16.1 Emissions Trading Programs and Other Binding Limits

The project does not reduce GHG emissions from activities that are included in an emissions trading program or any other mechanism that includes GHG allowance trading.

1.16.2 Other Forms of Environmental Credit

⁸ <https://www.mevzuat.gov.tr/mevzuat?MevzuatNo=20644&MevzuatTur=7&MevzuatTertip=5>

⁹ <https://www.mevzuat.gov.tr/mevzuat?MevzuatNo=13887&MevzuatTur=7&MevzuatTertip=5>

The project has not sought or received another form of GHG-related credit or renewable energy certificates. Please see Appendix 2 for the respective no double counting certificate.

1.16.3 Supply Chain (Scope 3) Emissions

Scope 3 emissions related to the project are considered negligible and it has been addressed in a way that there is no potential of double claiming.¹⁰

1.17 Sustainable Development Contributions

1.17.1 Sustainable Development Contributions Activity Description

The Project will contribute to sustainable development in the following ways:

- Increasing labour demand of skilled labour for the fabrication, installation, operation and maintenance of the methane recovery and electricity generation system and thus, contributing to the sustainable economic growth of the region,
- Generating and dispatching electricity from a renewable and sustainable energy source to a grid nowadays reliant on fossil,
- 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
- Improving air quality (i.e., by reducing odour) and therefore having positive effects on the local environment.

Nevertheless, it is still possible to note that the project will make positive contributions to at least three Sustainable Development Goals (SDGs). These are SDG 7-Affordable and Clean Energy, SDG 8-Decent Work and Economic Growth and SDG13-Climate Action. Contributions to these SDGs are summarized below:

SDG 7: Affordable and Clean Energy

The proposed Project is a waste to power project that will generate renewable energy by capturing methane from municipal waste and utilizing it to produce thermal and 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.

SDG 8: Decent Work and Economic Growth

¹⁰ The declaration regarding the same has now been submitted to the assessment team.

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

The proposed project activity will reduce 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.

1.17.2 Sustainable Development Contributions Activity Monitoring

It is defined in Section 1.17.1 and summarized in the Table 2.

Table 2: Sustainable Development Contributions

Row number	SDG Target	SDG Indicator	Net Impact on SDG Indicator	Current Project Contributions	Contributions Over Project Lifetime
1)	7.2	7.2.1 Renewable energy share in the total final energy consumption	The project being a renewable based power generation unit feeding power to the grid enhances the renewable energy share in the final energy consumption	Supply of 127,232 MWh of renewable electricity to the grid during this monitoring period.	Annual average of 289,714 MWh of electricity from landfill gas, which is a renewable fuel source will be supplied annually to the power grid during the first 7 years crediting period. In total, total contribution over project lifetime will be 2,027,995 MWh.
2)	8.5	8.5.2 Unemployment rate, by sex, age and persons with disabilities	The project activity results in temporary and permanent employment opportunity during the construction and operation phase	Created employment opportunities for 27 persons during current monitoring period.	The project will create at least 6 long term jobs over project lifetime. Created employment will be monitored via Social Security Institution documents.
3)	13.0	13.2.2 Tonnes of greenhouse gas emissions avoided or removed	Implemented activities avoided atmospheric release of methane through its capture and utilization for power generation. The generated electricity using renewable energy resources avoids greenhouse gas emission by refraining generation of electricity in fossil fuel-based power plant connected to the grid	Avoidance of 876,543 tCO ₂ e during the monitoring period.	The project is expected to generate 5,687,509 tCO ₂ e emissions reduction throughout its first 7-years crediting period. Annual average of emissions reductions over the crediting period is 812,501 tCO ₂ e.

1.18 Additional Information Relevant to the Project

Leakage Management

According to the methodology, no leakage effects are accounted for under the ACM0001 Version 19., Section 5.6.

Commercially Sensitive Information

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

Further Information

Not applicable.

2 SAFEGUARDS

2.1 No Net Harm

As mentioned in section 1.14 Compliance with Laws, Statutes and Other Regulatory Frameworks the project meets all necessary regulatory requirements such as socialization of the project, solid waste, water pollution, noise control and air quality protection, it is therefore possible to claim that there is no net harm linked to the project by supporting reports.

Water Quality

The amount of wastewater which is produced by the project is very small. Wastewater is originated from leachate at the landfill. To prevent this pollution hazard, first, base isolation was made in the existing SWDS and leakage from the SWDS to the soil and mixing with groundwater was prevented. Secondly, with the leachate drainage system installed at each stage, the leachate is collected and pumped back to the lot area at certain periods, allowing for some of it is evaporate and increasing the gas yield.

Air Quality

This project uses LFG which is collected from Avcıkoru Landfill site to generate electricity, and it avoids uncontrolled releasing of LFG. Therefore, it reduces greenhouse gas and effluvium emitting to air, and mitigates the possible danger of fire or explosion. The emission of NO_x, SO₂ and NH₃ for this project is less than the emission standards, that is because prior to electricity generation, LFG has been pre-treated to remove its impurities and moisture. After that, LFG is sent to gas-fired engines. And the exhaust gas would be emitted to atmosphere which is far away from sensitive targets. Therefore, the emission of exhaust gas has little impact on surrounding environment.

Soil Condition

This project does not produce any chemicals or hazardous waste (NO_x, SO_x, VOC, mercury, or cadmium) thus; it does not pollute the soil condition in quality and quantity. So, Avcıkoru Landfill Gas to Electricity Power Plant Project does not have negative impact on soil condition compared to the baseline.

Noise

The gas engine is housed in the setup with noise attenuation facilities thus ruling out any impact of noise. The nearest settlements to the project are the Avcıkoru Village and Karakiraz Village with 4.2 km distance. The noise of the project has no impact on surrounding residential areas.

Solid Waste

The project includes capture and utilisation of methane emanating from the landfilling operation and does not result in production for solid waste.

Quality of Employment

This project provides local employment during the construction and operational phase. The employees are trained on health and security issues. All the trainings have been provided in accordance with "Regulations of the Ministry of Labor and Social Security". Trainings and certificates also increase their capacity to be able to work in such an environment.

Livelihood of the Poor

This project creates job opportunities especially to young people and gives the opportunity to provide a living to their families without trying to look for a job in bigger cities for the employees. The social security system through a contract is also changing living standards of the local people.

Access to Affordable and Clean Energy Services

Dependency of Turkish electricity generation to imported fuels is projected to remain too high. So, any electricity generation from natural and local sources (waste to energy) decreases Turkey's dependency of imported fuels. Therefore, from local sources decreases Turkey's dependency of imported fuels, helps to attain more sustainable and affordable electricity service.

Balance of Payments and Investment

Natural gas is used domestically mainly in the electric power sector. This project supports to decrease the dependency of fuel import and result in net foreign currency saving and energy security. Thus, this parameter is also positive, but this is not monitored.

Technology Transfer and Technological Self-reliance

This project has positive effect on technology transfer and technological self-reliance indicator. Thus, this parameter is also positive.

2.2 Local Stakeholder Consultation

Invitation has been sent to the stakeholders on 24 August-2022 via, email, notice at public place and personal invitations.

Stakeholder engagement procedure was being conducted at the Avcıkoru Landfill Gas to Electricity Project site on 26-September-2022 with the local stakeholders and head of the Karakiraz Village, Şile, İstanbul.

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.

Few queries raised during local stakeholder consultation are given below with their responses:

- Question 1: Will the project have a negative impact on agricultural areas?
- Answer 1: This project prevents the release of gas into the atmosphere. If this power plant were not established and the landfill site were left as a wild waste dump, there could have been a negative impact on agriculture and plants. With the Avcıkoru LFG project, the landfill site is completely covered, landscaped, and sealed, preventing gas emissions into the atmosphere. We extract this gas through vertical pipes to generate energy. As a result, there is no adverse effect on agricultural areas and crops.
- Question 2: Will you prevent the gas from being released into nature?
- Answer 2: The Ministry of Environment and Urbanization would not allow us to continue operations if there were any such practice. The metropolitan municipality brings the

waste to the site, spreads it systematically, covers it with soil and clay, ensuring no emissions into the atmosphere. Vertical pipes are then installed to draw the gas to the power plant in a closed system, generating energy without emitting gas into the atmosphere. The primary purpose of establishing the facility is to prevent the release of landfill gas into the atmosphere and eliminate its negative impacts.

- Question 3: What are the benefits or drawbacks for our village?
- Answer 3: If the facility were not established, the gas emitted from the waste site would not be treated. This project eliminates the risks of gas buildup and explosions, prevents gas emissions into the atmosphere, and facilitates energy production from the gas. Without the facility, the odor from the wild waste dump could negatively affect the village. Thanks to the facility, the odor problem has been resolved.
- Question 4: Why did you name it Avcıkoru? Why not name it Karakiraz?
- Answer 4: The name of the project was determined by the Istanbul Metropolitan Municipality.

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.

2.3 Environmental Impact

The environmental matters in Turkey are the jurisdiction of the Ministry of Environment, Urbanization and Climate Change (The Ministry). The Environmental Impact Assessment (EIA)

Regulation¹¹, which is prepared on the basis of Environmental Law¹² and executed by the Ministry, defines the general requirements of the EIA and states specific requirements according to the type of project, location, size, and other characteristics.

The assessment of the "Avcıkoru 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.

This decision shows that the project meets all necessary regulatory requirements such as socialization of the project, solid waste, water pollution, noise control and air quality protection. 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.

2.4 Public Comments

After project listing, the VCS/Verra project Avcıkoru Landfill Gas to Electricity Project¹³ has been open for 30 days of public consultation. Public consultation period was between 29-December 2022 and 28-January-2023. During the period, no comments have been raised.

2.5 AFOLU-Specific Safeguards

This project is a non-AFOLU project, therefore this section is not required.

3 APPLICATION OF METHODOLOGY

3.1 Title and Reference of Methodology

Approved consolidated baseline methodology is ACM0001: Flaring or use of landfill gas Version 19.0¹⁴ and the tools used are given below:

¹¹ <https://www.mevzuat.gov.tr/mevzuat?MevzuatNo=39647&MevzuatTur=7&MevzuatTertip=5>

¹² <https://www.mevzuat.gov.tr/mevzuat?MevzuatNo=2872&MevzuatTur=1&MevzuatTertip=5>

¹³ <https://registry.verra.org/app/projectDetail/VCS/3997>

¹⁴ <https://cdm.unfccc.int/methodologies/DB/IPYB4DYQUXQPZLBDVPHA87479EMY9M>

- “Tool for the demonstration and assessment of additionality” TOOL01 Version 07.0.0¹⁵
- “Emissions from solid waste disposal sites” TOOL04 Version 08.1¹⁶
- “Tool to calculate the emission factor for an electricity system” TOOL07 Version 07.0¹⁷
- “Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation” TOOL05 Version 03.0¹⁸
- “Assessment of the validity of the original/current baseline and update of the baseline at the renewal of the crediting period” Methodological Tool, Version 03.0.1¹⁹
- “Tool to determine the mass flow of a greenhouse gas in a gaseous stream” TOOL08 version 03.0²⁰

3.2 Applicability of Methodology

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
Para 3	The methodology is applicable under the following conditions: Install a new LFG capture system in an existing or new (Greenfield) SWDS where no LFG capture	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

¹⁵ <https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-01-v7.0.0.pdf>

¹⁶ <https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-04-v8.1.pdf>

¹⁷ <https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-07-v7.0.pdf>

¹⁸ <https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-05-v3.0.pdf>

¹⁹ <https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-11-v3.0.1.pdf>

²⁰ <https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-08-v3.0.pdf>

	system was or would have been installed prior to the implementation of the project activity; or Make an investment into an existing LFG capture system to increase the recovery rate or change the use of the captured LFG, provided that: The captured LFG was vented or flared and not used prior to the implementation of the project activity; and 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.	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 methodology condition 3.c is applicable to the project activity: (i) As project is generating electricity using captured LFG, it is applicable. (ii) Not applicable. (iii) Not applicable. (iv) Not applicable. (v) Not applicable 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.
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 odor concerns, or for other reasons; and	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

	(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. (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.	project activity is atmospheric release of the LFG and hence complies to the applicability condition of the methodology.
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.

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 07.0.0:

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 included in the project boundary. 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
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 VCS PD-MR. The emissions will be monitored during the crediting period using the applicable approaches in the relevant methodologies (ACM0001 in this case).
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 maybe 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
A	If emissions are calculated for electricity consumption, the tool is only applicable if one out of the following three scenarios applies to the 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	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 consumption (Scenario A).

	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 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.
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 accounts for CO₂ emissions.	No captive renewable power generation technologies are installed to provide electricity in the project activity, in the baseline scenario or to sources of leakage.

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 to determine the mass flow of a greenhouse gas in a gaseous stream” TOOL08 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” TOOL08 version 03.0.0 is applicable for the proposed project activity.

3.3 Project Boundary

In line with the requirements of ACM0001 Flaring or use of landfill gas Version 19.0, the project boundary of the project activity include, as applicable:

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

The geographic and system boundaries for the relevant electricity grid can be clearly identified and information on the characteristics of the grid is available as required by the “Tool to calculate the emission factor for an electricity system” TOOL07 (version 07.0). The electricity produced on-site will be delivered to the Turkish national grid.

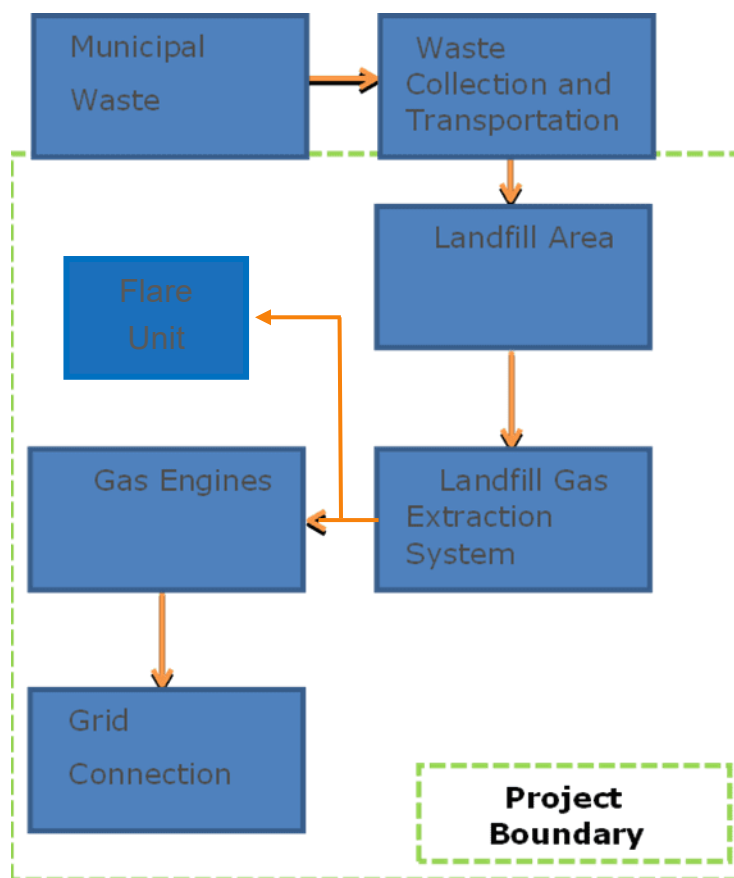
The gases and sources relevant to the proposed VER project are listed in the below table.

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

Source		Gas	Included?	Justification/Explanation
Project	Emissions from the use of natural gas	CO ₂	No	Not applicable. There is no supply of LFG through a natural gas distribution network, dedicated pipeline or using trucks is included in the project activity
		CH ₄	No	
		N ₂ O	No	
	Emissions from fossil fuel consumption for purposes other than electricity generation or transportation due to the project activity	CO ₂	No	Excluded since no fossil fuel is used by the project activity.
		CH ₄	No	Excluded since no fossil fuel is used by the project activity.
		N ₂ O	No	Excluded since no fossil fuel is used by the project activity.
	Emissions from electricity consumption due to the project activity	CO ₂	Yes	This is an important source of emissions in the project activity
		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	Source of emission (The emission due to flaring will be considered in case there is cases of flaring)
		N ₂ O	No	Emissions are considered negligible
	Emissions from distribution of LFG using trucks and dedicated pipelines	CO ₂	No	No distribution of LFG using trucks and dedicated pipelines, therefore associated emission is not applicable.
		CH ₄	No	No distribution of LFG using trucks and dedicated pipelines, therefore associated emission is not applicable.

Source	Gas	Included?	Justification/Explanation
	N ₂ O	No	No distribution of LFG using trucks and dedicated pipelines, therefore associated emission is not applicable.

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.



3.4 Baseline Scenario

Procedures for the selection of most plausible baseline scenario

According to ACM0001: Flaring or use of landfill gas - Version 19.0, the baseline scenario is identified using the “Tool for the demonstration and assessment of additionality – TOOL01 Version 07.0.0”.

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

This step is not applied.

Step 1: Identification of alternative scenarios

This step serves to identify all alternative scenarios to the proposed project activity which can be the baseline scenario following the sub-steps:

Step 1a: Define alternative scenarios to the proposed 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.
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:

Based on the above arguments, two alternatives' scenarios could be identified:

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 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 given below and compliance of the project with these mandatory laws and regulations are explained in Section 1.14.

- Electricity Market Law²¹ [Law Number: 6446 Ratification Date: 14-March-2013 Enactment Date: 30-March-2013]
- Law on Utilization of Renewable Energy Resources for the Purpose of Generating Electricity Energy²² [Law Number: 5346 Ratification Date: 10-May-2005 Enactment Date: 18-June-2005]
- Environmental Law²³ [Law Number: 2872 Ratification Date: 09-August-1983 Enactment Date: 11-August-1983]
 - Regulation on Waste Management²⁴ [Last updated on 23-March-2017]
 - Regulation on the Landfill of Waste²⁵ [Last updated on 24-June-2022]

Most 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: Barrier Analysis

Since the “Combined tool to identify the baseline scenario and demonstrate the additionality” Methodological Tool, version 07.0.0 is used to identify the baseline scenario, a barrier analysis has to be conducted to assess which alternative scenarios are prevented by defined barriers. When applying this step “Guidelines for objective demonstration of and assessment of barriers” version 01 has been taken into account.

Sub-step 2a: Identify barriers that would prevent the implementation of alternative scenarios

This step has been explained in detail under section B.5 “Description of how the anthropogenic emissions of GHG by sources are reduced below those that would have occurred in the absence of the registered CDM project activity (assessment and demonstration of additionality)” of this PDD. Only the outcome of this step has been presented in order to identify the baseline scenario.

²¹ <https://www.mevzuat.gov.tr/mevzuat?MevzuatNo=6446&MevzuatTur=1&MevzuatTertip=5>

²² <https://www.mevzuat.gov.tr/mevzuat?MevzuatNo=5346&MevzuatTur=1&MevzuatTertip=5>

²³ <https://www.mevzuat.gov.tr/mevzuat?MevzuatNo=2872&MevzuatTur=1&MevzuatTertip=5>

²⁴ <https://www.mevzuat.gov.tr/mevzuat?MevzuatNo=20644&MevzuatTur=7&MevzuatTertip=5>

²⁵ <https://www.mevzuat.gov.tr/mevzuat?MevzuatNo=13887&MevzuatTur=7&MevzuatTertip=5>

Outcome of Step 2a:

Realistic and credible barriers that would prevent alternative scenarios to occur have been identified under the generic topic “Investment Barriers”.

Sub-step 2b: Eliminate alternative scenarios which are prevented by the identified barriers

This step has been explained in detail under section B.5 “Description of how the anthropogenic emissions of GHG by sources are reduced below those that would have occurred in the absence of the registered CDM project activity (assessment and demonstration of additionality)” of this PDD. Only the outcome of this step has been presented in order to identify the baseline scenario.

Table 2: Assessment of alternative scenarios against the impact of identified barriers

Scenario	Identified Barriers
	Investment Barrier
	One of the major barriers related to project activity is defined as “limited access to finance”.
Scenario 1: Project activity including power generation from LFG without being registered as a VER project activity.	Waste management projects need a high level of financing and limited access to finance represents a real and credible barrier that would prevent the project activity invested without the VER revenues.
Scenario 2: Atmospheric release of the LFG and electricity would have been generated by the existing grid connected power plants as continuation of the situation before the project activity.	Since this scenario is the continuation of the current practice, it does not require any investment and therefore is not affected by the identified barrier.

Outcome of Step 2a:

Based on the above arguments, the following scenarios are not prevented by any identified barriers.

Scenario	Alternatives			Description of situation
	Landfill Gas	Electricity	Heat	
2 (Identified as the baseline scenario)	LFG 2	E 3	N/A	Atmospheric release of the LFG and electricity would have been generated by the existing grid connected power plants as continuation of the situation before the project activity. This scenario also represents the continuation of the situation before the implementation of the proposed project activity.

Outcome of Step 2:

There is only one alternative scenario that is not prevented by any barrier, which is Scenario 2; Atmospheric release of the LFG and electricity would have been generated by the existing grid connected power plants as continuation of the situation before the project activity. In line with

the requirements of “Combined tool to identify the baseline scenario and demonstrate the additionality” TOOL01 version 07.0.0, Scenario 2 has been identified as the baseline scenario.

Since the assessment of the above sub-steps outlines changes of baseline emission factor and IPCC value of GWP the current baseline data parameters relating to baseline grid emission factor and GWP is being modified in accordance to step 2 of the applied tools.

Baseline Emission Factor

Developing the baseline and calculation of the emission reductions for the proposed project activity is calculated according to “Tool to calculate the emission factor of an electricity system” TOOL07 Version 07.0. The baseline is the Landfill Methane Recovery identified through the baseline selection procedure.

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

- Emission factor will remain same over the crediting period,
- 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, TOOL07 version 07.0”. Option 1 has been selected.

Option 1

A delineation of the project electricity system and connected electricity systems published by the DNA or the group of the DNAs of the host country(ies), In case a delineation is provided by a group of DNAs, the same delineation should be used by all the project participants applying the tool in these countries:

The Ministry of Energy and Natural Resources has published the Operating, Build and Combined Margin Emission Factors for Turkish National Grid²⁶. The Ministry has calculated the emission factor by using the “Tool to calculate the emission factor for an electricity system” TOOL07 methodology. Since it was updated in 20-September-2022 by the Ministry, these factors have been used for emission reduction calculation.

Table 3: The National EF published by Ministry of Energy and Natural Resources

Factor Type	Year	Value (tCO ₂ /MWh)
Operational Emission Factor	2020	0.7424
Build Emission Factor	2020	0.3680
Combined Emission Factor (other renewable energy sources)	2020	0.5552

²⁶<https://enerji.gov.tr/evced-cevre-ve-iklim-turkiye-ulusal-elektrik-sebekesi-emisyon-faktoru> and <https://enerji.gov.tr/Media/Dizin/EVCED/tr/%C3%87evreVe%C4%B0klim/%C4%B0klimDe%C4%9Fi%C5%9Fikli%C4%9Fi/TUESEmisyonFktr/Belgeler/Bform2020.pdf> (This links may not be working out of Türkiye, therefore, this form is also integrated into ER sheet.)

3.5 Additionality

The additionality of a Project shall be demonstrated by applying the following approach, consisting of two components: (i) A Legal Requirement Test; and (ii) An Additionality Test either based on a Positive List test or a projects-specific additionality test.

The project is not mandated/enforced by law and is entirely a voluntary activity. Below, additionality of the project has been demonstrated based on “Methodological Tool- Tool for the demonstration and assessment of additionality”, TOOL01 Version 7.0.0.

Specify the methodology or activity requirement or product requirement that establish deemed additionality for the proposed project (including the version number and the specific paragraph, if applicable).	This project applies an approved large-scale methodology ACM0001: Flaring or use of landfill gas Version 19.0.
Describe how the proposed project meets the criteria for deemed additionality.	1. Project without carbon revenue is not financially attractive and is outlined in investment analysis section below (benchmark and sensitivity analysis). 2. Continuation of the current scenario of venting of LFG to the atmosphere and dumping of organic fraction of solid waste to the landfill is permitted by regulatory authority of the host country government. Implementation of the project is additional to the baseline scenario which is an alternative to above and therefore reduces the emissions. 3. Continuation of the baseline scenario as well as the project activity is in compliance to the local laws and regulations. Both the alternatives (baseline scenario and the project activity) are in compliance with host country laws and regulations required. There is not any mandatory requirement to implement the project activity. 4. In accordance with common practice analysis there is no plants similar to the proposed project and built without carbon revenue, the proposed type of project should not be considered as a common practice.

Additionality Assessment for large scale project activity Instances

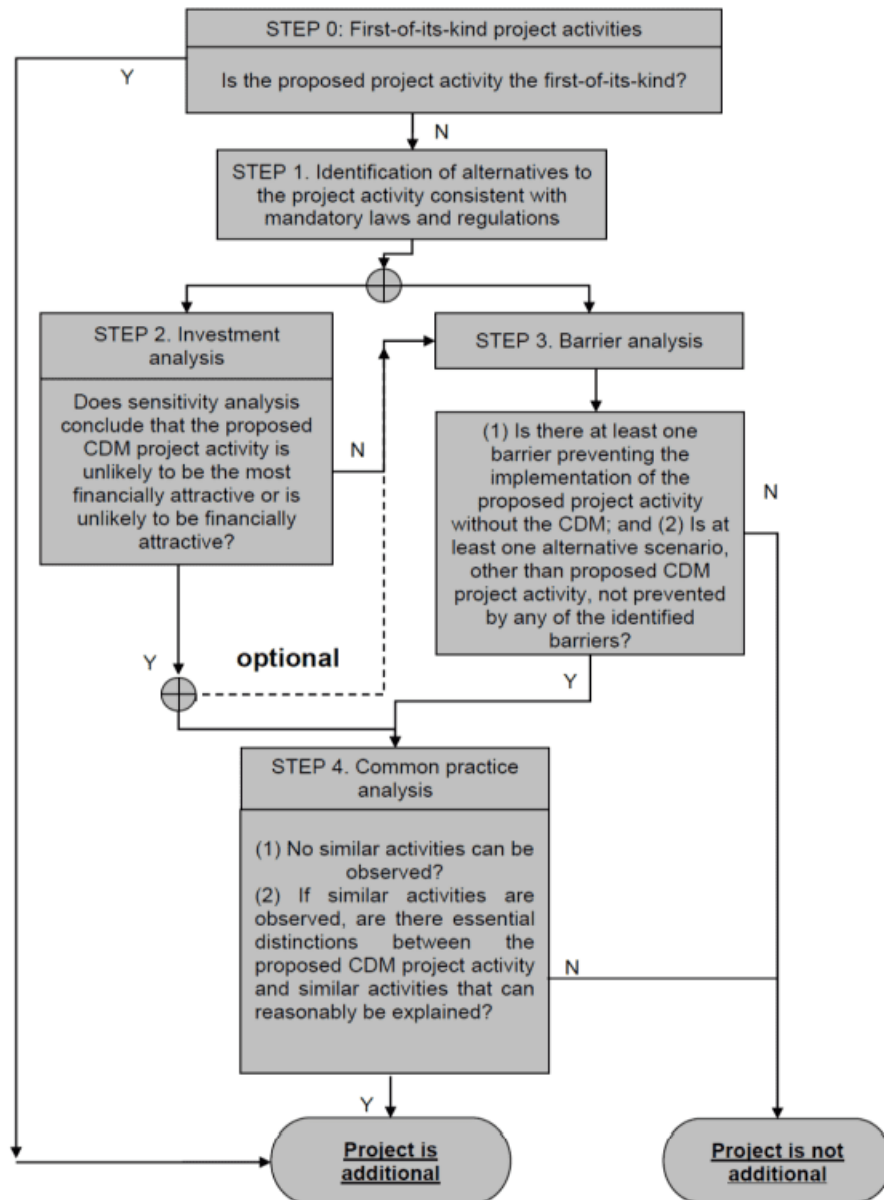
The table below is only applicable if the proposed project activity is a type of project activity which is deemed automatically additional, as defined by the applied approved methodology or standardized baseline.

Specify the methodology or activity requirement or product requirement that establish deemed additionality for the proposed project (including the version number and the specific paragraph, if applicable).	NA
Describe how the proposed project activity meets the criteria for automatic additionality in the relevant methodology or standardized baselines.	NA

The project activity includes capture and utilization of LFG for generation of electricity, for power generation. Although the project technology complies to positive technology list, but the generation capacity is higher than proposed capacity that can be opted under the positive lists.

The methodology requires the project owner to determine the additionality based on “Methodological Tool- Tool for the demonstration and assessment of additionality”, TOOL01 Version 7.0.0. The tool provides a step-wise approach to demonstrate and assess the additionality of a project (figure below). These steps are:

- (a) Step 0 Demonstration whether the proposed project activity is the first-of-its-kind;
- (b) Step 1 Identification of alternatives to the project activity;
- (c) Step 2 Investment analysis;
- (d) Step 3 Barriers analysis;
- (e) Step 4 Common practice analysis.



The stepwise approach to establish additionality of the project activity has been followed, details of which are provided in the following paragraphs:

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.

The alternatives to the project activity are established in the section (B.4) above.,

Outcome of Sub-step 1.a: Identified realistic and credible alternative scenario(s) to the project activity

Sub-step 1b: The alternative(s) shall be in compliance with all mandatory applicable legal and regulatory requirements, even if these laws and regulations have objectives other than GHG reductions, e.g., to mitigate local air pollution.

The alternatives to the project activity as identified above (Section B.4) is in compliance with all mandatory applicable legal and regulatory requirements.

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 12.0)²⁷

Sub-step 2a: Determine appropriate analysis method

The project activity envisages capture and utilisation 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 had been

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

carried out before the decision to undertake the project was taken and management approval was 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:

Project	Date of First Equipment Agreement	Start / Commissioning Date
Avcıkoru Landfill Gas to Electricity Project	23-January-2021	18-June-2021

The data defined by World Bank for similar project types in Türkiye are used for benchmark analysis. It is given as 20% for equity IRR on page 40 of the report generated in May 2017.

Report Link:

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

Page 40, Table 3.3 The post-tax equity IRR of the project is 13.58%, less than the 20% threshold. Therefore, the project is not financially attractive.

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:

- Gas Generation from Biomass:** Both biomass gas and landfill gas projects are fundamentally waste-to-energy processes, where gas is generated from organic material. In landfill gas projects, the gas (primarily methane) is produced from the natural decomposition of biomass, i.e., organic waste in landfills. Similarly, biomass gas projects involve the controlled conversion of organic matter into gas through processes like anaerobic digestion or gasification. Therefore, in both cases, the gas originates from biological sources, justifying the comparison of financial performance.
- Project Type and Financial Dynamics:** From a financial perspective, both landfill and biomass gas projects face similar challenges and opportunities:
 - Capital Expenditure (CapEx):** Both project types require substantial upfront investment in technology, gas capture, and conversion systems.
 - Operating Costs (OpEx):** Ongoing operational costs in both cases involve maintaining the gas collection system, monitoring emissions, and ensuring efficiency in gas conversion.

- c. **Revenue Generation:** Both types of projects generate revenue from the sale of electricity produced by burning the captured gas, as well as potential carbon credits.

These shared economic drivers, in terms of both costs and revenue, contribute to the similarity in financial performance expectations.

3. **Threshold IRR on Equity:** The Threshold IRR on Equity is a key financial metric used to evaluate whether a project is financially viable, considering the return on equity required by investors. Given the analogous nature of gas generation from biomass in both project types, it is reasonable to apply the benchmark IRR for biomass gas to the landfill gas project. The IRR reflects the financial feasibility, taking into account market risks, capital structure, and expected returns, which are largely similar for both biomass and landfill gas projects due to their comparable economic models.
4. **Risk and Return Profile:** Both landfill and biomass gas projects share similar risk factors, such as fluctuations in gas yield, market volatility in electricity prices, and regulatory risks related to environmental policies. Consequently, investors' expected returns (as measured by IRR) for both types of projects align closely, further supporting the use of the same benchmark for financial assessment.

In conclusion, the financial feasibility of applying the Threshold IRR on Equity (%) for Biomass Gas to the landfill gas project is sound due to the similar project structures, economic drivers, and risk-return profiles. The gas in both cases is generated from organic (biomass) sources, making this benchmark an appropriate choice for evaluating the landfill gas project.

Sub-step 2c: Calculation and comparison of financial indicators (only applicable to Options II and III):

The Post tax Equity IRR is evaluated for the entire lifetime of the project activity covered by the generation 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 agreement with the municipality, and the assets will be dismantled. The IRR and Benchmark analysis is calculated in excel spreadsheet²⁸ and is also summarized below.

Particulars	Unit	Value	Reference Document
Tariff rate ²⁹	USD/MWh	133	YEKDEM; The Law on the Use of Renewable Energy Sources for the

²⁸ Sources of the values used is mentioned in the IRR sheet. Depreciation rate (book accounting depreciation) and tax rate are from State Revenue Administration. Depreciation rate can be reached from following link: https://www.gib.gov.tr/sites/default/files/fileadmin/user_upload/Yararli_Bilgiler/amortisman_oranlari.pdf . Tax rate can be reached from following link: <https://www.gib.gov.tr/yararlim-ve-kaynaklar/yararli-bilgiler/gecici-vergi-oranlari>

²⁹ The tariff rate is fixed by the state guarantee.

			Purpose of Electricity Generation ³⁰
Average annual production over 10 years	MWh	267,748	Feasibility Study
Average annual OM over 10 years	\$	22,111,922	Feasibility Study
Project Start Date	-	18-June-2021	Commissioning Certificate
Total Investment	\$	43,000,000	Feasibility Study
Buildings and underground/overland plants	\$	13,000,000	Feasibility Study
Electromechanical Equipment	\$	28,000,000	Feasibility Study
Gas Engine Generator Sets	\$	15,000,000	Feasibility Study
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	Feasibility Study

While the initial electricity generation started on 18 June 2021, it is common for projects like these to undergo phased expansions. The Gas Engine Generator Sets (27 units) with a total investment of 15 million USD and the Step-up Transformers (27 units) with a total cost of 5 million USD, which were purchased in 2020 and 2021 respectively, were likely sufficient to initiate the project and begin energy production from LFG (Landfill Gas). These pieces of equipment allowed the plant to commence operations and generate electricity by increasing the voltage of the electricity produced during generation.

As operations expanded and additional needs for efficiency arose, further investments were made in 2022 and 2023. The Booster-Blower-Chiller Systems (total of 5 million USD in 2022) were installed to enhance the process by adjusting the vacuum of the gas extracted from the site, cooling the gas, and removing its moisture, ensuring more efficient and stable operation. Lastly, in 2023, the MV Cells (35 units, costing a total of 3 million USD) were added to ensure the connection of the units with the medium voltage side, further optimizing the plant's performance and enabling it to handle increased production capacity or improve connectivity and reliability.

This phased approach allowed the project to start operations on time while making necessary equipment upgrades as the project expanded and matured.

³⁰ <https://www.mevzuat.gov.tr/mevzuat?MevzuatNo=5346&MevzuatTur=1&MevzuatTertip=5> under Article 15 of the regulation; please check “ç. Biyokütleyle dayalı üretim tesisi (çöp gazı dâhil)” line, the value is given as 13.3 (USD Dolar cent/kWh)

Expenses on operation & maintenance of the equipment: The electromechanical equipment investments for 2021, 2022, and 2023, as indicated in the previous sections, are capital expenditures meant to enhance the plant's capacity. These investments differ from the maintenance expenses, which are captured under the operational expenses (OPEX) table in the Feasibility Study.

As seen in the Feasibility Study:

- In 2021, maintenance expenses were \$2.128 million, while the total operational expenses were \$3.499 million.
- In 2022, maintenance expenses increased to \$2.447 million, with total operational expenses of \$12.385 million.
- In 2023, maintenance expenses reached \$2.814 million, contributing to total operational expenses of \$21.082 million.

The investments made in electromechanical equipment during these years are separate from these regular maintenance costs. The capital investments in equipment (e.g., booster-blower-chiller systems and MV cells) are to ensure long-term efficiency and operational enhancements, whereas the maintenance expenses refer to the ongoing costs of maintaining the equipment already installed and ensuring smooth daily operations.

Depreciation rate (book accounting depreciation)	State revenue administration ³¹	Electromechanical equipment: page 21, in item 45.1.9 Transmission line: page 21 in item 45.2.1 Buildings on page 1 in item 1.2.1
Tax rate	State revenue administration ³²	
Benchmark rate	World Bank ³³	Page 40, table 3.3

The project has been financed by equity only. Based on the result of IRR excel spreadsheets, the post-tax equity IRR of the project is calculated as 13.58%, less than the 20% benchmark. This substantiates that the investment is not financially attractive. Thus, it can be easily concluded that project activity is additional and is not business as usual scenario.

Sub-step 2d: Sensitivity Analysis

Addressing Guidance under Sensitivity Analysis Version-11.0, following factors has been subjected to sensitivity analysis:

1. Energy Yield
2. O&M Cost
3. Project Cost
4. Tariff

The rationale of sensitivity is, "The ultimate objective of the sensitivity analysis is to determine the likelihood of the occurrence of a scenario other than the scenario presented, in order to

³¹ https://www.gib.gov.tr/sites/default/files/fileadmin/user_upload/Yararli_Bilgiler/amortisman_oranlari.pdf

³² <https://www.gib.gov.tr/yarlim-ve-kaynaklar/yararli-bilgiler/gecici-vergi-oranlari>

³³ <https://documents1.worldbank.org/curated/en/799701498842988254/pdf/ICR00004069-06192017.pdf>

provide a cross-check on the suitability of the assumptions used in the development of the investment analysis."

Sensitivity Analysis

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

Result of Sensitivity Analysis

Sensitivity Analysis	Equity IRR		
Variation %	-10%	Normal	10%
Electricity Yield	6.20%	13.58%	19.60%
O&M	17.87%	13.58%	8.70%
Project Cost	15.56%	13.58%	11.83%
Tariff rate	6.20%	13.58%	19.60%

Probability to breach the benchmark:
Sensitivity Parameter 1: Electricity yield
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 in the SWDS 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 -60% change and is hypothetical case. However, such a reduction in the O&M cost is highly unlikely.
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. Thus, it is unlikely that project cost will change beyond sensitivity range
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. However, Sensitivity is carried out for +/-10%. Even then the benchmark is not breached.

Outcome of Step 2:

Final Result

Equity IRR without CDM	Benchmark (Equity IRR)
13.58%	20%

Based on the above result, the equity IRR is less than the Benchmark. Thus, it can be easily concluded that, the project activity is additional.

Step 3: Barrier analysis

As per Tool for demonstration and assessment of additionality” TOOL01 (Version 07.0.0), Step 2 or Step 3 or both can be used to demonstrate additionality of the project activity. In this case, Step 3 is not being used for the purpose.

Step 4: Common practice analysis

As per para 57 of Tool for demonstration and assessment of additionality” TOOL01 (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 MW 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%	57.308	MW
Capacity of the proposed project activity	38.205	MW
- 50%	19.103	MW

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 MWe to 57.308 MWe.
- 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 of the project has been signed on 23-January-2021.

Findings of analysis of Step 2

Company Name	COD	Project Name	Installed Capacity (MWe)	GS/VCS/GCC 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, N_{all} .

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.

$N_{all} = 0$

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 N_{diff} ,

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):

- 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);
- 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);
- 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%).

$$N_{diff} = 0$$

Step (5): Calculate factor $F = 1 - N_{diff}/N_{all}$ 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

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

$$F = 1$$

So, F is greater than 0.2

$$N_{all} - N_{diff} = 0$$

So, $N_{all} - N_{diff}$ 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 greater than 3.

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

3.6 Methodology Deviations

No methodology deviation is applied in the project.

4 IMPLEMENTATION STATUS

4.1 Implementation Status of the Project Activity

Implementation status of the project activity during this monitoring period is that there are 11 gas engines each with 1.415 MWe capacity till 31-October-2022. Project activity is operational with an

installed capacity of 15.565 (11*1.415) MWe during this monitoring period. There has been no deviation since the beginning. Calibration of equipment performed periodically.

The project has started operation as of 18-June-2021. During the operation phase of the project, there has been no major event that impact the GHG emissions reductions occurred. Milestones of the project are given in the table below:

Date	Action
01-January-2020	Board Investment Decision
22-January-2021	EIA Exemption Decision
23-January-2021	Gas Engines Supply Agreement
15-April-2021	Generation License
18-June-2021	Start of operation, commissioning of 3 gas engines
10-December-2021	Connection Agreement
10-December-2021	System Usage Agreement
23-December-2021	Commissioning of 7 gas engines
01-April-2022	Commissioning of 1 gas engine
23-June-2023	Commissioning of 10 gas engines
18-January-2024	Commissioning of 3 gas engines
16-February-2024	Commissioning of 1 gas engine

5 ESTIMATED GHG EMISSION REDUCTIONS AND REMOVALS

5.1 Baseline Emissions

In accordance with ACM0001 “Flaring or Use of Landfill Gas” Version 19.0, baseline emissions should 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 project activity;
- C) Heat generation using fossil fuels in the absence of project activity; and
- D) Natural gas used from the natural gas network in the absence of the project activity.

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:

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

Where:

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

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

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

$$BE_{CH_4} = \left((1 - OX_{top_layer}) \times F_{CH_4,PJ,y} - F_{CH,BL,y} \right) \times GWP_{CH_4} \quad \text{Equation 2 in ACM0001}$$

Where:

Parameter	Unit	Description
BE_{CH_4}	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_{CH_4}	tCO ₂ e/tCH ₄	Global warming potential of CH ₄

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

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

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

Where:

$F_{CH_4,PJ,y}$: Amount of methane in the LFG which is flared and/or used in the project activity in year y (tCH₄/yr)

$F_{CH_4,flared,y}$: Amount of methane in the LFG which is destroyed by flaring in year y (tCH₄/yr)

$F_{CH_4,EL,y}$: Amount of methane in the LFG which is used for electricity generation in year y (tCH₄/yr)

$F_{CH_4,HG,y}$: Amount of methane in the LFG which is used for heat generation in year y (tCH₄/yr)

$F_{CH_4,NG,y}$: 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/yr)

Since there is no heat generations or natural gas usage therefore *Ex-post determination of* $F_{CH_4,PJ,y}$ will be limited to methane emissions from SWDS (A) and electricity generation (B) will be taken into account.

$$F_{CH_4,PJ,y} = F_{CH_4,flared,y} + F_{CH_4,EL,y}$$

$F_{CH_4,EL,y}$ 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 ($Op_{j,h,y}$).

$F_{CH_4,PJ,y}$ is determined using the “Tool to determine the mass flow of a greenhouse gas in a gaseous stream” TOOL08 version 03.0.0.

The tool provides procedures to determine the following parameter:

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

The mass flow of CH₄ in LFG is determined through measurement of the flow and volumetric fraction of the gaseous stream (LFG). The “Tool to determine the mass flow of a greenhouse gas in a gaseous stream” TOOL08 version 03.0.0 provides 6 different ways to make these measurements and the corresponding calculation option for $F_{i,t}$.

Table 4: Measurement options for $F_{i,t}$

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

Option	Flow of Gaseous Stream	Volumetric Fraction
E	Mass flow-wet basis	Dry basis
F	Mass flow-wet basis	Wet basis

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

Option A:

According to the “Tool to determine the mass flow of a greenhouse gas in a gaseous stream” TOOL08 version 03.0.0, flow measurement on a dry measurement is not doable for a wet gaseous stream. Therefore, it will be demonstrated that the temperature of the gaseous stream (T_t) is less than 600C (333.15 K) at the flow measurement point.

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 (CH ₄) 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 (CH ₄) 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 (CH ₄) 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 (CH ₄)
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 (CH ₄)

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

The project participant opts to exclude the flare system from the baseline calculations and 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 to the above explanation, the “Project emissions from flaring” TOOL06 Version 03, is not applied to the proposed project activity and no emission reductions will be claimed from the flaring activity, therefore the amount of methane destroyed by flaring $F_{CH_4,flared,y}$ is fixed to “0”.

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

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

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

Where:

Parameter	Unit	Description
$F_{CH_4,PJ,y}$	tCH ₄ /yr	Amount of methane in the LFG which is flared and or used in the project activity in year y
$BE_{CH_4,SWDS,y}$	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

$BE_{CH_4,SWDS,y}$ is determined using the methodological tool “Emissions from solid disposal sites” TOOL04 version 08.1. The amount of methane generated from disposal of waste at the SWDS is calculated based on a first order decay (FOD) model. The amount of methane generated from disposal of waste at the SWDS is calculated for year y as follows:

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

Equation 1 in TOOL04 V08.1

Where:

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)

Parameter	Unit	Description
DOC _j	Dimensionless	Fraction of degradable organic carbon (by weight) in the waste type j
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 1.0		
k_j	The following values for the different waste types have been applied as a default value:		
	Waste type j		Boreal and Temperate (MAT <20 °C)
			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.			
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 ³⁴
Pulp, paper and cardboard	10.38%
Wood and wood products	0%
Textiles	5%

³⁴ https://webdosya.csb.gov.tr/db/ced/icerikler/-istanbul_2020_-cdr-20220110121837.pdf

Waste Type	Fraction of the waste type ³⁴
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 1.0, which corresponds to anaerobic managed solid waste disposal site.

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

This step provides a procedure to determine the amount of methane that would have been captured and destroyed (by flaring) in the baseline due to regulatory requirements, or to address safety and odour concerns. ACM0001 “Flaring or Use of Landfill Gas” version 19.0.0 provides 4 cases and corresponding instructions.

Situation at the start of the project activity:	Requirement to destroy methane	Existing LFG capture and destruction system
Case 1: No requirement to destroy methane exists and no existing LFG capture system	No	No
Case 2: Requirement to destroy methane exists and no existing LFG capture system	Yes	No
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:

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

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

In accordance to paragraph 54 the methodology (ACM0001- Flaring or use of landfill gas, version19.0) the baseline emissions associated with electricity generation in year y ($BE_{EC,y}$) is calculated in accordance with the “Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation ” TOOL05 Version 3.0.

- The electricity source k in the tool corresponds to the sources of electricity generated by the grid, which is identified as the most plausible baseline scenario.
- $EC_{BL,k,y}$ in the tool is equivalent to the net amount of electricity generated using LFG in year y ($EG_{PJ,y}$).

In accordance to paragraph 54 the approved consolidated methodology ACM0001- Flaring or use of landfill gas, version19.0, paragraph 16 of Tool 5- Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation, version 03.0 is being referred to for estimation of baseline emission ($BE_{EC,y}$).

In the generic approach outlined under paragraph 16 of Tool 5, baseline emissions from consumption of electricity are calculated based on the quantity of electricity consumed, an emission factor for electricity generation and a factor to account for transmission losses, as follows:

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

Equation 2 in TOOL05 V3

where:

Parameter	Unit	Description
$BE_{EC,y}$	tCO ₂ e/yr	Baseline emissions from electricity consumption in year y. 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 the selection of the most plausible baseline scenario; Since grid is the most plausible baseline scenario therefore k = 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.

Parameter	Unit	Description
		<i>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 $EC_{PJ,j,y}$.</i>
$EF_{EF,k,y}$	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

$TDL_{k,y}$ value is equal to 1.89%,.

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

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

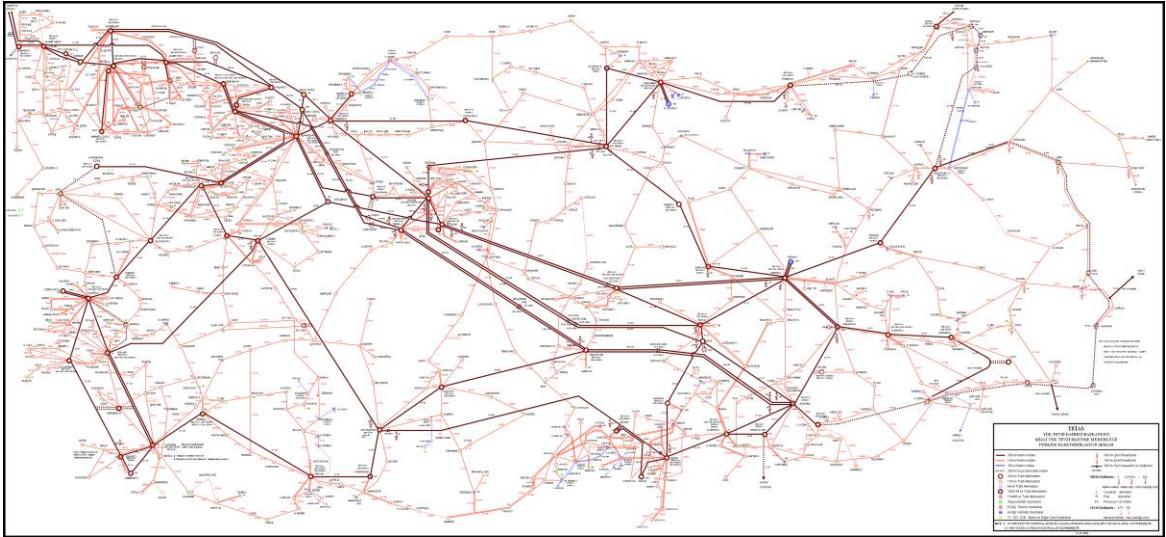
The CO₂ emission factor for the displacement of electricity generated by power plants in the project activity and fed to the grid is estimated using “Tool to calculate the emission factor for an electricity system” TOOL07 version 7.0. The estimation is carried out through following steps

- Step 1: Identify the relevant electricity systems;
- Step 2: Choose whether to include off-grid power plants in the project electricity system (optional);
- Step 3: Select a method to determine the operating margin (OM);
- Step 4: Calculate the operating margin emission factor according to the selected method;
- Step 5: Calculate the build margin (BM) emission factor;
- 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 "Türkiye Elektrik İletim 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 ($EF_{grid,OM,y}$) is based on one of the following methods, which are described under Step 4:

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

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

Table 5: In accordance with Electricity Market Production Capacity Projections List (TWh)³⁵

Parameter	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%

³⁵ <https://www.epdk.gov.tr/Detay/Icerik/3-0-66/elektrikuretim-kapasite-projeksiyonlari>

Parameter	2016	2017	2018	2019	2020	2021	Share in 2021 (%)
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

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

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

For OM factor calculation, Chronological order of power generation plants from TEİAŞ Load Dispatch Department with, fuel types, electricity generation for the calculated year were used as

input data. By using all the data which were mentioned above, Turkish Ministry of Energy and Natural Resources³⁶²⁶ calculated $EF_{grid,OM,y}$:

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

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

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

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

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

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 $EF_{grid,BM,y}$ chronological order of power generation plants from TEİAŞ Load Dispatch Department with commissioning dates, plant names, fuel types, installed power values, electricity generation for the calculated year were used as input data.

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

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

As per Methodological tool: “Tool to calculate the emission factor for an electricity system” TOOL07 (Version 07.0, EB 100, Annex 4) para 81:

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

(a) Weighted average CM; or

³⁶ <https://enerji.gov.tr/evced-cevre-ve-iklim-turkiye-ulusal-elektrik-sebekesi-emisyon-faktoru>

(b) Simplified CM.

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

The combined margin emission factor is calculated by using weighted average CM as per TOOL07 Version 07.0 formula below:

$$EF_{grid,CM,y} = EF_{grid,OM,y} \times w_{OM} + EF_{grid,BM,y} \times w_{BM} \quad \text{Equation 16 in TOOL07 V7}$$

Where:

Parameter	Unit	Description
$EF_{grid,BM,y}$	tCO ₂ /MWh	Build margin CO ₂ emission factor in year y
$EF_{grid,OM,y}$	tCO ₂ /MWh	Operating margin CO ₂ emission factor in year y
w_{OM}	per cent (%)	Weighting of operating margin emissions factor
w_{BM}	per cent (%)	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:

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

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

5.2 Project Emissions

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

$$PE_y = PE_{EC,y} + PE_{FC,y} + PE_{DT,y} + PE_{SP,y} \quad \text{Equation 22 in ACM0001 V19}$$

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 CO₂/yr)

Since there is 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:

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

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” TOOL05 Version 3.0.

5.3 Leakage

In accordance with ACM0001 “Flaring or Use of Landfill Gas” version 19.0, no leakage effects are accounted for the project activity.

5.4 Estimated Net GHG Emission Reductions and Removals

The emission reduction achieved by the project activity can be estimated ex ante by:

$$ER_y = BE_y - PE_y$$

Equation 26 in ACM0001 V19

Where:

ER_y = Emission reductions in year y (t CO₂e/yr)

BE_y = Baseline emissions in year y (t CO₂e/yr)

PE_y = Project emissions in year y (t CO₂/yr)

Year	Estimated baseline emissions or removals (tCO ₂ e)	Estimated project emissions or removals (tCO ₂ e)	Estimated leakage emissions (tCO ₂ e)	Estimated net GHG emission reductions or removals (tCO ₂ e)
Year 2021 (18-June-2021 – 31-December-2021)	299,372	0	0	299,372
Year 2022 (01-January-2022 – 31-December-2022)	692,606	0	0	692,606
Year 2023 (01-January-2023 – 31-December-2023)	777,184	0	0	777,184
Year 2024 (01-January-2024 – 31-December-2024)	833,190	0	0	833,190
Year 2025 (01-January-2025 – 31-December-2025)	846,013	0	0	846,013
Year 2026 (01-January-2026 – 31-December-2026)	859,783	0	0	859,783
Year 2027 (01-January-2027 – 31-December-2027)	872,768	0	0	872,768
Year 2028 (01-January-2028 – 17-December-2028)	506,593	0	0	506,593
Total	5,687,509	0	0	5,687,509

6 MONITORING

6.1 Data and Parameters Available at Validation

Data and parameters under ACM0001 “Flaring or Use of Landfill Gas” Version 19.0, that are available at validation and not monitored:

Data / Parameter	OX _{top_layer}
Data unit	Dimensionless
Description	Fraction of methane that would be oxidized in the top layer of the SWDS in the baseline
Source of data	Consistent with how oxidation is accounted for in the tool “Emissions from solid waste disposal sites” TOOL04
Value applied	0.1
Justification of choice of data or description of measurement methods and procedures applied	As referred under ACM0001
Purpose of Data	Calculation of baseline emissions
Comments	Applicable to Step A defined under ACM0001

Data / Parameter	GWP _{CH4}
Data unit	tCO ₂ e/tCH ₄
Description	Global Warming Potential of CH ₄
Source of data	Default value from IPCC Fourth Assessment Report (AR5).
Value applied	28 - After 1-January-2021
Justification of choice of data or description of measurement methods and procedures applied	As referred under ACM0001
Purpose of Data	Calculation of baseline emissions
Comments	The Global Warming Potential (GWP) values, for calculating the carbon dioxide equivalence of anthropogenic emissions by sources and removals by sinks, have been updated as per IPCC AR5 and taken as 28 as of 1-January-2021.

Data / Parameter	η _{PJ}
Data unit	Dimensionless
Description	Efficiency of the LFG capture system that will be installed in the project activity
Source of data	ACM0001
Value applied	50%
Justification of choice of data or description of measurement methods and procedures applied	Default value under ACM0001
Purpose of Data	Calculation of baseline emissions
Comments	Applicable to Step A.1.1 defined under ACM0001

Data and parameters under the “Tool to determine the mass flow of a greenhouse gas in a gaseous stream” TOOL08 Version 03.0.0, that are available at validation and not monitored:

Data / Parameter	R_u
Data unit	Pa.m ³ /kmol.K
Description	Universal ideal gases constant
Source of data	“Tool to determine the mass flow of a greenhouse gas in a gaseous stream” TOOL08
Value applied	8.314
Justification of choice of data or description of measurement methods and procedures applied	As referred under “Tool to determine the mass flow of a greenhouse gas in a gaseous stream” TOOL08
Purpose of Data	Calculation of baseline emissions
Comments	-

Data / Parameter	MM_{CH_4}		
Data unit	kg/kmol		
Description	Molecular mass of CH ₄		
Source of data	“Tool to determine the mass flow of a greenhouse gas in a gaseous stream” TOOL08		
Value applied	Compound	Structure	Molecular mass (kg/kmol)
	Methane	CH ₄	16.04
Justification of choice of data or description of measurement methods and procedures applied	As referred under “Tool to determine the mass flow of a greenhouse gas in a gaseous stream” TOOL08		
Purpose of Data	Calculation of baseline emissions		
Comments	-		

Data / Parameter	$\rho_{i,t}$
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Data unit	kg CH ₄ /m ³ CH ₄
Description	Density of greenhouse gas <i>i</i> (methane) in the gaseous stream
Source of data	"Tool to determine the mass flow of a greenhouse gas in a gaseous stream" TOOL08
Value applied	0.71566 kg/m ³
Justification of choice of data or description of measurement methods and procedures applied	As referred under "Tool to determine the mass flow of a greenhouse gas in a gaseous stream" TOOL08 Calculated in accordance with equation 6 of Tool 08: Tool to determine the mass flow of a greenhouse gas in a gaseous stream version 03.0
Purpose of Data	Calculation of baseline emissions
Comments	In accordance with the Data/Parameter 14 and 15 of Tool 08: "Tool to determine the mass flow of a greenhouse gas in a gaseous stream", Version 03, if the volumetric parameters are converted to normal conditions during the monitoring process the pressure and temperature need not need to be monitored. Therefore, density of LFG won't be estimated separately, and ex-ante estimated value of 0.71566 kg CH ₄ /m ³ CH ₄ will be used. The data determined ex-ante will be fixed for the entire crediting period.

Data and parameters under the tool "Emissions from solid disposal sites" TOOL04 Version 08.1, that are available at validation and not monitored:

Data / Parameter	Φ _{default}
Data unit	-
Description	Default value for the model correction factor to account for model uncertainties
Source of data	Emissions from solid disposal sites
Value applied	0.75
Justification of choice of data or description of measurement methods and procedures applied	As referred under "Emissions from solid disposal sites" TOOL04 Version 08.1
Purpose of Data	Calculation of baseline emissions
Comments	-
Data / Parameter	OX

Data unit	-
Description	Oxidation factor (reflecting the amount of methane from SWDS that is oxidized in the soil or other material covering the waste)
Source of data	“Emissions from solid disposal sites” TOOL04. Based on extensive review of published literature on this subject, including the IPCC 2006 Guidelines for National Greenhouse Gas Inventories.
Value applied	0.1
Justification of choice of data or description of measurement methods and procedures applied	As referred under “Emissions from solid disposal sites” TOOL04 Version 08.1
Purpose of Data	Calculation of baseline emissions
Comments	-

Data / Parameter	F
Data unit	-
Description	Fraction of methane in the SWDS (volume fraction)
Source of data	IPCC 2006 Guidelines for National Greenhouse Gas Inventories
Value applied	0.5
Justification of choice of data or description of measurement methods and procedures applied	As referred under “Emissions from solid disposal sites” TOOL04 Version 08.1
Purpose of Data	Calculation of baseline emissions
Comments	Upon biodegradation, organic material is converted to a mixture of methane and carbon dioxide

Data / Parameter	DOC _{f,default}
Data unit	Weight fraction
Description	Default value for the fraction of degradable organic carbon (DOC) in MSW that can decompose in the SWDS
Source of data	IPCC 2006 Guidelines for National Greenhouse Gas Inventories
Value applied	0.5
Justification of choice of data or description of measurement methods and procedures applied	As referred under “Emissions from solid disposal sites” TOOL04 Version 08.1
Purpose of Data	Calculation of baseline emissions

Comments	The proposed project activity falls under Application A
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Data / Parameter	MCF _{default}
Data unit	-
Description	Methane correction factor
Source of data	IPCC 2006 Guidelines for National Greenhouse Gas Inventories
Value applied	0.8
Justification of choice of data or description of measurement methods and procedures applied	As referred under “Emissions from solid disposal sites” TOOL04 Version, 08.1, the value for deep unmanaged solid waste disposal sites is used considering that the SWDS was unmanaged prior to the project activity and received waste since 1995.
Purpose of Data	Calculation of baseline emissions
Comments	The baseline falls under the definition “anaerobic managed solid waste disposal sites”

Data / Parameter	DOC _j														
Data unit	Weight fraction														
Description	Fraction of degradable organic carbon in waste type j (weight fraction)														
Source of data	IPCC 2006 Guidelines for National Greenhouse Gas Inventories (adapted from Volume 5, Table 2.4 and Table 2.5)														
Value applied	The following values for the different waste types have been applied: <table> <tr> <th>Waste type j</th><th>DOC_j (% wet waste)</th></tr> <tr> <td>Wood and wood products</td><td>43</td></tr> <tr> <td>Pulp, paper and cardboard</td><td>40</td></tr> <tr> <td>Food, food waste, beverages and tobacco</td><td>15</td></tr> <tr> <td>Textiles</td><td>24</td></tr> <tr> <td>Garden, yard and park waste</td><td>20</td></tr> <tr> <td>Glass, plastic, metal, other inert</td><td>0</td></tr> </table>	Waste type j	DOC _j (% wet waste)	Wood and wood products	43	Pulp, paper and cardboard	40	Food, food waste, beverages and tobacco	15	Textiles	24	Garden, yard and park waste	20	Glass, plastic, metal, other inert	0
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														

Justification of choice of data or description of measurement methods and procedures applied	As referred under “Emissions from solid disposal sites” TOOL04
Purpose of Data	Calculation of baseline emissions
Comments	-

Data / Parameter	Waste type j																
Data unit	%																
Description	Type of Organic Waste																
Source of data	Annual İstanbul Environmental Status Report of Ministry of Environment, Urbanization and Climate Change, Provincial Directorate ³⁷																
Value applied	The following values for the different waste types have been applied: <table> <tr> <th>Waste type j</th><th>DOC_j (in % wet waste)</th></tr> <tr> <td>Wood and wood products</td><td>0%</td></tr> <tr> <td>Pulp, paper and cardboard</td><td>10.38%</td></tr> <tr> <td>Food, food waste, beverages and tobacco</td><td>48.17%</td></tr> <tr> <td>Textiles</td><td>5%</td></tr> <tr> <td>Garden, yard and park waste</td><td>0%</td></tr> <tr> <td>Other organic waste</td><td>13.76%</td></tr> <tr> <td>Inorganic, other inert</td><td>23.00%</td></tr> </table>	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%
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%																
Justification of choice of data or description of	Based on the Annual İstanbul Environmental Status Report which presents waste amount, characteristics, and landfill data in																

³⁷ <https://ced.csb.gov.tr/il-cevre-durum-raporlari-i-82671>

measurement methods and procedures applied	İstanbul annually. The parameter is only used for estimation of ex-ante emission reduction.
Purpose of Data	The parameter is only used for estimation of ex-ante emission reduction.
Comments	-

Data / Parameter	W_x																																												
Data unit	tons																																												
Description	Total amount of solid waste disposed in the SWDS																																												
Source of data	Annual İstanbul Environmental Status Report of Ministry of Environment, Urbanization and Climate Change, Provincial Directorate ³⁸																																												
Value applied	The year wise amount of waste deposition avoided is included in the table below: <table border="1"> <thead> <tr> <th>Year</th><th>Total Waste /year (tons)</th></tr> </thead> <tbody> <tr><td>1995</td><td>1,861,500</td></tr> <tr><td>1996</td><td>1,861,500</td></tr> <tr><td>1997</td><td>1,861,500</td></tr> <tr><td>1998</td><td>1,861,500</td></tr> <tr><td>1999</td><td>1,861,500</td></tr> <tr><td>2000</td><td>1,861,500</td></tr> <tr><td>2001</td><td>1,861,500</td></tr> <tr><td>2002</td><td>1,861,500</td></tr> <tr><td>2003</td><td>1,861,500</td></tr> <tr><td>2004</td><td>1,861,500</td></tr> <tr><td>2005</td><td>1,861,500</td></tr> <tr><td>2006</td><td>1,861,500</td></tr> <tr><td>2007</td><td>1,861,500</td></tr> <tr><td>2008</td><td>1,861,500</td></tr> <tr><td>2009</td><td>1,861,500</td></tr> <tr><td>2010</td><td>2,190,000</td></tr> <tr><td>2011</td><td>2,190,000</td></tr> <tr><td>2012</td><td>2,190,000</td></tr> <tr><td>2013</td><td>2,019,180</td></tr> <tr><td>2014</td><td>2,019,180</td></tr> <tr><td>2015</td><td>2,019,180</td></tr> </tbody> </table>	Year	Total Waste /year (tons)	1995	1,861,500	1996	1,861,500	1997	1,861,500	1998	1,861,500	1999	1,861,500	2000	1,861,500	2001	1,861,500	2002	1,861,500	2003	1,861,500	2004	1,861,500	2005	1,861,500	2006	1,861,500	2007	1,861,500	2008	1,861,500	2009	1,861,500	2010	2,190,000	2011	2,190,000	2012	2,190,000	2013	2,019,180	2014	2,019,180	2015	2,019,180
Year	Total Waste /year (tons)																																												
1995	1,861,500																																												
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2015	2,019,180																																												

³⁸ <https://ced.csb.gov.tr/il-cevre-durum-raporlari-i-82671>

		2016	2,669,610
		2017	2,687,130
		2018	2,687,130
		2019	2,687,130
		2020	2,687,130
		2021	2,687,130
		2022	2,687,130
		2023	2,687,130
		2024	2,687,130
		2025	2,687,130
		2026	2,687,130
		2027	2,687,130
		2028	2,687,130
Justification of choice of data or description of measurement methods and procedures applied	Based on the 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.		
Purpose of Data	The parameter is only used for estimation of ex-ante emission reduction		
Comments	-		

Data / Parameter	W _{j,x}						
Data unit	tons						
Description	Amount of solid waste type j disposed in the SWDS						
Source of data	Annual İstanbul Environmental Status Report of Ministry of Environment, Urbanization and Climate Change, Provincial Directorate ³⁹						
Value applied	The year wise and type wise amount of waste deposition avoided is included in the table below:						
	(ton / year)	Pulp, Paper & Card-board	Food	Other Organic Waste	Textiles	Inorganic, inert waste	Total waste / year
	1995	193224	896685	256142	87304	428145	1861500
	1996	193224	896685	256142	87304	428145	1861500
	1997	193224	896685	256142	87304	428145	1861500
	1998	193224	896685	256142	87304	428145	1861500

³⁹ <https://ced.csb.gov.tr/il-cevre-durum-raporlari-i-82671>

	1999	193224	896685	256142	87304	428145	1861500
	2000	193224	896685	256142	87304	428145	1861500
	2001	193224	896685	256142	87304	428145	1861500
	2002	193224	896685	256142	87304	428145	1861500
	2003	193224	896685	256142	87304	428145	1861500
	2004	193224	896685	256142	87304	428145	1861500
	2005	193224	896685	256142	87304	428145	1861500
	2006	193224	896685	256142	87304	428145	1861500
	2007	193224	896685	256142	87304	428145	1861500
	2008	193224	896685	256142	87304	428145	1861500
	2009	193224	896685	256142	87304	428145	1861500
	2010	227322	1054923	301344	102711	503700	2190000
	2011	227322	1054923	301344	102711	503700	2190000
	2012	227322	1054923	301344	102711	503700	2190000
	2013	209591	972639	277839	94700	464411	2019180
	2014	209591	972639	277839	94700	464411	2019180
	2015	209591	972639	277839	94700	464411	2019180
	2016	277106	1285951	367338	125205	614010	2669610
	2017	278924	1294391	369749	126026	618040	2687130
	2018	278924	1294391	369749	126026	618040	2687130
	2019	278924	1294391	369749	126026	618040	2687130
	2020	278924	1294391	369749	126026	618040	2687130
	2021	278924	1294391	369749	126026	618040	2687130
	2022	278924	1294391	369749	126026	618040	2687130
	2023	278924	1294391	369749	126026	618040	2687130
	2024	278924	1294391	369749	126026	618040	2687130
	2025	278924	1294391	369749	126026	618040	2687130
	2026	278924	1294391	369749	126026	618040	2687130
	2027	278924	1294391	369749	126026	618040	2687130
	2028	278924	1294391	369749	126026	618040	2687130
Justification of choice of data or description of measurement methods and procedures applied	Based on the 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.						
Purpose of Data	The parameter is only used for estimation of ex-ante emission reduction						
Comments	-						

Data / Parameter	k _j		
Data unit	1/yr.		
Description	Decay rate for the waste type j		
Source of data	IPCC 2006 Guidelines for National Greenhouse Gas Inventories (Volume 5, Table 3.3)		
Value applied	The following values for the different waste types have been applied:		
	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
	Rapidly degrading	Food, food waste, sewage sludge, beverages and tobacco	0.06
Justification of choice of data or description of measurement methods and procedures applied	Emissions from solid disposal sites Climatic conditions for İstanbul where project site located in: MAT (Mean Annual Temperature): 15.2 °C ⁴⁰ MAP (Mean Annual Precipitation): 660.9 mm PET (Potential Evapotranspiration): 676 mm ⁴¹		

⁴⁰ <https://www.mgm.gov.tr/veridegerlendirme/il-ve-ilceler-istatistik.aspx?k=A&m=%C4%B0STANBUL/FLORYA>

⁴¹ http://tucaum.ankara.edu.tr/wp-content/uploads/sites/280/2015/08/tucaum4_4.pdf , Table 7, Florya Meteorological Station

	MAP/PET = 0.97766
	Therefore, Boreal and Temperate ($MAT \leq 20^{\circ}C$) and dry ($MAP/PET < 1$) conditions are observed in the project site.
Purpose of Data	Calculation of baseline emissions
Comments	-

Data and parameters under the “Tool to calculate the emission factor for an electricity system” TOOL07 Version 07.0.0, that are available at validation and not monitored:

Data / Parameter	$EF_{grid,OM,y}$
Data unit	tCO ₂ /MWh
Description	Operating margin CO ₂ emission factor for the project electricity system in year y
Source of data	The Ministry of Energy and Natural Sources ⁴²
Value applied	0.7424
Justification of choice of data or description of measurement methods and procedures applied	The Ministry of Energy and Natural Sources has published the Operating, Build and Combined Margin Emission Factors for Turkish National Grid. The Ministry has calculated the emission factor by using the “Tool to calculate the emission factor for an electricity system” TOOL07. Since it was latest updated in 20-September-2022 by the Ministry, these factors reflecting year 2020 have been used for emission reduction calculation.
Purpose of Data	Estimation of combined margin emission factor
Comments	This parameter is fixed ex-ante for the entire crediting period

Data / Parameter	$EF_{grid,BM,y}$
Data unit	tCO ₂ /MWh
Description	Build margin CO ₂ emission factor for the project electricity system in year y

⁴² <https://enerji.gov.tr/evced-cevre-ve-iklim-turkiye-ulusal-elektrik-sebekesi-emisyon-faktoru> Link may not work outside Turkey, therefore, emission factor information sheet is added as screenshots (TR and EN) in the latest page of ER sheet.

Source of data	The Ministry of Energy and Natural Sources
Value applied	0.3680
Justification of choice of data or description of measurement methods and procedures applied	The Ministry of Energy and Natural Sources has published the Operating, Build and Combined Margin Emission Factors for Turkish National Grid. The Ministry has calculated the emission factor by using the "Tool to calculate the emission factor for an electricity system" TOOL07. Since it was updated in 20-September-2022 by the Ministry, these factors have been used for emission reduction calculation
Purpose of Data	Estimation of combined margin emission factor
Comments	This parameter is fixed ex-ante for the entire crediting period

Data / Parameter	$EF_{grid,CM,y}$
Data unit	tCO ₂ /MWh
Description	Combined margin CO ₂ emission factor for the project electricity system in year y
Source of data	Calculated
Value applied	0.5552
Justification of choice of data or description of measurement methods and procedures applied	The combined margin emissions factor is calculated as follows: $EF_{grid,CM,y} = EF_{grid,OM,y} * W_{OM} + EF_{grid,BM,y} * W_{BM}$
Purpose of Data	To estimate baseline emissions
Comments	This parameter is fixed ex-ante for the entire crediting period

Data / Parameter	TDL _y
Data unit	%
Description	Average technical transmission and distribution losses

Source of data	EMRA Electricity Market Sector Report 2021 (page 107) ⁴³ Best available recent reliable and accurate data for Turkey.
Value applied	1.89%
Justification of choice of data or description of measurement methods and procedures applied	Republic of Türkiye Energy Market Regulatory Authority (EMRA) ⁴⁴ publishes official annual reports which include statistics about electricity generation and distribution.
Purpose of Data	Estimation of project emissions
Comments	-

6.2 Data and Parameters Monitored

Data and parameters under ACM0001 “Flaring or Use of Landfill Gas” version 19.0, that are monitored:

Data / Parameter	$Op_{j,h}$
Data unit	H
Description	Operation of the equipment that consumes the LFG
Source of data	Project participant
Description of measurement methods and procedures to be applied	For each equipment unit j using the LFG, the operation of the plant in hour h is monitored by: - Products generated (such as electricity generation) $Op_{j,h}=0$ when: - No products are generated in hour h Otherwise $Op_{j,h}=1$
Frequency of monitoring/recording	Hourly
Value applied	7500 h ⁴⁵
Monitoring equipment	SCADA system
QA/QC procedures to be applied	N/A
Purpose of data	Calculation of baseline emissions
Calculation method	-
Comments	-

⁴³ <https://www.epdk.gov.tr/Detay/Icerik/3-0-24/yillik-sektor-raporu>

⁴⁴ EPDK | T.C. Enerji Piyasası Düzenleme Kurumu

⁴⁵ <https://www.epdk.gov.tr/Detay/DownloadDocument?id=V97kmmOGNsw=>

Data / Parameter	Management of SWDS
Data unit	-
Description	Management of SWDS
Source of data	One of the following sources could be used: • Original design of the landfill • Technical specifications for the management of the SWDS • Local or national regulations
Description of measurement methods and procedures to be applied	Project participants will refer to the original design of the landfill to ensure that any practice to increase methane generation have been occurring prior to the implementation of the project activity.
Frequency of monitoring/recording	Annually
Value applied	N/A
Monitoring equipment	Not applicable
QA/QC procedures to be applied	Any change in the management of the SWDS after the implementation of the project activity should be justified by referring to technical or regulatory specifications.
Purpose of data	Calculation of baseline emissions
Calculation method	-
Comments	-

Data / Parameter	$F_{CH_4, BL, R, y}$
Data unit	t CH ₄ /yr
Description	Amount of methane in the LFG which is flared due to a requirement in year y
Source of data	Regulation on the Landfill of Waste ⁴⁶
Description of measurement methods	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.

⁴⁶ <https://www.mevzuat.gov.tr/mevzuat?MevzuatNo=13887&MevzuatTur=7&MevzuatTertip=5>

and procedures to be applied	Regulation is based on the Environmental Law and responsibility is on the Ministry of Environment, Urbanization and Climate Change.
Frequency of monitoring/recording	Annually
Value applied	0
Monitoring equipment	-
QA/QC procedures to be applied	Any update in the regulation will be followed.
Purpose of data	Relevant regulations for LFG project activities shall be updated at renewal of each credit period. Changes to regulation will be concerted to the amount of methane that would have been destroyed/combusted during the year in the absence of the project activity.
Calculation method	-
Comments	-

Data / Parameter	$\rho_{reg,y}$
Data unit	Dimensionless
Description	Fraction of LFG that is required to be flared due to a requirement in year y
Source of data	Regulation on the Landfill of Waste ⁴⁷
Description of measurement methods and procedures to be applied	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. Regulation is based on the Environmental Law and responsibility is on the Ministry of Environment, Urbanization and Climate Change.
Frequency of monitoring/recording	Annually
Value applied	0
Monitoring equipment	-

⁴⁷ <https://www.mevzuat.gov.tr/mevzuat?MevzuatNo=13887&MevzuatTur=7&MevzuatTertip=5>

QA/QC procedures to be applied	Any update in the regulation will be followed.
Purpose of data	Relevant regulations for LFG project activities shall be updated at renewal of each credit period. Changes to regulation will be concerted to the amount of methane that would have been destroyed/combusted during the year in the absence of the project activity.
Calculation method	-
Comments	-

Data and parameters under the “Tool to determine the mass flow of a greenhouse gas in a gaseous stream” TOOL08 version 03.0.0, that are monitored:

Data / Parameter	V _{t,db}	
Data unit	m ³ dry gas/h	
Description	Volumetric flow of the gaseous stream in time interval t on a dry basis	
Source of data	Volumetric flow meter	
Description of measurement methods and procedures to be applied	Volumetric flow will be monitored with a volumetric flow meter. V _{t,db} will be converted to normal conditions.	
Frequency of monitoring/recording	Continuous Flow is monitored hourly, archived on daily basis and will be reported monthly for ER calculations.	
Value applied	For the calculation of baseline emissions: 58,792,235 m ³ /year is estimated. Corresponds to almost 7,838 m ³ /hour	
Monitoring equipment	Equipment Type	Flowmeter
	Manufacturer	INC Endüstriyel Ürünler A.Ş.
	Location	On site
	Accuracy	+/- 1%
	Serial Number	211001-39077
	Calibration Date	20-August-2020
QA/QC procedures to be applied	Periodic calibration against a primary device provided by an independent accredited laboratory. In accordance with the “Regulation on Measurement and Measuring Tools” – Article 9 ⁴⁸ , electricity meters and gas/flow meters have to be calibrated within a frequency of once per 10 years.	

⁴⁸ <https://www.mevzuat.gov.tr/anasayfa/MevzuatFihristDetayIframe?MevzuatTur=7&MevzuatNo=6381&MevzuatTertip=5>

	Hourly data have been calculated by considering 7500 h data provided by Energy Market Regulatory Authority for landfill projects. ⁴⁹
Purpose of data	Calculation of baseline emissions
Calculation method	-
Comments	As per the paragraph 33 of the applied methodology ACM0001 v19.0, a single flowmeter can be used if the LFG is used for multiple purposes (e.g. flaring or energy generation), and all methane destruction devices are verified to be operational. In case of any periods that one or more of the LFG destruction devices are not operational paragraph 5 (a) and (b) of the Appendix of the "Tool to determine the mass flow of a greenhouse gas in a gaseous stream" tool shall be followed. The project activity meets the conditions described in paragraph 5 (a) and (b). (a) All destruction devices have valves on the input gas line to automatically stop and direct the gas flow. (b) If one or more gas engines are not operational, the LFG is sent to the flare unit which has sufficient capacity to destroy incoming gas.

Data / Parameter	V _{CH4,t,db}	
Data unit	m ³ gas CH ₄ /m ³ dry gas	
Description	Volumetric fraction of CH ₄ in a time interval t on a dry basis	
Source of data	The volumetric fraction of CH ₄ will be monitored with a gas analyzer	
Description of measurement methods and procedures to be applied	Continuous gas analyzer operating in dry basis	
Frequency of monitoring/recording	Continuous – Daily	
Value applied	50% is estimated 52.44% is observed in 2021 51.23% is observed in 2022	
Monitoring equipment	Equipment Type	Gas Analyser
	Manufacturer	Siemens Ultramat 23

⁴⁹ <https://www.epdk.gov.tr/Detay/DownloadDocument?id=V97kmmOGNsw=>

	Location	On site
	Accuracy	± 0.5%
	Serial Number	N1-M3-096
	Calibration Date	29-September-2022 30-March-2022 16-July-2021
QA/QC procedures to be applied	Calibration should include zero verification with an inert gas (e.g., N ₂) and at least one reading verification with a standard gas (single calibration gas or mixture calibration gas). Calibration and frequency of calibration is 6-12 months.	
Purpose of data	Calculation of baseline emissions	
Calculation method	-	
Comments	-	

Data / Parameter	EG _{PJ,y} (EG _{PJ,y} = EG _{PJ,Grid,y})
Data unit	MWh
Description	Amount of electricity generated using LFG by the project activity in year y. Since the electricity generated by the project activity (after supplying electricity to auxiliary load) is totally supplied to grid therefore the quantity of electricity generated by the project activity in the year y is equivalent to quantity of electricity generated and supplied by the project power plant to the grid in year y (EG_{PJ,Grid,y})⁵⁰.
Source of data	TEIAS OSF/OSOS forms (Electricity supplied to the grid is measured using more than one electricity meters (main and spare) are reflected in the TEIAS OSF/OSOS forms)
Description of measurement methods and procedures to be applied	Total quantum of electricity generated and supplied (exported) to the grid is monitored using bi-directional energy meter(s).
Frequency of monitoring/recording	Continuous monitoring and monthly recording

⁵⁰ Electricity required by the project facility other than the auxiliary load is met by importing power from the grid and is monitored as EC_{PJ,j,y}.

Value applied	Estimated as 156,209 MWh/year (average during 7 years crediting period). 2021 MR period actual: 19,429 MWh 2022 MR period actual: 87,946 MWh		
Monitoring equipment		Main Meter	Back-up Meter
	Manufacturer	ITRON SL7000	ITRON SL7000
	Location	On site	On site
	Serial Number	84500212	84500190
	Manufacture Year / Calibration Date	2020 / 19-February-2020	2020 ⁵¹ /19-February-2020
QA/QC procedures to be applied	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”⁵² – 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. Calibration year of electricity meter(s) is most of the time stated by the Grid Company in the meter replacement protocols. The electricity meters are used to measure the electricity supplied to the grid and delivered from the grid and used for billing purposes. Therefore, the meters are sealed by TEİAŞ (Turkish Electricity Transmission Company). The electricity generation (, TEİAS OSF/OSOS forms) shall be cross-checked with records of electricity sale (EPIAS screenshots).		
Purpose of data	Calculation of baseline emissions from electricity supplied to the grid. In accordance to paragraph 54 the methodology ACM0001-version19.0, the baseline emission associated with electricity generation in year y ($BE_{EC,y}$) is calculated in accordance with the equation 2 of “TOOL05 Version 3.0. $BE_{EC,y} = \sum_k EC_{BL,k,y} \times EF_{EF,k,y} \times (1 + TD_{L,k,y})$ Equation 2 in TOOL05 Where $BE_{EC,y}$ - Baseline emissions from electricity consumption in year y, 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		

⁵¹ 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”⁵¹ – Article 9.

⁵² <https://www.mevzuat.gov.tr/anasayfa/MevzuatFihristDetayIframe?MevzuatTur=7&MevzuatNo=6381&MevzuatTertip=5>

	$EC_{BL,k,y}$ = Quantity of electricity that would be consumed by the baseline electricity consumer k in year y As per paragraph 54.a of the ACM0001, electricity sources k in the tool correspond to the sources of electricity generated identified in the selection of the most plausible baseline scenario; Since grid is the most plausible baseline scenario therefore $k = \text{grid}$. In addition, in accordance to paragraph 54.b of the ACM0001, $EC_{BL,k,y}$ is equivalent to $EG_{PJ,y}$. In accordance to Data / Parameter table 13 of the methodology ACM0001- $EG_{PJ,y}$ 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, $EG_{PJ,grid,y}$ 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 $EC_{PJ,j,y}$. $EF_{EF,k,y}$ - Emission factor for electricity gen source k in year y $TDL_{k,y}$ = Average technical and transmission and distribution losses for providing electricity to source k in year y
Calculation method	Electricity generated from the gas turbine is supplied to grid after supplying power to the auxiliary load. The net electricity supplied to the grid is monitored using bidirectional meter and is obtained from TEIAS OSF/OSOS forms records and cross-checked with records of electricity sale (EPIAS).
Comments	The electricity supplied to the grid is equivalent to the net electricity generated by the project power plant. Data relating to the net electricity supplied/exported to the grid will be archived for two years after the last monitoring period or after last issuance, whichever is later.

Data / Parameter	$EG_{EC,y}$ ($EG_{EC,y} = EC_{PJ,j,y}$)
Data unit	MWh
Description	Amount of electricity consumed by the project activity in year y. Since amount of electricity consumed by the project activity in year y ($EG_{EC,y}$) is imported from the grid therefore it is equivalent to Quantity of electricity consumed by the project electricity consumption source j in year 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.

Source of data	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).		
Description of measurement methods and procedures to be applied	This parameter will be monitored using bi-directional energy meter(s).		
Frequency of monitoring/recording	Continuous monitoring and monthly recording		
Value applied	2021 MR period actual: 5.80 MWh 2022 MR period actual: 5.08 MWh		
Monitoring equipment		Main Meter	Back-up Meter
	Manufacturer	ITRON SL7000	ITRON SL7000
	Location	On site	On site
	Serial Number	84500212	84500190
	Manufacture Year / Calibration Date	2020 / 19-February-2020	2020 ⁵³ /19-February-2020
QA/QC procedures to be applied	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”⁵⁴ – 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. Maintenance and calibration of equipment will be carried out according to the instructions of the manufacturer. The electricity meters are used to measure the net electricity exported to the grid and used for billing purposes. Therefore, the meters are sealed by TEİAŞ (Turkish Electricity Transmission Company).		
Purpose of data	Calculation of project emissions		
Calculation method	Electricity consumed by importing from the grid is directly measured using bi-directional meter and is obtained from TEIAS OSF/OSOS forms records and cross-checked with records of electricity sale (EPIAS).		

⁵³ 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”⁵³ – Article 9.

⁵⁴ <https://www.mevzuat.gov.tr/anasayfa/MevzuatFihristDetayIframe?MevzuatTur=7&MevzuatNo=6381&MevzuatTertip=5>

Comments

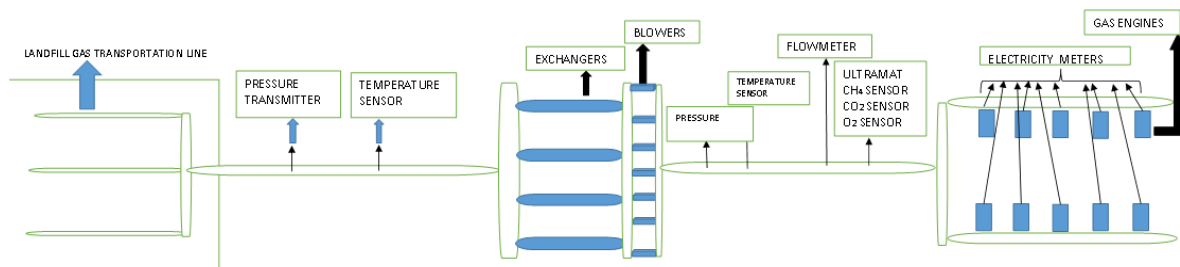
The quantity of electricity consumed is monitored by the same equipment, which monitors the net amount of electricity generated by the project activity.

6.3 Monitoring Plan

Monitoring will be carried out following the procedures set by the consolidated baseline methodology ACM0001 version 19 and all applicable tools of the above explained parameters. The monitoring consists of:

- Amount of landfill gas combusted in power generation units
- Temperature of the landfill gas sent to power generation to ensure compliance regarding dry basis for measurement
- Concentration of methane of the landfill gas
- Total amount of electricity exported to the grid
- Operating hours of power generation units
- Total amount of the electricity imported from the grid

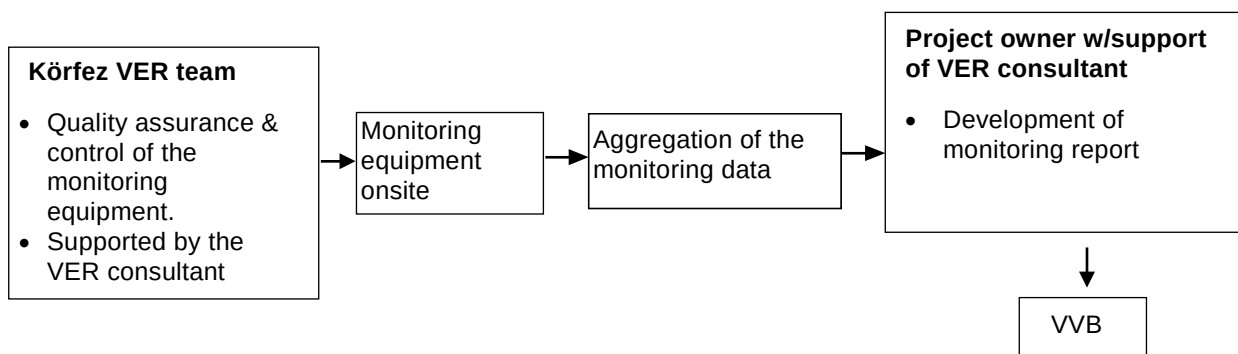
A flow diagram of the project activity indicating the places of the monitoring equipment is presented below.



Responsibilities for monitoring

The project owner is responsible for the operation and maintenance of the landfill and the installed equipment. The project owner is also responsible for the administration of the data, setting up a VER team who will be responsible for monitoring all data required to estimate emission reductions.

In the diagram below the organization of monitoring management and data application is presented.



Registration of the monitored data

Körfez VER-Team will be responsible for quality assurance and quality control of the monitoring equipment. The data measured by the monitoring equipment will be stored and will be processed into a

monitoring report, which will be submitted by the project owner. All the monitored data will be stored during the crediting period and for at least two years after the end of the crediting period, whichever occurs later.

Corrective actions and emergency preparedness

The VER-Team will regularly check the monitoring system on errors. In the case of errors, corrective actions will be undertaken by the VER-Team, or if required, by the supplier of the monitoring equipment.

QA/QC procedure

Strong quality assurance and quality control procedure will be taken to monitor the equipment and data collection. Equipment and facilities will be subject to a regular maintenance and testing regime to ensure accuracy following supplier's manual.

Measuring of exported and imported electricity

The main meter for the monitoring of the electricity import and export is at grid connection. Monthly protocols based on the readings, that are confirmed by both TEIAS, and the project participant are prepared by the end of each month and stored. These protocols are also the basis of invoicing for the electricity sales from the proposed project activity. The electricity meters are bidirectional and will measure both the imported and exported electricity from and to the grid.

7 QUANTIFICATION OF GHG EMISSION REDUCTIONS AND REMOVALS

7.1 Data and Parameters Monitored

Data / Parameter	Op _{j,h}								
Data unit	hours								
Description	Operation of the equipment that consumes the LFG								
Value applied	0 The total operating hours of the gas engines are presented in the table below. <table border="1"> <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>	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								
Comments	Operation hours of the other destruction device-flare between the monitoring period, 18-June 2021 to 31-October-2022 is zero as per SCADA Records.								

Period	Op _{j,h} (hours) – Flare Unit
18-June-2021 to 31-December-2021	0
01-January-2022 to 31-October-2022	0
Total	0

Data / Parameter	Management of SWDS
Data unit	-
Description	Management of SWDS
Value applied	During this monitoring period, no changes took place in the management of the landfill. By the end of this monitoring period, the regulations and provisions on LFG recovery and utilization have not changed in the current effective laws and standards in Turkey, and it is a common practice in Turkey that methane is released into the atmosphere without recovery or utilization.
Comments	-

Data / Parameter	F _{CH₄,BL,R,y}
Data unit	t CH ₄ /yr
Description	Amount of methane in the LFG which is flared due to a requirement in year y
Value applied	0
Comments	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

Data / Parameter	p _{reg,y}
Data unit	Dimensionless
Description	Fraction of LFG that is required to be flared due to a requirement in year y
Value applied	0
Comments	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

Data and parameters under the “Tool to determine the mass flow of a greenhouse gas in a gaseous stream” TOOL08 version 03.0.0, that are monitored:

Data / Parameter	$V_{t,db}$						
Data unit	m ³ dry gas/h						
Description	Volumetric flow of the gaseous stream in time interval t on a dry basis						
Value applied	Values during this monitoring period are shown in the table below. <table> <tr> <th>Period</th><th>$V_{t,db}$</th></tr> <tr> <td>18-June-2021 - 31-December-2021</td><td>10,971,715</td></tr> <tr> <td>01-January-2022 - 31-October-2022</td><td>50,695,086</td></tr> </table>	Period	$V_{t,db}$	18-June-2021 - 31-December-2021	10,971,715	01-January-2022 - 31-October-2022	50,695,086
Period	$V_{t,db}$						
18-June-2021 - 31-December-2021	10,971,715						
01-January-2022 - 31-October-2022	50,695,086						
Comments	-						

Data / Parameter	$V_{CH_4,t,db}$
Data unit	m ³ gas CH ₄ /m ³ dry gas
Description	Volumetric fraction of CH ₄ in a time interval t on a dry basis
Value applied	51.73% (Average value)
Comments	-

Data / Parameter	$EG_{PJ,y}$ ($EG_{PJ,y} = EG_{PJ,Grid,y}$)						
Data unit	MWh						
Description	Amount of electricity generated using LFG by the project activity in year y. Since the electricity generated by the project activity (after supplying electricity to auxiliary load) is totally supplied to grid therefore the quantity of electricity generated is equivalent to quantity of electricity generated and supplied by the project power plant to the grid in year y ($EG_{PJ,Grid,y}$) y						
Value applied	Actual values of the net electricity supplied to the grid during this monitoring period are shown in the table below. <table> <tr> <th>Period</th><th>$EG_{PJ,Grid,y}$</th></tr> <tr> <td>18-June-2021 - 31-December-2021</td><td>19,069</td></tr> <tr> <td>01-January-2022 - 31-October-2022</td><td>86,315</td></tr> </table>	Period	$EG_{PJ,Grid,y}$	18-June-2021 - 31-December-2021	19,069	01-January-2022 - 31-October-2022	86,315
Period	$EG_{PJ,Grid,y}$						
18-June-2021 - 31-December-2021	19,069						
01-January-2022 - 31-October-2022	86,315						

Comments

EG_{PJ,y} which is equal to the net electricity generated and supplied to the grid is used for estimation of baseline emission in accordance to equation 2 of “TOOL05 Version 3.0.
The net electricity supplied to the grid is monitored using bidirectional meter and is obtained from TEIAS OSF/OSOS forms/ records and cross-checked with records of electricity sale (EPIAS).

The calibration information of the meters is given below:

	Main Meter	Back-up Meter
Manufacturer	ITRON SL7000	ITRON SL7000
Location	On site	On site
Serial Number	84500212	84500190
Manufacture Year / Calibration Date	2020 / 19-February-2020	2020 ⁵⁵ /19-February-2020

Data / Parameter	EG _{EC,y} (EG _{EC,y} =EC _{PJ,j,y})		
Data unit	MWh		
Description	Amount of electricity consumed by the project activity in year y. Since the electricity generated by the project activity (after supplying electricity to auxiliary load) is totally supplied to grid therefore the quantity of electricity generated by the project activity in the year y is equivalent to quantity of electricity generated and supplied by the project power plant to the grid in year y (EG _{PJ,Grid,y}).		
Value applied	Period	EC _{PJ,j,y}	
	18-June-2021 - 31-December-2021	5.80	
	01-January-2022 - 31-October-2022	5.08	
Comments	Total quantity of electricity consumed is imported from the grid and is monitored using bidirectional meter. Amount of electricity imported is obtained from TEIAS OSF/OSOS forms/ records and cross-checked with records of electricity sale (EPIAS).		
	The calibration information of the meters is given below:		
		Main Meter	Back-up Meter
	Manufacturer	ITRON SL7000	ITRON SL7000
	Location	On site	On site
	Serial Number	84500212	84500190

⁵⁵ 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” – Article 9.

	Manufacture Year / Calibration Date	2020 / 19- February-2020	2020 ⁵⁶ /19- February-2020
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7.2 Baseline Emissions

In accordance with ACM0001 “Flaring or Use of Landfill Gas” Version 19.0, baseline emissions should comprise the following sources:

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

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

Where:

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

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:

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

Baseline emission of methane from SWDS ($BE_{CH_4,y}$):

In accordance with ACM0001 Flaring or Used of Landfill Gas Version 19, the baseline emissions of methane from the SWDS ($BE_{CH_4,y}$) are determined based on the amount of methane that is captured under the project activity. In addition, the effect of methane oxidation that is present in the baseline and absent in the project is considered.

$$BE_{CH_4} = \left((1 - OX_{top_layer}) \times F_{CH_4,PJ,y} - F_{CH,BL,y} \right) \times GWP_{CH_4} \quad \text{Equation 2 in ACM0001}$$

Where:

$BE_{CH_4,y}$	tCO ₂ e	Baseline emissions of methane from SWDS in year y
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⁵⁶ 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” – Article 9.

OX_{top_layer}	-	Oxidation factor
$F_{CH_4,PJ,y}$	tCH_4	Amount of methane in the LFG that which is flared and/or used in the project activity year y
$F_{CH_4,BL,y}$	tCH_4	Amount of methane in the LFG that would be flared in the baseline in year y
GWP_{CH_4}	tCO_2e/tCH_4	Global warming potential of CH_4

Ex-post determination of $F_{CH_4,PJ,y}$

Please refer to the Section 4.2 for the equations used for the calculation and see the results for the current monitoring period in the table below.

Period	$V_{t,db}$ ($Nm^3/year$)	$V_{CH_4,t,db}$ (%)	$\rho_{CH_4,t}$ (ton/m^3)	$F_{CH_4,PJ,y}$ (tCH_4)
Year 2021 (18-June-2021 - 31-December-2021)	10,971,715	52.4%	0.00071566	4,120
Year 2022 (01-January-2022 - 31-October-2022)	50,695,086	51.2%	0.00071566	18,580
Total	61,666,801	51.7%	0.00071566	22,699

Subsequently, in accordance with ACM0001 Version 19, the baseline emissions of methane from the SWDS ($BE_{CH_4,y}$) are calculated and results are listed in the table below.

Period	$F_{CH_4,PJ,y}$ (tCH_4)	$F_{CH_4,BL,y}$ (tCH_4)	OX_{top_layer}	GWP_{CH_4}	$BE_{CH_4,y}$ (tCO_2e)
Year 2021 (18-June-2021 - 31-December-2021)	4,120	0	0.1	28	103,809
Year 2022 (01-January-2022 - 31-October-2022)	18,580	0	0.1	28	468,206
Total	22,699	0	0.1	28	572,015

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

Please refer to Section 4.2 for equations used for the calculation of baseline emissions associated with the electricity generation.

Period	$EG_{PJ,y} = EG_{PJ,Grid,y}$ (MWh)	$EF_{EL,k,y}$	TDL	$BE_{EC,y}$ (tCO _{2e})
Year 2021 (18-June-2021 - 31-December-2021)	19,429	0.5552	1.89%	10,787
Year 2022 (01-January-2022 - 31-October-2022)	87,946	0.5552	1.89%	48,828
Total	107,375	0.5552		59,615

Baseline emissions calculated as shown in the table below.

Period	$BE_{CH_4,y}$ (tCO _{2e})	$BE_{EC,y}$ (tCO _{2e})	BE_y (tCO _{2e})
Year 2021 (18-June-2021 - 31-December-2021)	103,809	10,787	114,593
Year 2022 (01-January-2022 - 31-October-2022)	468,206	48,828	517,028
Total	572,015	59,615	631,621

7.3 Project Emissions

Please refer to Section 4.2 for equations used for the calculation of project emissions.

Period	$EG_{EC,y} = EC_{PJ,y}$ (MWh)	$EF_{EL,k,y}$	TDL _y	$PE_{EC,y}$ (tCO _{2e})
Year 2021 (18-June-2021 - 31-December-2021)	5.91	0.5552	1.89%	8.00
Year 2022 (01-January-2022 - 31-October-2022)	5.17	0.5552	1.89%	10.00
Total	11.08	0.5552	1.89%	18.00

7.4 Leakage

No leakage effects are accounted for under the methodology ACM0001 (version 19.0), i.e., $LE_y = 0$.

7.5 Net GHG Emission Reductions and Removals

The net GHG emission reductions and removals achieved for this monitoring period is quantified, the key results (breakdown of GHG emission reductions and removals by calendar year) are summarized using the table below:

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	8.00	0	114,585
Year 2022 (01-January-2022-31-October-2022)	517,028	10.00	0	517,018
Total	631,621	18.00	0	631,603

Estimated ex-ante GHG emission reductions and removals and the achieved emission reductions and removals for this monitoring period is stated in the table below. The percentage difference is also reported and the difference is justified.

<u>Ex-ante emissions reductions/removals</u>	<u>Achieved emissions reductions / removals</u>	<u>Percent difference</u>	<u>Justification for the difference</u>
876,543	631,603 tCO ₂ e	-28%	The decrease in the emission reduction during the monitoring period relates to: 1. Out of total approved 27 gas engines, only 11 were commissioned during the monitoring period till 31-October-2022, 16 were yet to be commissioned. 2. As more than half (59%) of the gas engines are not yet working, the facility has not reached its full capacity. The capacity of the facility is determined based on the amount of gas generated from the SWDS. Currently, the amount of gas generated by the SWDS is being utilized by 41% of the total capacity of the project activity. As waste continues to accumulate in the landfill, the amount of gas generated will increase over time, and the capacity of the plant will be increased gradually. The ex-ante emissions reductions/removals were calculated based on estimation studies

			of the SWDS, considering the projected amount of waste and methane generation. However, as the project has not yet reached full capacity (59% less), the achieved emissions reductions of methane from the SWDS are smaller, in line with the current gas engine capacity. All of the collected landfill gas (LFG) is sent to the gas engines for electricity generation, and no portion of the collected gas is flared, as confirmed by SCADA records. The facility ensures that all collected gas is fully utilized. As the landfill continues to generate more LFG over time, the commissioning of gas engines has proceeded in phases. According to the monitoring records, no gas was flared during the monitoring period; thus, the ex-post baseline emissions were calculated solely based on the amount of gas utilized for electricity generation, not the total gas generated at the landfill site. Consequently, there is no unutilized collected landfill gas, even though the facility has not yet reached its full planned capacity. 3. 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 different therefore results in differences on gas capture and its utilization.
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APPENDIX 1: EIA EXEMPTION



T.C.
ÇEVRE ve ŞEHİRCİLİK BAKANLIĞI
Çevresel Etki Değerlendirmesi, İzin ve Denetim Genel Müdürlüğü

T.C.
İSTANBUL VALİLİĞİ
ÇEVRE ve ŞEHİRCİLİK İL MÜDÜRLÜĞÜ

Karar Tarihi : 22-01-2021
Karar No : 71280893 220-02 E-2021233

ÇEVRESEL ETKİ DEĞERLENDİRME BELGESİ

25.11.2014 tarih ve 29186 sayılı Resmi Gazete'de yayımlanarak yürürlüğe giren Çevresel Etki Değerlendirmesi Yönetmeliği'nin Ek-II listesinde yer alan '**ÇÖP DEPO GAZINDAN (BİYOGAZ) ELEKTRİK ENERJİSİ ÜRETİMİ (42,45 MWe ? 100,56 MWt), ÇÖP BİYOGAZ ÇIKARMA (257.513.541 m3/yıl), KOJENERASYON (5,6 MWe-28,0 MWt) KAPASİTE ARTIŞI**' projesi ile ilgili olarak inceleme-değerlendirme yapılmış ve Proje Tanıtım Dosyasında çevresel etkilere karşı alınması öngörülen önlemler yeterli görülmüştür. Ayrıca ÇED Raporu hazırlanmasına gerek bulunmadığı tespit edilmiş olup, söz konusu projeye ÇED Yönetmeliğinin 17. Maddesi gereğince Valiliğimizce "**Çevresel Etki Değerlendirmesi Gerekli Değildir**" kararı verilmiştir.

Refik GÜNDOĞAR
Vali a.
Çevre ve Şehircilik İl Müdürü V.

Proje Sahibi : KÖRFEZ ENERJİ SAN. VE TİC. A.Ş.- AVCIKÖRÜ ŞUBESİ
Proje Yeri : İstanbul İli, Şile İlçesi, İstanbul İli, Şile İlçesi, Karakiraz Mahallesi, Ergun Sk. No:305A
Kapasite : Elektrik Enerji Üretimi:42,45MWe-100,56MWt, Çöp Biyogaz Çıkarma:257.513.541 m3/yıl, Kojenerasyon:5,6 MWe-28 MWt

APPENDIX 2: NO DOUBLE COUNTING CERTIFICATE



11/11/2022
İSTANBUL/TURKEY

To whom it may concern,
Avcıkoru Landfill Gas to Electricity Project is a renewable energy project which converts landfill gas into electrical energy. As the Project Owner of the Avcıkoru Landfill Gas to Electricity Project, we hereby confirm that:

- The project activity is neither included in an emissions trading program nor does it take place in a jurisdiction or sector in which binding limits are established on GHG emissions.
- The project has not created any form of other credit such as renewable energy certificate (REC). Projects does not obtain any public funding.
- The project does not participate/has not participated under any other GHG program.
- The project has not applied for crediting under any other GHG program, nor it has been rejected from any other GHG program.

KÖRFEZ ENERJİ SAN. VE TİC. A.Ş.
Ahmet ÇİÇEKÇİ
Manger