

MONITORING REPORT

PUBLICATION DATE **14.10.2020**

VERSION **v. 1.1**

RELATED SUPPORT - **TEMPLATE GUIDE Monitoring Report v. 1.1**

This document contains the following Sections

Key Project Information

0 - Description of project

0 - Implementation of project

0 - Description of monitoring system applied by the project

0 - Data and parameters

0 - Calculation of SDG Impacts

0 - Safeguards Reporting

0 - Stakeholder inputs and legal disputes

KEY PROJECT INFORMATION

Key Project Information

GS ID (s) of Project (s)	GS 6193
Title of the project (s) covered by monitoring report	Sakarya Landfill Gas Power Plant
Version number of the PDD/VPA-DD (s) applicable to this monitoring report	Version 10
Version number of the monitoring report	05
Completion date of the monitoring report	13/09/2024
Date of project design date certification	10/06/2021
Date of Last Annual Report	27/12/2023
Monitoring period number	1 st Verification
Duration of this monitoring period	01/03/2021-31/12/2023 (Both Days are included)
Project Representative	CLIMETREK LTD
Host Country	TURKEY
Activity Requirements applied	☐ Community Services Activities ☒ Renewable Energy Activities ☐ Land Use and Forestry Activities/Risks & Capacities ☐ N/A
Methodology (ies) applied and version number	ACM0001 Version 19.0: 'Flaring or use of landfill gas' ACM0002 Version 20.0: 'Grid Connected Electricity Generation from Renewable Sources'
Product Requirements applied	☒ GHG Emissions Reduction & Sequestration ☐ Renewable Energy Label ☐ N/A

Table 1 - Sustainable Development Contributions Achieved

Sustainable Development Goals Targeted	SDG Impact	Amount Achieved	Units/ Products
SDG 13 Climate Action	Emission Reductions	525,609	tCO ₂ e/VERs
SDG 7 Affordable and clean energy	MWh of renewable energy generated.	93,136	MWh
SDG11 Sustainable Cities and Communities	Municipal waste used for electricity generation	778,243	Tonnes

Table 2 – Product Vintages

		Amount Achieved
Start Dates	End Dates	VERs
01/03/2021	31/12/2021	159,616
01/01/2022	31/12/2022	184,584
01/01/2023	31/12/2023	181,409

SECTION A. DESCRIPTION OF PROJECT

A.1. General description of project

Sakarya Entegre Katı Atık Yönetimi Anonim Şirketi targeted to build a 5 MW landfill gas power plant (hereafter referred to as the “project”) on a area of around 200,000 m² in municipal landfill site of Sakarya, Turkey. According to the production license granted by the EMRA (Energy Market Regulatory Authority) the realized capacity of the project is 4.68 MW.

In the scope of the project, municipal wastes are used as feedstock and the yields of the project are clean electricity to Turkish grid and organic fertilizer. Therefore, the proposed project activity reduces GHG emissions (1) by using electricity from a renewable energy source instead of a fossil fuel and therefore displacing electricity which otherwise would have been generated by thermal power plants connected to the national grid, and (2) capturing resulting methane of the municipal waste and using it for electricity production.

The project activity stimulates the commercial use of municipal waste for electricity production as a renewable energy source in Turkey. In addition to existing renewable energy sources hydro, wind, geothermal and biogas it will significantly contribute to the sustainable development of the region by achieving the following benefits:

The project will help Turkey to stimulate and commercialize the use of grid-connected renewable energy technologies and markets. Furthermore, the project will demonstrate the viability of grid-connected landfill gas-to-energy plants which can support improved energy security, improved air quality, alternative sustainable energy futures, improved local livelihoods and sustainable renewable energy industry development. The specific goals of the project are to:

- Reduction of GHG in Turkey compared to the business-as-usual scenario (using fossil fuel for electricity production)
- Improvement of local livelihoods by creating local employment during the construction and operation phase of the facility
- The risk for explosion and fire of the municipal waste from open and uncontrolled dumping is eliminated
- Reduction of the bad odour and thus improvement of the air quality for the region
- Knowledge transfer on municipal waste-to-energy principles and stimulation of the municipal waste-to-energy industry in Turkey
- Contribution to the decrease of Turkey’s energy deficit and import dependency

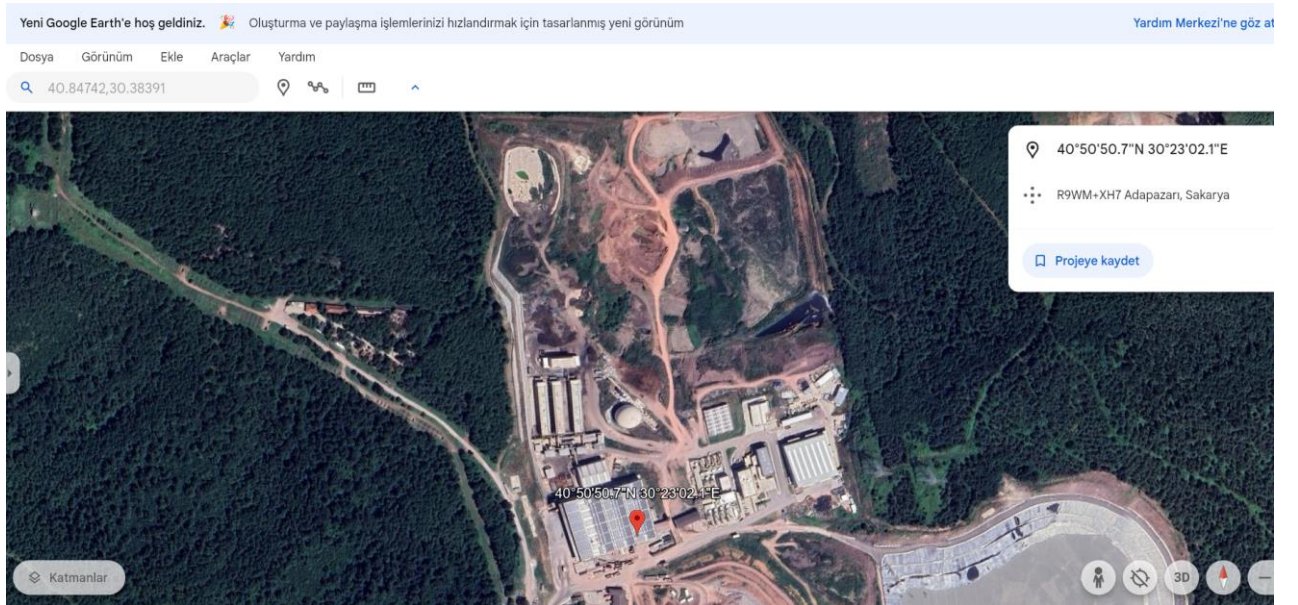
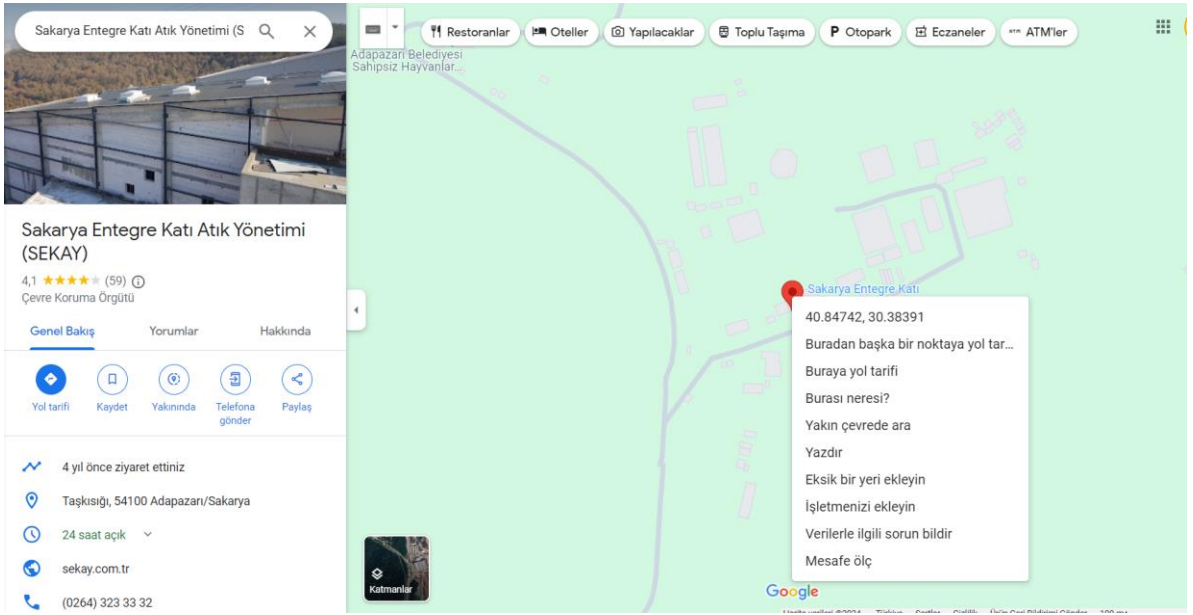
The electricity production license of the Project was granted by EMRA (Energy Market Regulatory Authority) on 04.10.2018. The waste disposal site is delivered by the municipality on 02/01/2018 and the start of operation of the facility is 30/10/2018.

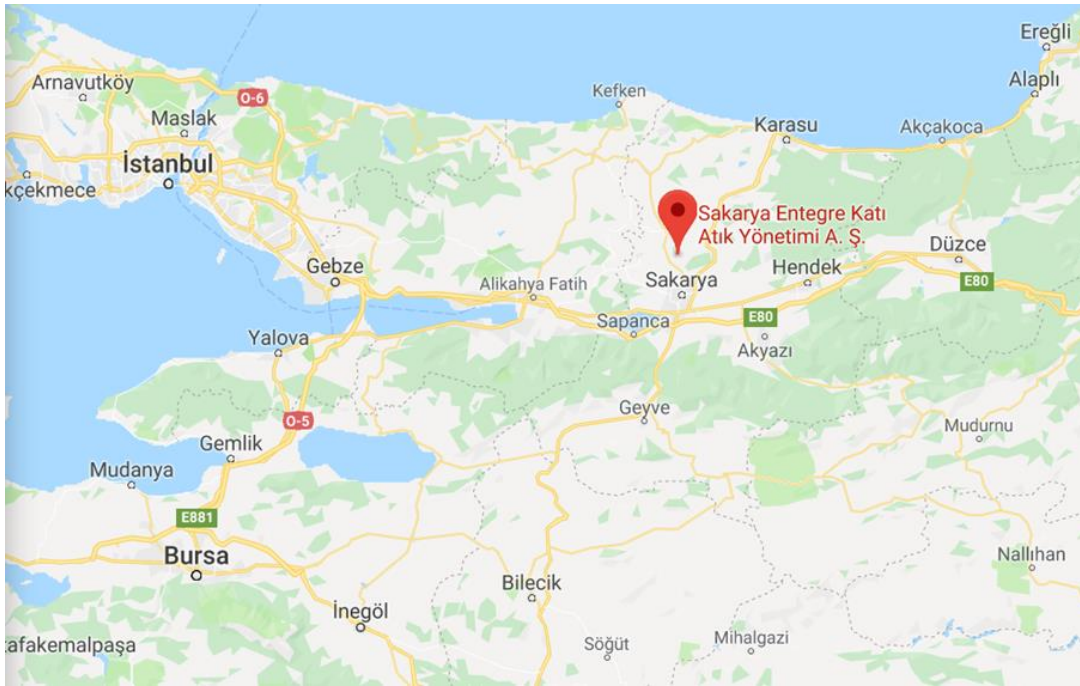
A.2. Location of project

The project is located in the Adapazari District of Sakarya, Turkey. The closest settlement area to the project site is Taşkırsığı Neighborhood.

The location of the project activity is N 40°.84742' and, E 30°.38391'

The exact project location of the project is illustrated in Figure 1.





A.3. Reference of applied methodology

ACM0001 Version 19.0: 'Flaring or use of landfill gas'¹

ACM0002 Version 20.0: 'Grid Connected Electricity Generation from Renewable Sources'¹

¹ <http://cdm.unfccc.int/methodologies/SSCmethodologies/approved.html>

A.4. Crediting period of project

Each crediting period of the project is 5 years. The crediting period will be renewed two times more. Therefore, total length of the crediting period will be 15 years. Project has been design certified on 10/06/2021. As per the GHG Emissions Reductions & Seq. Product Requirements V.2.2² para 10.2.1 start date of the crediting period is the start date of the project operation or two years prior to the date of Project Design certification whichever is later. As inline with the registered PD crediting start date is defined as 01/07/2019 and end date of the first crediting period is 30/06/2024.

SECTION B. IMPLEMENTATION OF PROJECT

B.1. Description of implemented project

The project installation is completed according to the description in the PDD and is completely operational. The project consists of only one site. The activity includes installing a landfill gas extraction system, an enclosed flare, and three biogas driven gensets for electricity production each with a capacity of 1,560 kW. The total licensed, installed capacity of the project is 4.68 MWe. Additionally, one gas generator with the same capacity is in reserve for the purpose of substitution of the engine which might be stopped due to malfunction or maintenance issues. The extraction system includes a network of vertical gas extraction wells, de-watering units and gas transport pipelines connected to the main collector system. The gas is driven to the gas engine and the flare via a booster system. The Sakarya Landfill Project reduces methane gas generated at the Sakarya landfill by combusting the collected gas in an engine to generate electricity.

By implementing the project, gas extraction and control system was implemented. The control activities include periodic adjustment of the gas wells by means of measuring equipment - gas flow, methane content, and oxygen content are very important parameters (landfill gas may form an explosive mixture when it combines with air in certain proportions; methane is explosive between its LEL of 5% by volume and its UEL4 of 15% by volume).

The gas extraction plant is equipped with boosters that create a suction vacuum in the system necessary for LFG extraction (booster system). Landfill gas is used for electricity generation, and excess gas is flared in a high-temperature flare (800-1200°C, retention time 0.3 s). The produced energy is fed into the national grid. There is also an emergency diesel genset in the plant, which was only used during construction.

Upon Sakarya Metropolitan Municipality's decision and due to the delay of the biogas plant completion and additionally not effectively working of the biogas plant in years 2021,2022

² <https://globalgoals.goldstandard.org/501-pr-ghg-emissions-reductions-sequestration/>

and 2023 Landfill site accepted more MSW than the expected amount in the registered PD by %45 in total during this monitoring period.

Table 3- Technical Specifications of Gas Generators

Gas Generator	
Brand/Model	Caterpillar CG170-16
Max Continuous Rating (Electrical Power at 100% Load)	1560 kW
Max Electrical Efficiency (at 100% Load)	42.1 %
Frequency	50Hz

Table 4- Technical specifications of Gas Extraction and Combustion System

Gas Extraction and Combustion System	
Brand/Model	HT2000x2 (+2000) F1000 CO
Flow m³/h	4000
Blowers	2 (+1 predisposition)
Blower diff. pressure	300 mbar
Suction Pressure	-150 mbar
Outlet Pressure	+150 mbar

The most important milestones are included in the following table:

No.	Date	Key Event
1	08/03/2016	EIA Positive Decision
2	25/12/2017	LSC Meeting
4	27/02/2018	Gas Engine Contract Date
5	21/03/2018	Submission of LSC Report to the Gold Standard
6	04/10/2018	Issuance of EMRA License
7	30/10/2018	Start of Commercial Operation
8	01/07/2019	Crediting Period Start Date (within two years prior to the date of Project Design Certification)
9	10/06/2021	Design Certification Date

Moreover, the Project is in commercial operation in line with the description in the registered PDD.

There are no significant overhaul times, downtimes of equipment, or equipment exchange that could impact the applicability of the UNFCCC tools and methodologies that have been used.

B.1.1 Forward Action Requests

N/A

B.2. Post-Design Certification changes

N/A

B.2.1. Temporary deviations from the approved Monitoring & Reporting Plan, methodology or standardized baseline

First site visit was conducted by the VVB on 26/02/2020. But the 2nd site visit of the VVB could not be conducted after 3 years of the first visit due to circumstances beyond the control of the project developer and the project owner. So, the project developer has submitted a deviation request on 13 November 2023 to extend the 3 years' time constraint to 3 years and 9 months between two consequent site visits.

Then the project has obtained a partial deviation approval on 28/11/2023 from Gold Standard. As per Approved Deviation#579; The project is therefore only allowed to submit request for issuance of ERs and SDG impacts for a three-year retroactive period from the latest VVB site visit date. As the VVB Site visit has been conducted on 19/02/2024 for the first monitoring period. The first monitoring period has been applied from 01/03/2021 to 31/12/2023 as in-line with the approved DEV#579.

B.2.2. Corrections

N/A

B.2.3. Changes to start date of crediting period

N/A

B.2.4. Permanent changes from the Design Certified monitoring plan, applied methodology or applied standardized baseline

N/A

B.2.5. Changes to project design of approved project

N/A

SECTION C. DESCRIPTION OF MONITORING SYSTEM APPLIED BY THE PROJECT

The monitoring methodology is based on directly measuring the amount of landfill gas captured and destroyed at the flare platform(s) and the electricity generating unit(s) to determine the quantities, as shown in Figure 1. The monitoring plan provides for continuous measurement of the quantity and quality of LFG flared. The main variables that need to be determined are the quantity of Volumetric flow of the gaseous stream in the hour h on a dry basis ($V_{t,db}$) and the quantity of methane used to generate electricity ($LFG_{electricity,y}$). The methodology also measures the energy generated by the use of LFG ($EC_{BL,y}$).

From the monitoring methodology, it could be seen that there are the following main variables to be measured:

Table 3: Summary of Monitoring Plan

S.no.	Parameter	Description
1	$V_{t,db}$	The volumetric flow of the gaseous stream in the hour h on a dry basis (Nm ³)
2	$F_{CH_4,sentflare,y}$	Amount of methane in LFG which is sent to the flare in year y
3	$F_{CH_4,EL,y}$	Amount of methane in LFG which is sent to the genset for electricity generation in year y
4	$V_{CH_4,t,db}$	The volumetric flow of CH ₄ in time interval on a dry basis (Nm ³)
5	W_{CH_4}	Methane fraction in the landfill gas
6	$EC_{BL,y}$	Net electricity delivered to the grid

Other than the fixed gas flow and pressure measurement equipment present in boosters, portable flow meters, pressure meters, and gas analysers were employed to ensure more reliable monitoring of the process. Whenever there seems to be a problem in one of the fixed measurement equipment, portable devices are employed to measure the relevant parameter.

Mass flow of methane in the residual gaseous is determined by calculation. The amount of landfill gas combusted in generators is determined by calculations. Methane fraction in the total gas is depicted by Gas Analyser Project Emissions from flaring are calculated. The thermocouple depicts the temperature in the exhaust gas of the enclosed flare.

Table 4: Measurement devices

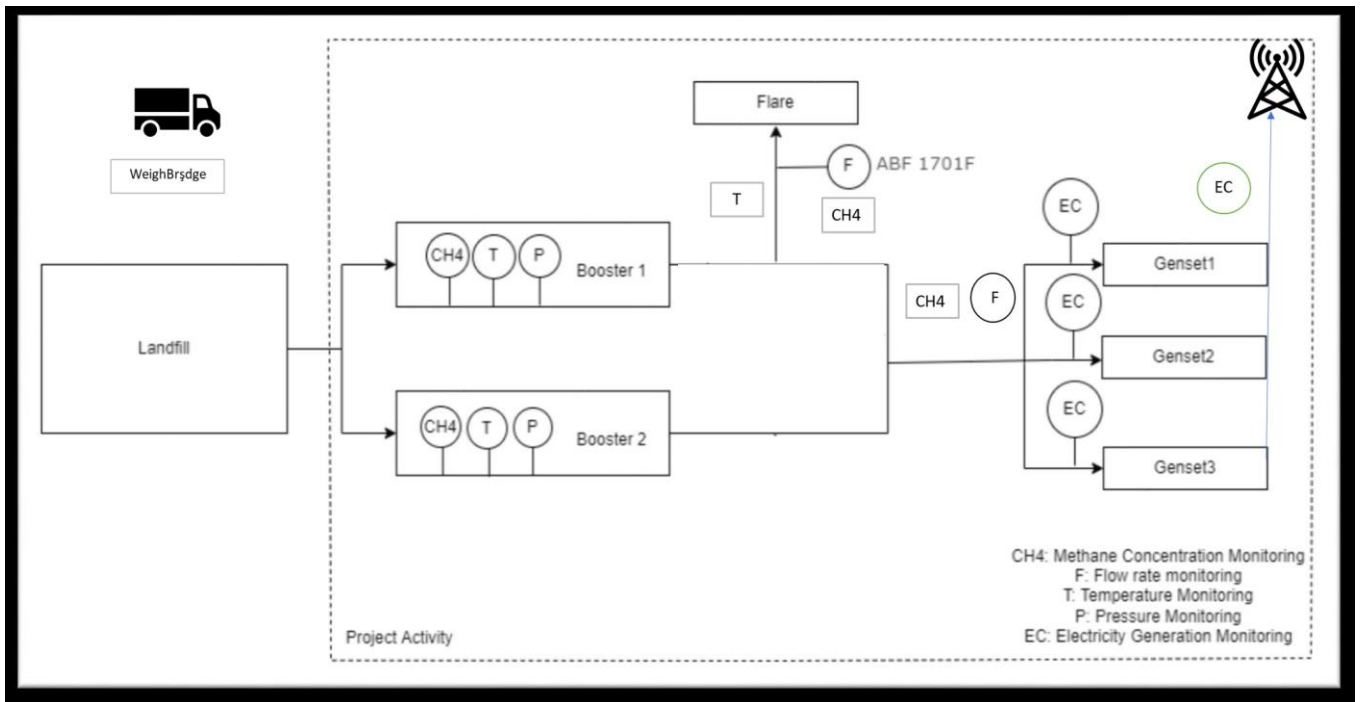
MEASUREMENT EQUIPMENT						
MEASUREMENT EQUIPMENT	MODEL	MANUFACTURER	SERIAL NO.	ACCURACY	CALIBRATION FREQUENCY	DATE of CALIBRATION
Gas Analyser 1	SSM-100BIOGAS	MRU	80942	2%-3% OF FULL SCALE	10 years	29/05/2018
Weighbridge	LL2	TUNAYLAR	17657	80.000KG $\pm$ 50KG	2 Years	09/12/2021 and 14/03/2023
Flow meter 1	ORIFICE PLATE - DCMD200016CS	TECNOVA HT	16218-FE-01	2%-3% OF FULL SCALE	10 years	8/05/2018
Flowmeter 2	ORIFICE PLATE - DCMD200016CS	TECNOVA HT	16218-FE-02	2%-3% OF FULL SCALE	10 years	8/05/2018
Pressure meter 1	FKCT22V5AKCYA 2YY	FUJI ELECTRIC	AIC5385F	0.065% OF FULL SCALE	10 years	29/05/2018
Pressure meter 2	FKCT22V5AKCYA 2YY	FUJI ELECTRIC	AIC616F	0.065% OF FULL SCALE	10 years	29/05/2018
Thermocouple 1	TC 1XK AISI 446 D.21X650	CONVECO	ADK13G*21000650	IEC60584 CLASSE 1	10 years	3/10/2018
Thermocouple 2	TC 1XK AISI 446 D.21X650	CONVECO	ADK13G*21300450	IEC60584 CLASSE 1	10 years	3/10/2018
ELECTRICITY METER 1 (MAIN)	LANDISGYR ZG405CR4	LANDIS+GYR	40761750	IEC-EN 60687 0.5 class	10 years	11/10/2018
ELECTRICITY METER 2 (SPARE)	LANDISGYR ZG405CR4	LANDIS +GYR	40761749	IEC-EN 60687 0.5 class	10 years	11/10/2018
ELECTRICITY METER 3 INSTALLED INSTEAD OF ELECTRICITY METER WITH SERIAL 40761750	LANDISGYR ZG405CR4	LANDIS+GYR	50714836	IEC-EN 60687 0.5 class	10 years	6/11/2020

The Project's net amount of electricity supplied to the grid is determined by the primary and secondary electricity measurement devices by EPIAŞ. There are two electricity meters as main and backup. But the main electricity meter with serial number 40761750 has been changed by SEDAS Electricity Distribution Company with the electricity meter with serial number 50714836 on 06/11/2020 due to malfunctioning of call button which has no effect on the remote readings of the electricity meter. Since the calibration of the meters is valid

for ten years, there was no additional calibration conducted during this Monitoring Period. Moreover, the project owner has no control over the electricity meters, which means they can't perform any change on the electricity meters. Sole control over the electricity meters is on SEDAS Electricity Distribution Company. The meters are annually controlled for accuracy and sealed by the SEDAS Electricity Distribution Company. SEDAS is responsible for monitoring and ensuring that the measurement devices satisfy the requirements. SEDAS is also responsible for the calibration of the measurement devices. In case of any detected problem (e.g. failure of one of the measurement devices, inconsistency between the readings of the primary and the backup meter etc.), the plant manager in the name of the Project owner is responsible for coordinating the necessary maintenance and calibration procedure with the SEDAS.

Responsibilities for the data processing and management lie with SEKAY. Therefore, they established a VER team. This team is responsible for monitoring all data required to estimate emission reductions.

Figure 1: Monitoring Scheme



EPIAS stores the power generation data. The website of EPIAS (<https://www.epias.com.tr/uzlastirma/aylik-uzlastirma-bildirimsureci/>) is accessible by the Project owner with their unique user ID and password. Once accessed, the Project owners can retrieve electricity generation and consumption data. The Project owner uses the same data for invoicing purposes. The electricity generation data are reported on a monthly basis.

Data Processing and collection

The monitoring equipment and other plant equipment are connected to a Programmable Logic Controller (PLC), which collects all the monitoring data and sends them to the SCADA system so that the operator can read the main parameters in real-time. The PLC archives reading values in a database which is accessible through the SCADA interface. Monitored data can be read and downloaded with the SCADA system for reporting purposes. Moreover, these electronic records are backed-up in a separate computer. The main source for landfill gas data is the Project activity's PLC-SCADA system. The system automatically reads measurement devices and records data on hard drives. The PLC system records meter readings at pre-determined intervals, as specified in the CDM monitoring manual. This data is used to calculate the total emission reductions.

1) Flow measurements

Gas flow is measured by flow meters, including the flow into the flare, generators and the total flow. These parameters are required to be normalized at 0°C and 1 atm, using actual gas temperature and pressure data to be measured with temperature and pressure transmitters. These in-built transmitters are integrated into each flow meter and equipped with a flow computer so that the values sent to the SCADA system have already been normalized (converted to normal cubic meters). Therefore, temperature and pressure data at each flowmeter do not need to be separately monitored. Methane content in the gas is measured by a gas analyser that is connected to the PLC-SCADA system.

2) Gas Quality and efficiency of the flare

An enclosed flare unit determines methane destruction with an inbuilt flame detection unit. The project emissions from flaring and emission reductions from the destruction of LFG have been monitored at this point. The readings have been taken and recorded internally by compatible and proper measurement devices automatically with high data quality. The measured parameters are automatically converted to dry- basis and normal conditions by the PLC system. The instruments monitor parameters continuously.

The concentration of methane and oxygen in the landfill gas stream and the exhaust gas of the flare are the parameters that are essential for the calculation of emission reductions and the safe and efficient operation of the system.

The concentration of methane and oxygen in the landfill gas stream is controlled by a common sample line installed in the main collection system piping and measured continuously by gas analyser to measure methane, oxygen and carbon dioxide each. Although compensation for temperature and pressure is not required for the methane and oxygen sensors, the sensors are designed to operate within specified temperature and pressure conditions.

The concentration of methane and oxygen in the exhaust gas stream is monitored by a common sample line installed in the upper section of the flare.

Calibration: Analysers are periodically calibrated according to the manufacturers and regulations on "Metering and Testing of Metering Systems"³ of the Ministry of Science, Industry and Technology recommendation. Calibration equipment will provide +/- 1% accuracy by volume.

3) Electricity Generation:

The electricity generation data is stored by EPIAS, the financial settlement centre of TEİAŞ (the national grid operator). The website of EPIAS (<https://www.epias.com.tr/uzlastirma/>) is accessible by the Project owner with their ID used for control and checks and for invoicing purposes. The electricity generation data is reported on a monthly basis. The procedure involves the following tasks:

- Accessing the website of EPIAS (<https://www.epias.com.tr/uzlastirma/>),
- Obtaining the electricity generation and consumption reports
- Store the data in electronic version on the computer of Her Enerji on the site
- Issue invoices to TEİAŞ based on the data published in EPIAS.

SECTION D. DATA AND PARAMETERS

D.1. Data and parameters fixed ex ante or at renewal of crediting period

Relevant SDG Indicator	SDG13 Climate Action Target: 13.3 Improve education, awareness-raising and human and institutional capacity on climate change mitigation, adaptation, impact reduction and early warning Indicator: 13.3.1 Number of countries that have integrated mitigation, adaptation, impact reduction and early warning into primary, secondary and tertiary curricula
Data/Parameter	GWP _{CH4}
Unit	tCO ₂ e/tCH ₄
Description	Global warming potential of CH ₄
Source of data	IPCC Fifth Assessment Report: AR5

³ http://www.sanayi.gov.tr/download/osgm/olcu_aletleri_muayene_yonetmelik.zip (page 2)

	https://www.ipcc.ch/site/assets/uploads/2018/02/WG1AR5_Chapter08_FINAL.pdf
Value(s) applied	28
Choice of data or measurement methods and procedures	Default value. No measurement methods and procedures are necessary.
Purpose of data/parameter	To calculate baseline emissions due to methane from the SWDS
Additional comments	

Relevant SDG Indicator	SDG13 Climate Action Target: 13.3 Improve education, awareness-raising and human and institutional capacity on climate change mitigation, adaptation, impact reduction and early warning Indicator: 13.3.1 Number of countries that have integrated mitigation, adaptation, impact reduction and early warning into primary, secondary and tertiary curricula
Data/Parameter	ρ CH ₄ , n
Unit	kg/m ³
Description	Density of methane gas at reference conditions
Source of data	Default Value of TOOL06 (https://cdm.unfccc.int/methodologies/PAMethodologies/tools/am-tool-06-v4.0.pdf/history_view)
Value(s) applied	0.716
Choice of data or measurement methods and procedures	Default value at reference conditions
Purpose of data/parameter	Determination of the methane mass flow of the residual gas
Additional comments	No additional comments

Relevant SDG Indicator	SDG13 Climate Action Target: 13.3 Improve education, awareness-raising and human and institutional capacity on climate change mitigation, adaptation, impact reduction and early warning Indicator: 13.3.1 Number of countries that have integrated mitigation, adaptation, impact reduction and early warning into primary, secondary and tertiary curricula
-------------------------------	--

Data/Parameter	Φ		
Unit	-		
Description	Default value for the model correction factor to account for model uncertainties		
Source of data	"Methodological Tool: Emissions from solid waste disposal sites" (Version 06.0.0) https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-04-v6.0.1.pdf		
Value(s) applied	0.75		
	Default values for the model correction factor	Humid/wet conditions	Dry conditions
	Application A	0.75	0.75
	Application B	0.85	0.80
Choice of data or measurement methods and procedures	Default value for the model correction factor to account for model uncertainties for Application A		
Purpose of data/parameter	To calculate baseline emissions due to methane from the SWDS		
Additional comments	No additional comment		

Relevant SDG Indicator	SDG13 Climate Action Target: 13.3 Improve education, awareness-raising and human and institutional capacity on climate change mitigation, adaptation, impact reduction and early warning Indicator: 13.3.1 Number of countries that have integrated mitigation, adaptation, impact reduction and early warning into primary, secondary and tertiary curricula		
Data/Parameter	OX		
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	2006 IPCC Guidelines for National Greenhouse Gas Inventories, Vol. 5 Waste, Table 3.2. (https://www.ipcc-nggip.iges.or.jp/public/2006gl/vol5.html)		
Value(s) applied	0.1		
Choice of data or measurement methods and procedures	As the landfill was covered by soil, the default value for oxidation could be applied. Default value. No measurement methods and procedures are necessary.		
Purpose of data/parameter	To calculate baseline emissions due to methane from the SWDS		

Additional comments	-
----------------------------	---

Relevant SDG Indicator	SDG13 Climate Action Target: 13.3 Improve education, awareness-raising and human and institutional capacity on climate change mitigation, adaptation, impact reduction and early warning Indicator: 13.3.1 Number of countries that have integrated mitigation, adaptation, impact reduction and early warning into primary, secondary and tertiary curricula
Data/Parameter	F
Unit	-
Description	Fraction of methane in the SWDS gas (volume fraction)
Source of data	2006 IPCC Guidelines for National Greenhouse Gas Inventories, Vol. 5 Waste, (https://www.ipcc-nggip.iges.or.jp/public/2006gl/vol5.html)
Value(s) applied	0.5
Choice of data or measurement methods and procedures	Default value. No measurement methods and procedures are necessary.
Purpose of data/parameter	To calculate baseline emissions due to methane from the SWDS
Additional comments	No Additional Comments

Relevant SDG Indicator	SDG13 Climate Action Target: 13.3 Improve education, awareness-raising and human and institutional capacity on climate change mitigation, adaptation, impact reduction and early warning Indicator: 13.3.1 Number of countries that have integrated mitigation, adaptation, impact reduction and early warning into primary, secondary and tertiary curricula
Data/parameter	$DOC_{f,default}$
Unit	Weight fraction
Description	Default value for the fraction of degradable organic carbon (DOC) in MSW that decomposes in the SWDS
Source of data	IPCC 2006 Guidelines for National Greenhouse Gas Inventories (https://www.ipcc-nggip.iges.or.jp/public/2006gl/vol5.html)
Value(s) applied	0.5
Choice of data or Measurement methods and procedures	Default value
Purpose of data	To calculate baseline emissions due to methane from the SWDS

Additional comment	-
---------------------------	---

Relevant Indicator	SDG	SDG13 Climate Action Target: 13.3 Improve education, awareness-raising and human and institutional capacity on climate change mitigation, adaptation, impact reduction and early warning Indicator: 13.3.1 Number of countries that have integrated mitigation, adaptation, impact reduction and early warning into primary, secondary and tertiary curricula
Data/parameter		MCFdefault
Unit		-
Description		Methane correction factor
Source of data		IPCC 2006 Guidelines for National Greenhouse Gas Inventories (https://www.ipcc-nggip.iges.or.jp/public/2006gl/vol5.html)
Value(s) applied		1
Choice of data or Measurement methods and procedures		The project site is anaerobic managed solid waste disposal site which has controlled placement of waste and cover material.
Purpose of data		To calculate baseline emissions due to methane from the SWDS
Additional comment		-

Relevant Indicator	SDG	SDG13 Climate Action Target: 13.3 Improve education, awareness-raising and human and institutional capacity on climate change mitigation, adaptation, impact reduction and early warning Indicator: 13.3.1 Number of countries that have integrated mitigation, adaptation, impact reduction and early warning into primary, secondary and tertiary curricula
Data/parameter		DOC_j
Unit		-
Description		Fraction of degradable organic carbon in the waste type j (weight fraction)
Source of data		IPCC 2006 Guidelines for National Greenhouse Gas Inventories (adapted from Volume 5, Tables 2.4 and 2.5)

Value(s) applied	For MSW, the following values for the different waste types j should be applied: Default values for DOC_j <table border="1"> <thead> <tr> <th>Waste type j</th><th>DOC_j (% wet waste)</th></tr> </thead> <tbody> <tr> <td>Wood and wood products</td><td>43</td></tr> <tr> <td>Pulp, paper and cardboard (other than sludge)</td><td>40</td></tr> <tr> <td>Food, food waste, beverages and tobacco (other than sludge)</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 waste</td><td>0</td></tr> </tbody> </table>	Waste type j	DOC_j (% wet waste)	Wood and wood products	43	Pulp, paper and cardboard (other than sludge)	40	Food, food waste, beverages and tobacco (other than sludge)	15	Textiles	24	Garden, yard and park waste	20	Glass, plastic, metal other inert waste	0
Waste type j	DOC_j (% wet waste)														
Wood and wood products	43														
Pulp, paper and cardboard (other than sludge)	40														
Food, food waste, beverages and tobacco (other than sludge)	15														
Textiles	24														
Garden, yard and park waste	20														
Glass, plastic, metal other inert waste	0														
Choice of data or Measurement methods and procedures	The percentages listed in table above are based on wet waste basis which are concentrations in the waste as it is delivered to the SWDS.														
Purpose of data	To calculate baseline emissions due to methane from the SWDS														
Additional comment	-														

Relevant Indicator	SDG	SDG13 Climate Action Target: 13.3 Improve education, awareness-raising and human and institutional capacity on climate change mitigation, adaptation, impact reduction and early warning Indicator: 13.3.1 Number of countries that have integrated mitigation, adaptation, impact reduction and early warning into primary, secondary and tertiary curricula
Data/parameter		k_j
Unit		1/yr
Description		Decay rate for the waste type j
Source of data		IPCC 2006 Guidelines for National Greenhouse Gas Inventories (adapted from Volume 5, Table 3.3) https://www.ipcc-nggip.iges.or.jp/public/2006gl/vol5.html

Value(s) applied						
	Waste type j		Boreal and Temperate (MAT$\leq$20°C)		Tropical (MAT$>$20°C)	
			Dry (MAP/ PET $<$ 1)	Wet (MAP/PET $>$ 1)	Dry (MAP $<$ 1000mm)	Wet (MAP $>$ 1000mm)
	Slowly degrading	Pulp, paper, cardboard (other than sludge), textiles	0.04	0.06	0.045	0.07
		Wood, wood products and straw	0.02	0.03	0.025	0.035
	Moderately degrading	Other (non-food) organic putrescible garden and park waste	0.05	0.10	0.065	0.17
	Rapidly degrading	Food, food waste, sewage sludge, beverages and tobacco	0.06	0.185	0.085	0.40
Choice of data or Measurement methods and procedures	Climatic conditions for Sakarya where project site located in: MAT – mean annual temperature: 14.6 °C MAP – Mean annual precipitation: 840.3 mm PET – potential evapotranspiration: 750 mm (max-annual) Therefore, Boreal and Temperate (MAT$\leq$20°C) and wet (MAP/PET $>$1) conditions are observed in the project site and Sources: https://www.mgm.gov.tr/veridegerlendirme/il-ve-ilceler-istatistik.aspx?m=SAKARYA					
Purpose of data	To calculate baseline emissions due to methane from the SWDS					
Additional comment	-					

Relevant Indicator	SDG	SDG13 Climate Action Target: 13.3 Improve education, awareness-raising and human and institutional capacity on climate change mitigation, adaptation, impact reduction and early warning Indicator: 13.3.1 Number of countries that have integrated mitigation, adaptation, impact reduction and early warning into primary, secondary and tertiary curricula
Data/parameter		nPJ
Unit		Dimensionless
Description		Efficiency of the LFG capture system that is installed in the project activity
Source of data		-
Value(s) applied		default value of 50 per cent
Choice of data or Measurement methods and procedures		Technical specifications of the LFG capture system to be installed is not available so a default value of 50 per cent is used.
Purpose of data		To calculate baseline emissions due to methane from the SWDS
Additional comment		-

Relevant Indicator	SDG	SDG7 Affordable and Clean Energy Target: 7.2 By 2030, increase substantially the share of renewable energy in the global energy mix Indicator: 7.2.1 Renewable energy share in the total final energy consumption
Data/parameter		$F_{Ci,y}$
Unit		m ³ for gas and ton for others
Description		Amount of fuel type i consumed in the project electricity system in year y (2016, 2017, 2018)
Source of data		TEİAŞ; https://webapi.teias.gov.tr/file/c5515d5d-db06-4446-87bd-584603173283?download
Value(s) applied		Please see Appendix 3 in the registered PD. 18,954.1 22,954.9 19,568.1
Choice of data or Measurement methods and procedures		TEİAŞ is publicly owned transmission company which publishes official statistics about electricity generation and distribution.
Purpose of data		To calculate baseline emissions due to electricity generation
Additional comment		-

Relevant Indicator	SDG	SDG7 Affordable and Clean Energy Target: 7.2 By 2030, increase substantially the share of renewable energy in the global energy mix Indicator: 7.2.1 Renewable energy share in the total final energy consumption
Data/parameter		NCV_{i,y}
Unit		TJ/million m3 for Natural Gas and TJ/k ton for others
Description		Net calorific value (energy content) of fuel type i in year y (2016, 2017, 2018)
Source of data		Calculations based on data of TEİAŞ for heating values of fuels consumed in thermal plants and FCI,y: https://webapi.teias.gov.tr/file/2bc10d2a-056b-4ef4-809f-c7f7bfdd1bf7?download
Value(s) applied		Please see Appendix 4 in the registered PD.
Choice of data or Measurement methods and procedures		TEİAŞ is publicly owned transmission company which publishes official statistics about electricity generation and distribution.
Purpose of data		To calculate baseline emissions due to electricity generation
Additional comment		-

Relevant Indicator	SDG	SDG7 Affordable and Clean Energy Target: 7.2 By 2030, increase substantially the share of renewable energy in the global energy mix Indicator: 7.2.1 Renewable energy share in the total final energy consumption
Data/parameter		EF_{CO₂,m,i,y}
Unit		tCO ₂ /GJ
Description		CO ₂ emission factor of fuel type i in year y
Source of data		IPCC default values at the lower limit of the uncertainty at a 95 per cent confidence interval as provided in table 1.4 of Chapter1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories https://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/2_Volume2/V2_1_Ch1_Introduction.pdf

Value(s) applied	Please see the Table 10.	
	Fuel Type	Effective CO2 emission factor (tCO₂/GJ)
	Imported Coal	0.0895
	Lignite	0.0909
	Natural Gas	0.0543
Choice of data or Measurement methods and procedures	There is no official information on the fuel specific default emission factor in Turkey. Therefore, IPCC values have been applied as referred in the "Tool to calculate the emission factor for an electricity system (V 07.0)"	
Purpose of data	To calculate baseline emissions due to electricity generation	
Additional comment	-	

Relevant Indicator	SDG	SDG7 Affordable and Clean Energy Target: 7.2 By 2030, increase substantially the share of renewable energy in the global energy mix Indicator: 7.2.1 Renewable energy share in the total final energy consumption								
Data/parameter	EG _y									
Unit	MWh									
Description	Net electricity generated in the project electricity system in year y (2016, 2017, 2018)									
Source of data	Calculations based on data of TEİAŞ for energy generation, consumption and loses https://webapi.teias.gov.tr/file/09f91243-aa67-48ec-b092-86f9a18f04cc?download									
Value(s) applied	<table><tr><td>2016</td><td>2017</td><td>2018</td></tr><tr><td>261,936.8</td><td>284,257.5</td><td>290,502.2</td></tr></table>			2016	2017	2018	261,936.8	284,257.5	290,502.2	
2016	2017	2018								
261,936.8	284,257.5	290,502.2								
Choice of data or Measurement methods and procedures	TEİAŞ is publicly owned transmission company which publishes official statistics about electricity generation and distribution. Net electricity production for each type of fuel is calculated by using gross- net production and import data.									
Purpose of data	To calculate baseline emissions due to electricity generation									
Additional comment	No Additional Comments									

Relevant Indicator	SDG	SDG7 Affordable and Clean Energy Target: 7.2 By 2030, increase substantially the share of renewable energy in the global energy mix Indicator: 7.2.1 Renewable energy share in the total final energy consumption									
Data/parameter		$\eta_{m,y}$									
Unit		-									
Description		Average net energy conversion efficiency of power unit m in year y									
Source of data		The default values provided in in Table 2, Appendix of TOOL09: "Determining the baseline efficiency of thermal or electric energy generation systems" https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-09-v2.0.pdf									
Value(s) applied		Please see table 10 <table><tr><th>Fuel Type</th><th>Average Efficiency ($\eta_{m,y}$)</th></tr><tr><td>Imported Coal</td><td>50.00%</td></tr><tr><td>Lignite</td><td>50.00%</td></tr><tr><td>Natural Gas</td><td>62.00%</td></tr></table>		Fuel Type	Average Efficiency ($\eta_{m,y}$)	Imported Coal	50.00%	Lignite	50.00%	Natural Gas	62.00%
Fuel Type	Average Efficiency ($\eta_{m,y}$)										
Imported Coal	50.00%										
Lignite	50.00%										
Natural Gas	62.00%										
Choice of data or Measurement methods and procedures		Largest default values are used to be conservative.									
Purpose of data		To calculate baseline emissions due to electricity generation									
Additional comment		-									

Relevant Indicator	SDG	SDG13 Climate Action Target: 13.3 Improve education, awareness-raising and human and institutional capacity on climate change mitigation, adaptation, impact reduction and early warning Indicator: 13.3.1 Number of countries that have integrated mitigation, adaptation, impact reduction and early warning into primary, secondary and tertiary curricula
Data/parameter		N flare,m
Unit		% (Percentange)

Description	Flare efficiency
Source of data	Default Value of TOOL06
Value(s) applied	80%
Choice of data or Measurement methods and procedures	Since option A conditions are met and enclosed flare could be defined low height, 80% has been chosen.
Purpose of data	Determination of project emissions from flaring
Additional comment	It has not been used as the flare was not used during this monitoring period

Relevant SDG Indicator	SDG7 Affordable and Clean Energy Target: 7.2 By 2030, increase substantially the share of renewable energy in the global energy mix Indicator: 7.2.1 Renewable energy share in the total final energy consumption
Data/Parameter	$EF_{grid,CM,y}$
Unit	tCO ₂ /MWh
Description	Combined Margin Emission factor for Turkish electricity grid
Source of data	Registered PDD
Value(s) applied	0.5045 tCO ₂ /MWh
Choice of data or measurement methods and procedures	As calculated in STEP 6 - Calculate the combined margin emissions factor in the registered PD
Purpose of data/parameter	Calculation of baseline and project emissions.
Additional comments	No Additional Comments

D.2 Data and parameters monitored

Relevant SDG Indicator	SDG13 Climate Action Target: 13.3 Improve education, awareness-raising and human and institutional capacity on climate change mitigation, adaptation, impact reduction and early warning Indicator: 13.3.1 Number of countries that have integrated mitigation, adaptation, impact reduction and early warning into primary, secondary and tertiary curricula
-------------------------------	--

Data / Parameter	LFG _{total,y}																																			
Unit	Nm ³																																			
Description	Total amount of landfill gas captured under Normal Temperature and Pressure in year y																																			
Source of data	Flow meters																																			
Value(s) applied	<table><tr><th>Year</th><th colspan="5">TOTAL LFG PRODUCTION Nm3</th></tr><tr><td>01/03/2021 31/12/2021</td><td colspan="5">14,512,928</td></tr><tr><td>01/01/2022 31/12/2022</td><td colspan="5">16,860,595</td></tr><tr><td>01/01/2023 31/12/2023</td><td colspan="5">16,636,902</td></tr><tr><td>Total</td><td colspan="5">48,010,425</td></tr></table>						Year	TOTAL LFG PRODUCTION Nm3					01/03/2021 31/12/2021	14,512,928					01/01/2022 31/12/2022	16,860,595					01/01/2023 31/12/2023	16,636,902					Total	48,010,425				
Year	TOTAL LFG PRODUCTION Nm3																																			
01/03/2021 31/12/2021	14,512,928																																			
01/01/2022 31/12/2022	16,860,595																																			
01/01/2023 31/12/2023	16,636,902																																			
Total	48,010,425																																			
Measurement methods and procedures	<table><tr><th>MODEL</th><th>MANUFACTURER</th><th>SERIAL NO.</th><th>ACCURACY</th><th>CALIBRATION FREQUENCY</th><th>DATE of CALIBRATION</th></tr><tr><td>ORIFICE PLATE - DCMD2000 16CS</td><td>TECNOVA HT</td><td>1621 8-FE-01 1621 8-FE-02</td><td>2%-3% OF FULL SCALE</td><td>10 years</td><td>8/05/2018</td></tr></table>						MODEL	MANUFACTURER	SERIAL NO.	ACCURACY	CALIBRATION FREQUENCY	DATE of CALIBRATION	ORIFICE PLATE - DCMD2000 16CS	TECNOVA HT	1621 8-FE-01 1621 8-FE-02	2%-3% OF FULL SCALE	10 years	8/05/2018																		
MODEL	MANUFACTURER	SERIAL NO.	ACCURACY	CALIBRATION FREQUENCY	DATE of CALIBRATION																															
ORIFICE PLATE - DCMD2000 16CS	TECNOVA HT	1621 8-FE-01 1621 8-FE-02	2%-3% OF FULL SCALE	10 years	8/05/2018																															
Monitoring frequency	Continuous measurement by the flowmeters in real time. (Measurement every minute aggregated to hourly measurement)																																			
QA/QC procedures	Maintenance and calibration of flow meters is carried out according to the instructions of the manufacturer and legal requirements.																																			
Purpose of data	To calculate baseline and project emissions due to methane avoidance																																			
Additional comment	-																																			

Relevant SDG Indicator	SDG13 Climate Action Target: 13.3 Improve education, awareness-raising and human and institutional capacity on climate change mitigation, adaptation, impact reduction and early warning Indicator: 13.3.1 Number of countries that have integrated mitigation, adaptation, impact reduction and early warning into primary, secondary and tertiary curricula																	
Data / Parameter	LFG_{flare,y}																	
Unit	Nm ³																	
Description	Total amount of landfill gas flared under Normal Temperature and Pressure in year y																	
Source of data	Flow meters installed by Project Investor at flare pipe																	
Value(s) applied	<table><tr><th>Year</th><th>Flare Nm3</th></tr><tr><td>01/03/2021 – 31/12/2021</td><td>0,0</td></tr><tr><td>01/01/2022 – 31/12/2022</td><td>0,0</td></tr><tr><td>01/01/2023 – 31/12/2023</td><td>0,0</td></tr><tr><td>Total</td><td>0,0</td></tr></table>						Year	Flare Nm3	01/03/2021 – 31/12/2021	0,0	01/01/2022 – 31/12/2022	0,0	01/01/2023 – 31/12/2023	0,0	Total	0,0		
Year	Flare Nm3																	
01/03/2021 – 31/12/2021	0,0																	
01/01/2022 – 31/12/2022	0,0																	
01/01/2023 – 31/12/2023	0,0																	
Total	0,0																	
Measurement methods and procedures	Measured by flow meters. The data will be aggregated regularly (monthly-yearly) <table><tr><th>MODEL</th><th>MANUFACTURER</th><th>SERIAL NO.</th><th>ACCURACY</th><th>CALIBRATION FREQUENCY</th><th>DATE of CALIBRATION</th></tr><tr><td>ORIFICE PLATE - DCMD2000 16CS</td><td>TECNOVA HT</td><td>16218-FE-02</td><td>2%-3% OF FULL SCALE</td><td>10 years</td><td>8.05.2018</td></tr></table>						MODEL	MANUFACTURER	SERIAL NO.	ACCURACY	CALIBRATION FREQUENCY	DATE of CALIBRATION	ORIFICE PLATE - DCMD2000 16CS	TECNOVA HT	16218-FE-02	2%-3% OF FULL SCALE	10 years	8.05.2018
MODEL	MANUFACTURER	SERIAL NO.	ACCURACY	CALIBRATION FREQUENCY	DATE of CALIBRATION													
ORIFICE PLATE - DCMD2000 16CS	TECNOVA HT	16218-FE-02	2%-3% OF FULL SCALE	10 years	8.05.2018													
Monitoring frequency	Continuous measurement by the flowmeters in real time every second aggregated to hourly daily and monthly measurements																	
QA/QC procedures	Maintenance and calibration of flow meters is carried out according to the instructions of the manufacturer or legal requirements.																	
Purpose of data	To calculate baseline and project emissions due to methane avoidance																	

Additional comment	-
---------------------------	---

Relevant SDG Indicator	SDG13 Climate Action Target: 13.3 Improve education, awareness-raising and human and institutional capacity on climate change mitigation, adaptation, impact reduction and early warning Indicator: 13.3.1 Number of countries that have integrated mitigation, adaptation, impact reduction and early warning into primary, secondary and tertiary curricula																							
Data / Parameter	LFG _{electricity,y}																							
Unit	Nm ³																							
Description	Total amount of landfill gas combusted in the gas generator under Normal Temperature and Pressure in year y																							
Source of data	Flow meters installed by Project Investor at gas generator pipe																							
Value(s) applied	<table><tr><th>Year</th><th>TOTAL LFG PRODUCTION Nm3</th><th>Flare Nm3</th><th>Total LFG combusted in the gas generator</th></tr><tr><td>01/03/2021 – 31/12/2021</td><td>14,512,928</td><td>0,0</td><td>14,512,928</td></tr><tr><td>01/01/2022 – 31/12/2022</td><td>16,860,595</td><td>0,0</td><td>16,860,595</td></tr><tr><td>01/01/2023 – 31/12/2023</td><td>16,636,902</td><td>0,0</td><td>16,636,902</td></tr><tr><td>Total</td><td>48,010,425</td><td>0,0</td><td>48,010,425</td></tr></table>				Year	TOTAL LFG PRODUCTION Nm3	Flare Nm3	Total LFG combusted in the gas generator	01/03/2021 – 31/12/2021	14,512,928	0,0	14,512,928	01/01/2022 – 31/12/2022	16,860,595	0,0	16,860,595	01/01/2023 – 31/12/2023	16,636,902	0,0	16,636,902	Total	48,010,425	0,0	48,010,425
Year	TOTAL LFG PRODUCTION Nm3	Flare Nm3	Total LFG combusted in the gas generator																					
01/03/2021 – 31/12/2021	14,512,928	0,0	14,512,928																					
01/01/2022 – 31/12/2022	16,860,595	0,0	16,860,595																					
01/01/2023 – 31/12/2023	16,636,902	0,0	16,636,902																					
Total	48,010,425	0,0	48,010,425																					
Measurement methods and procedures	Measured by flow meters. The data will be aggregated regularly (monthly-yearly) for each gas generator. <table><tr><th>MODEL</th><th>MANUFACTURER</th><th>SERIAL NO.</th><th>ACCURACY</th><th>CALIBRATION FREQUENCY</th><th>DATE of CALIBRATION</th></tr><tr><td>ORIFICE PLATE - DCMD2000 16CS</td><td>TECNOVA HT</td><td>16218-FE-02</td><td>2%-3% OF FULL SCALE</td><td>10 years</td><td>8/05/2018</td></tr></table>					MODEL	MANUFACTURER	SERIAL NO.	ACCURACY	CALIBRATION FREQUENCY	DATE of CALIBRATION	ORIFICE PLATE - DCMD2000 16CS	TECNOVA HT	16218-FE-02	2%-3% OF FULL SCALE	10 years	8/05/2018							
MODEL	MANUFACTURER	SERIAL NO.	ACCURACY	CALIBRATION FREQUENCY	DATE of CALIBRATION																			
ORIFICE PLATE - DCMD2000 16CS	TECNOVA HT	16218-FE-02	2%-3% OF FULL SCALE	10 years	8/05/2018																			
Monitoring frequency	Continuous measurement by the flowmeters in real time.																							

QA/QC procedures	Maintenance and calibration of flow meters is carried out according to the instructions of the manufacturer or legal requirements.
Purpose of data	To calculate baseline emissions due to methane avoidance
Additional comment	-

Relevant SDG Indicator	SDG13 Climate Action Target: 13.3 Improve education, awareness-raising and human and institutional capacity on climate change mitigation, adaptation, impact reduction and early warning Indicator: 13.3.1 Number of countries that have integrated mitigation, adaptation, impact reduction and early warning into primary, secondary and tertiary curricula											
Data / Parameter	F _{CH4,RG,m}											
Unit	tCH4/y											
Description	Mass flow of methane in the residual gas in the minute m (Dry Basis)											
Source of data	Calculated based on the flow of LFG and the concentration of methane in the LFG that is sent to the gensets											
Value(s) applied	<table><tr><th>PERIOD</th><th>FCH4, EL, y (tCH4)</th></tr><tr><td>01/03/2021 – 31/12/2021</td><td>5,741</td></tr><tr><td>01/01/2022 – 31/12/2022</td><td>6,670</td></tr><tr><td>01/01/2023 – 31/12/2023</td><td>6,582</td></tr><tr><td>TOTAL</td><td>18,993</td></tr></table>		PERIOD	FCH4, EL, y (tCH4)	01/03/2021 – 31/12/2021	5,741	01/01/2022 – 31/12/2022	6,670	01/01/2023 – 31/12/2023	6,582	TOTAL	18,993
PERIOD	FCH4, EL, y (tCH4)											
01/03/2021 – 31/12/2021	5,741											
01/01/2022 – 31/12/2022	6,670											
01/01/2023 – 31/12/2023	6,582											
TOTAL	18,993											

Measurement methods and procedures	Measured by flow meters and gas analysers. The data will be aggregated regularly (monthly-yearly) for each gas generator.						
	MEASUREMENT EQUIPMENT	MODEL	MANUFACTURER	SERIAL NO.	ACCURACY	CALIBRATION FREQUENCY	DATE of CALIBRATION
	Gas Analyser 1	SWG-100BIOGAS	MRU	80942	2%-3% OF FULL SCALE	10 years	29/05/2018
	Gas Analyser 2 Manual	OPTIMA 7	MRU	315854	2%-3% OF FULL SCALE	10 years	17/09/2021
	Flow meter 1	ORIFICE PLATE - DCMD200016CS	NOVA HT	16218-FE-01	2%-3% OF FULL SCALE	10 years	8/05/2018
	Flowmeter 2	ORIFICE PLATE - DCMD200016CS	TECN OVA HT	16218-FE-02	2%-3% OF FULL SCALE	10 years	8/05/2018
Monitoring frequency	Continuous measurement by the flowmeters and gas analyser in real time.						
QA/QC procedures	Maintenance and calibration of flow meters and gas analysers is carried out according to the instructions of the manufacturer or legal requirements. If the main analyser is not working use the 2 nd analyser (OPTIMA 7)						
Purpose of data	To calculate baseline emissions due to methane avoidance						
Additional comment	-						

Relevant SDG Indicator	SDG13 Climate Action Target: 13.3 Improve education, awareness-raising and human and institutional capacity on climate change mitigation, adaptation, impact reduction and early warning Indicator: 13.3.1 Number of countries that have integrated mitigation, adaptation, impact reduction and early warning into primary, secondary and tertiary curricula
-------------------------------	--

Data / Parameter	W _{CH4}						
Unit	%						
Description	Methane fraction in the landfill gas						
Source of data	Gas analyzers						
Value(s) applied		Year		CH ₄ % (Methane %)			
		01/03/2021 – 31/12/2021		55.25			
		01/01/2022 – 31/12/2022		53.98			
		01/01/2023 – 31/12/2023		54.43			
		Average		54.55			
Measurement methods and procedures	Methane concentration is controlled by means of regular sampling.						
	MEASUREMENT EQUIPMENT	MODEL	MANUFACTURER	SERIAL NO.	ACCURACY	CALIBRATION FREQUENCY	DATE of CALIBRATION
	Gas Analyser 1	SWG-100 BIOGAS	MRU	80942	2%-3% OF FULL SCALE	10 years	29/05/2018
	Gas Analyser 2 Manual	OPTIMA 7	MRU	315854	2%-3% OF FULL SCALE	10 years	17/09/2021
Monitoring frequency	Continuous measurement by the gas analyzer in real time.						
QA/QC procedures	Maintenance and calibration gas analysers is carried out according to the instructions of the manufacturer or legal requirements. If the main analyser is not working use the 2 nd analyser (OPTIMA 7)						
Purpose of data	To calculate baseline and project emissions due to methane avoidance						

Additional comment	-
---------------------------	---

Relevant SDG Indicator	SDG13 Climate Action Target: 13.3 Improve education, awareness-raising and human and institutional capacity on climate change mitigation, adaptation, impact reduction and early warning Indicator: 13.3.1 Number of countries that have integrated mitigation, adaptation, impact reduction and early warning into primary, secondary and tertiary curricula					
Data / Parameter	PE_{flare,y}					
Unit	t CO _{2e}					
Description	Project emissions from flaring of the residual gas stream in year y					
Source of data	Flowmeters and efficiency value of equipment manufacturer or default values stated in the tool "Project emissions from flaring" Version 03.0					
Value(s) applied	0					
Measurement methods and procedures	The values measured by flow meters will be used for calculation. The data will be aggregated regularly (monthly-yearly)					
Monitoring frequency	Continuous measurement by the flow meters in real time.					
	MODEL	MANUFACTURER	SERIAL NO.	ACCURACY	CALIBRATION FREQUENCY	DATE of CALIBRATION
	ORIFICE PLATE - DCMD20001 6CS	TECNOVA HT	16218 -FE- 02	2%-3% OF FULL SCALE	10 years	8/05/2018
QA/QC procedures	Maintenance and calibration of flow meters is carried out according to the instructions of the manufacturer or legal requirements.					
Purpose of data	To calculate project emissions due to methane avoidance					

Additional comment	During this monitoring period there was no flow recorded to the flare.
---------------------------	--

Relevant SDG Indicator	SDG13 Climate Action Target: 13.3 Improve education, awareness-raising and human and institutional capacity on climate change mitigation, adaptation, impact reduction and early warning Indicator: 13.3.1 Number of countries that have integrated mitigation, adaptation, impact reduction and early warning into primary, secondary and tertiary curricula												
Data / Parameter	V _{i,t,db}												
Unit	m ³ gas i/m ³ dry gas												
Description	Volumetric fraction of greenhouse gas i in a time interval t on a dry basis												
Source of data	PLC (Measured based on the flow of LFG)												
Value(s) applied	<table><tr><th>Year</th><th>Nm³</th></tr><tr><td>01/03/2021 – 31/12/2021</td><td>14,512,928</td></tr><tr><td>01/01/2022 – 31/12/2022</td><td>16,860,595</td></tr><tr><td>01/01/2023 – 31/12/2023</td><td>16,636,902</td></tr><tr><td>Total</td><td>48,010,425</td></tr></table>	Year	Nm ³	01/03/2021 – 31/12/2021	14,512,928	01/01/2022 – 31/12/2022	16,860,595	01/01/2023 – 31/12/2023	16,636,902	Total	48,010,425		
Year	Nm ³												
01/03/2021 – 31/12/2021	14,512,928												
01/01/2022 – 31/12/2022	16,860,595												
01/01/2023 – 31/12/2023	16,636,902												
Total	48,010,425												

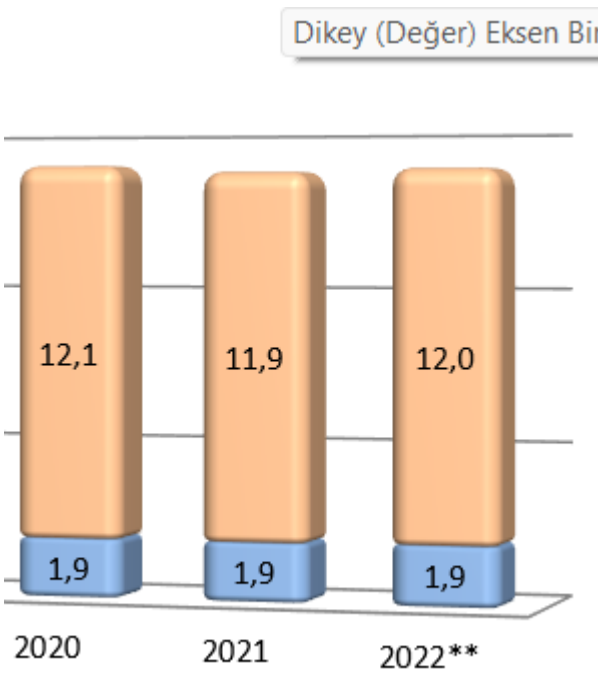
Measurement methods and procedures	The values are measured by flow meters will be used for calculation. The data will be aggregated regularly (monthly-yearly) <table><tr><th>MODEL</th><th>MANUFACTURER</th><th>SERIAL NO.</th><th>ACCURACY</th><th>CALIBRATION FREQUENCY</th><th>DATE of CALIBRATION</th></tr><tr><td>ORIFICE PLATE - DCMD200 016CS</td><td>TECNOVA HT</td><td>1621 8-FE-02</td><td>2%-3% OF FULL SCALE</td><td>10 years</td><td>8/05/2018</td></tr></table>	MODEL	MANUFACTURER	SERIAL NO.	ACCURACY	CALIBRATION FREQUENCY	DATE of CALIBRATION	ORIFICE PLATE - DCMD200 016CS	TECNOVA HT	1621 8-FE-02	2%-3% OF FULL SCALE	10 years	8/05/2018
MODEL	MANUFACTURER	SERIAL NO.	ACCURACY	CALIBRATION FREQUENCY	DATE of CALIBRATION								
ORIFICE PLATE - DCMD200 016CS	TECNOVA HT	1621 8-FE-02	2%-3% OF FULL SCALE	10 years	8/05/2018								
Monitoring frequency	Measured by a flow meter, which is a turbine system with a special internal shell for biogas, completed with a volume checker and a fiscal converter of frequency. Continuous measurement and hourly recording aggregated to monthly and yearly.												
QA/QC procedures	The instrument is calibrated regularly utilizing a certified span gas on site until the unit is no longer able to be calibrated on site. Should the instrument not be able to be calibrated then the instrument sensor is replaced.												
Purpose of data	Calculation of Baseline Emissions												
Additional comment	Temperature and pressure are automatically measured, and LFG volumes are expressed in normalised cubic meters												

Relevant SDG Indicator	SDG13 Climate Action Target: 13.3 Improve education, awareness-raising and human and institutional capacity on climate change mitigation, adaptation, impact reduction and early warning Indicator: 13.3.1 Number of countries that have integrated mitigation, adaptation, impact reduction and early warning into primary, secondary and tertiary curricula
Data / Parameter	Operation of the power plant
Unit	h

Description	Operational duration of the power plant
Source of data	Data log system of the power plant
Value(s) applied	24,864
Measurement methods and procedures	Plant assumed to be operating when there is a gas flow to the engines and electricity is fed to the national grid.
Monitoring frequency	Monitored annually
QA/QC procedures	Maintenance and calibration of the equipment is carried out according to the instructions of the manufacturer or legal requirements.
Purpose of data	This information is not used in any calculation.
Additional comment	Plant has received and produced electricity and no major breakdown occurred

Relevant SDG Indicator	SDG13 Climate Action Target: 13.3 Improve education, awareness-raising and human and institutional capacity on climate change mitigation, adaptation, impact reduction and early warning Indicator: 13.3.1 Number of countries that have integrated mitigation, adaptation, impact reduction and early warning into primary, secondary and tertiary curricula
Data / Parameter	$T_{EG,m}$
Unit	°C
Description	Temperature in the exhaust gas of the enclosed flare in minute m
Source of data	Measured by means of a temperature meter (Thermocouple)
Value(s) applied	0
Measurement methods and procedures	Thermocouple. Measure the temperature of the exhaust gas in the flare by an appropriate temperature measurement equipment. Measurements outside the operational temperature specified by the manufacturer may indicate that the flare is not functioning correctly and may require maintenance.

Monitoring frequency	Monitored annually
QA/QC procedures	Maintenance and calibration of the temperature measurement equipment is carried out according to the instructions of the manufacturer or legal requirements.
Purpose of data	To calculate baseline and project emissions due to methane avoidance
Additional comment	During this monitoring period there was no flow recorded to the flare thus temperature measurements show only outside temperature.

Relevant SDG Indicator/ Safeguarding Principle	SDG13 Climate Action Target: 13.3 Improve education, awareness-raising and human and institutional capacity on climate change mitigation, adaptation, impact reduction and early warning Indicator: 13.3.1 Number of countries that have integrated mitigation, adaptation, impact reduction and early warning into primary, secondary and tertiary curricula												
Data / Parameter	$TDL_{k,y}$												
Unit	-												
Description	Average technical transmission and distribution losses for providing electricity to source k in year y												
Source of data	https://webim.teias.gov.tr/file/0b1fe67b-fec9-4d9c-9fcb-89bff9949c07?download  <table><caption>Data from Source of data chart</caption><thead><tr><th>Year</th><th>Orange Series (Top)</th><th>Blue Series (Bottom)</th></tr></thead><tbody><tr><td>2020</td><td>12,1</td><td>1,9</td></tr><tr><td>2021</td><td>11,9</td><td>1,9</td></tr><tr><td>2022**</td><td>12,0</td><td>1,9</td></tr></tbody></table>	Year	Orange Series (Top)	Blue Series (Bottom)	2020	12,1	1,9	2021	11,9	1,9	2022**	12,0	1,9
Year	Orange Series (Top)	Blue Series (Bottom)											
2020	12,1	1,9											
2021	11,9	1,9											
2022**	12,0	1,9											

Value(s) applied	13.9%(Avg. value from 2020-2022 ⁴)
Measurement methods and procedures	TEİAŞ is publicly owned transmission company which publishes official statistics about electricity <i>generation</i> and distribution.
Monitoring frequency	Once each verification
QA/QC procedures	Check TEİAŞ latest published data for the monitoring period
Purpose of data	Calculation of Project emissions from Electricity Consumption
Additional comments	The average of the total network losses of the years 2020,2021 and 2022 respectively are 14, 13.8 and 13.9, gives a result of 13.9 as a percentage.

Relevant SDG Indicator/ Safeguarding Principle	SDG13 Climate Action Target: 13.3 Improve education, awareness-raising and human and institutional capacity on climate change mitigation, adaptation, impact reduction and early warning Indicator: 13.3.1 Number of countries that have integrated mitigation, adaptation, impact reduction and early warning into primary, secondary and tertiary curricula
Data / Parameter	FC _{i,j,y}
Unit	t/year
Description	Quantity of diesel combusted for auxiliary purposes
Source of data	Working hour of genset and per hour fuel consumption
Value(s) applied	For 2021: 0.0 tons For 2022: 0.0 tons For 2023: 0.0 tons Total for the Monitoring Period: 0.0 tons
	Fuel consumption is calculated using a mass balance approach based on the quantity of fuel purchased and the difference in the quantity held in stock.
Monitoring frequency	Fuel consumption is calculated using a working hour of genset and per hour consumption of diesel Measuring frequency is done per monitoring period.
QA/QC procedures	Cross-check with operation hours of the emergency genset.
Purpose of data	Calculation of Project emissions from fossil fuel usage.
Additional comments	Fuel usage for auxiliary combustion only. There has been no usage of the generator during this monitoring period.

⁴ Value is not available for 2023 till date 25/05/2024.

Relevant SDG Indicator	SDG7 Affordable and Clean Energy Target: 7.2 By 2030, increase substantially the share of renewable energy in the global energy mix Indicator: 7.2.1 Renewable energy share in the total final energy consumption																							
Data / Parameter	$EG_{PJ,y}$																							
Unit	MWh/yr																							
Description	Quantity of net electricity (difference between the total quantity of electricity generated by the power plant/unit and electricity consumption, “Delivery amount - Withdrawal amount”) generation that is produced and fed into the grid as a result of the implementation of the project activity in year y																							
Source of data	Electricity meter measurement at project site																							
Value(s) applied	93,136 MWh (Net electricity export) <table><tr><th>Period</th><th>EGPJ,y (MWh)</th><th>Import (MWh)</th><th>Export (MWh)</th></tr><tr><td>01/03/2021 – 31/12/2021</td><td>29,603</td><td>3</td><td>29,606</td></tr><tr><td>01/01/2022 – 31/12/2022</td><td>32,702</td><td>2</td><td>32,704</td></tr><tr><td>01/01/2023 – 31/12/2023</td><td>30,831</td><td>3</td><td>30,834</td></tr><tr><td>TOTAL</td><td>93,136</td><td>8</td><td>93,144</td></tr></table>				Period	EGPJ,y (MWh)	Import (MWh)	Export (MWh)	01/03/2021 – 31/12/2021	29,603	3	29,606	01/01/2022 – 31/12/2022	32,702	2	32,704	01/01/2023 – 31/12/2023	30,831	3	30,834	TOTAL	93,136	8	93,144
Period	EGPJ,y (MWh)	Import (MWh)	Export (MWh)																					
01/03/2021 – 31/12/2021	29,603	3	29,606																					
01/01/2022 – 31/12/2022	32,702	2	32,704																					
01/01/2023 – 31/12/2023	30,831	3	30,834																					
TOTAL	93,136	8	93,144																					

Measurement methods and procedures	The quantity of net electricity generation supplied to the grid by the project plant will be recorded and reported based on the TEIAS meters at the project site.						
	MEASURE MENT EQUIPME NT	MOD EL	MANUF ACTURE R	SERIAL NO.	ACCUR ACY	CALI BRA T ION FRE QUE NC Y	DATE of CALIBR ATION
	ELECTRICI TY METER 1 (MAIN)	LAND ISGY R ZG40 5CR4	LANDIS +GYR	40761750	IEC-EN 60687 0.5 class	10 years	11/10/2 018
	ELECTRICI TY METER 2 (SPARE)	LAND ISGY R ZG40 5CR4	LANDIS +GYR	40761749	IEC-EN 60687 0.5 class	10 years	11/10/2 018
	ELECTRICI TY METER 3 INSTALLE D INSTEAD OF ELECTRIC TY METER WITH SERIAL 40761750	LAND ISGY R ZG40 5CR4	LANDIS +GYR	50714836	IEC-EN 60687 0.5 class	10 years	6/11/20 20
Monitoring frequency	The quantity of net electricity generation supplied to the grid is measured continuously and recorded at least monthly.						

QA/QC procedures	According to the Article 2 of the 'Communiqué Regarding the Meters to be used in the Electricity Market '⁵ (Communiqué): <i>'The meters to be used in the electricity market shall be compliant with the standards of Turkish Standards Institute or IEC and have obtained "Type and System Approval" certificate from the Ministry of Trade and Industry.'</i> Therefore, Ministry of Science, Industry and Technology (Ministry) is responsible from control and calibration of the meters. Paragraph b) of the Article 9 of the 'Regulation of Metering and Testing of Metering Systems'⁶ (Regulation) of Ministry states that: <i>' b) Periodic tests of meters of electricity, water, coal gas, natural gas and current and voltage transformers are done every 10 years.'</i> Therefore, periodic calibration of the meters will be done every 10 years. Also, according to Article 67 (page 20) of this regulation, the calibration shall be done in calibration stations which have been tested and approved by Ministry of Trade and Industry. Article 10-d) of Communiqué requires the meters shall be three phase four wire and Article 64 of Regulation clearly states how calibration shall be performed for this kind of meters. According to Article 3 of System Usage Agreement⁷ done by SEKAY and TEIAS; other than periodic tests, if a party alleges the meters are not working appropriately tests of the meters will be done by presence of both parties. If, after controls, it is seen that the meter is not working appropriately, the measurements of reserve meters are taken into account beginning from date both meters are reading the same (page 3, 2-c) As above mentioned, the data acquisition and management and quality assurance procedures that are anyway in place, no additional procedures have to be established for the monitoring plan.
Purpose of data	To measure the quantity of net electricity generation that is produced from a renewable energy source and fed into the grid
Additional comment	-

Relevant SDG Indicator/ Safeguarding Principle	7.2.1 "Renewable energy share in the total final energy consumption"
Data /	ECpJ,y

⁵ <http://www.epdk.org.tr/english/regulations/electric/meters.doc>, (page 6)

⁶ http://www.sanayi.gov.tr/download/osgm/olcu_aletleri_muayene_yonetmelik.zip (page 2)

⁷ <https://www.mevzuat.gov.tr/mevzuat?MevzuatNo=18985&MevzuatTur=7&MevzuatTertip=5>

	of EPIAS consist hourly electricity production and withdrawn from the grid • Since the meters are reading electricity supplied to the system and withdrawn from the system separately, the net electricity amount supplied to the grid will be calculated by electricity supplied minus electricity withdrawn which will be taken from monthly settlement notifications. Thus, with this procedure is monitored sufficient and no extra Monitoring has to be implemented. The above-described measurement method follows Article 81 of the official regulation "Electricity Market Balancing and Settlement Regulation"
Monitoring frequency	Continuously
QA/QC procedures	According to the Article 2 of the 'Communiqué Regarding the Meters to be used in the Electricity Market': 'The meters to be used in the electricity market shall be compliant with the standards of Turkish Standards Institute or IEC and have obtained "Type and System Approval" certificate from the Ministry of Trade and Industry.' Therefore, Ministry of Science, Industry and Technology (Ministry) is responsible from control and calibration of the meters. Paragraph b) of the Article 9 of the 'Regulation of Metering and Testing of Metering Systems' (Regulation) of Ministry states that: ' b) Periodic tests of meters of electricity, water, coal gas, natural gas and current and voltage transformers are done every 10 years.' Therefore, periodic calibration of the meters will be done every 10 years. Also, according to Article 67 (page 20) of this regulation, the calibration shall be done in calibration stations which have been tested and approved by Ministry of Trade and Industry. Article 10-d) of Communiqué requires the meters shall be three phase four wire and Article 64 of Regulation clearly states how calibration shall be performed for this kind of meters. According to Article 3 of System Usage Agreement done by SEKAY and TEIAS; other than periodic tests, if a party alleges the meters are not working appropriately tests of the meters will be done by presence of both parties. If, after controls, it is seen that the meter is not working appropriately, the measurements of reserve meters are taken into account beginning from date both meters are reading the same (page 3, 2-c) As above mentioned, the data acquisition and management and quality assurance procedures that are anyway in place, no additional procedures have to be established for the monitoring plan.
Purpose of data	Calculation of the project emissions
Additional comments	-

Relevant SDG Indicator	SDG11 Sustainable Cities and Communities Target: 11.6 By 2030, increase substantially the share of renewable energy in the global energy mix Indicator: 11.6.1 Proportion of urban solid waste regularly collected and with adequate final discharge out of total urban solid waste generated, by cities
Data / Parameter	W_x
Unit	tons
Description	Total amount of waste disposed in a SWDS in year x

Source of data	Measurements by project participants by a weighbridge and plant records.																				
Value(s) applied		Period		TOTAL MUNICIPAL SOLID WASTE ENTERED (Tonnes)																	
		01/03/2021 – 31/12/2021		220,044																	
		01/01/2022 – 31/12/2022		249,303																	
		01/01/2023 – 31/12/2023		308,896																	
		Total		778,243																	
Measurement methods and procedures	The garbage truck which carries municipal waste is weighed and printed receipts are filed.																				
Monitoring frequency	The total amount of waste is continuously measured and the data is aggregated at least annually.																				
QA/QC procedures	<table><tr><th>MEASURE MENT EQUIPME NT</th><th>MO DEL</th><th>MANU FACTU RER</th><th>SERI AL NO.</th><th>ACC URA CY</th><th>CALIBR AT ION FREQUE NC Y</th><th>DATE of CALIBR ATION</th></tr><tr><td>Weighbrid ge</td><td>LL2</td><td>TUNAY LAR</td><td>17657</td><td>80.0 00K G ± 50K G</td><td>2 Years</td><td>21/12/2 020 09/12/2 021 14/03/2 023</td></tr></table> Maintenance and calibration of weighbridges is carried out according to the instructions of the manufacturer or legal requirements.							MEASURE MENT EQUIPME NT	MO DEL	MANU FACTU RER	SERI AL NO.	ACC URA CY	CALIBR AT ION FREQUE NC Y	DATE of CALIBR ATION	Weighbrid ge	LL2	TUNAY LAR	17657	80.0 00K G ± 50K G	2 Years	21/12/2 020 09/12/2 021 14/03/2 023
MEASURE MENT EQUIPME NT	MO DEL	MANU FACTU RER	SERI AL NO.	ACC URA CY	CALIBR AT ION FREQUE NC Y	DATE of CALIBR ATION															
Weighbrid ge	LL2	TUNAY LAR	17657	80.0 00K G ± 50K G	2 Years	21/12/2 020 09/12/2 021 14/03/2 023															
Purpose of data	To measure municipal waste prevented to be used for electricity generation																				
Additional comment	-																				

D.3. Comparison of monitored parameters with last monitoring period

This is the 1st monitoring period; no last monitoring period can be compared.

Data/Parameter Value obtained in this monitoring period			Value obtained last monitoring period
LFG _{total,y} (Nm ³)	01/03/2021 – 31/12/2021	14,512,928	N/A
	01/01/2022 – 31/12/2022	16,860,595	
	01/01/2023 – 31/12/2023	16,636,902	
	Total	48,010,425	
LFG _{flare,y} (Nm ³)	01/03/2021 – 31/12/2021	0	N/A
	01/01/2022 – 31/12/2022	0	
	01/01/2023 – 31/12/2023	0	
	Total	0	
LFG _{electricity,y} (Nm ³)	01/03/2021 – 31/12/2021	14,512,928	N/A
	01/01/2022 – 31/12/2022	16,860,595	
	01/01/2023 – 31/12/2023	16,636,902	
	Total	48,010,425	
F _{CH4,RG,m} (tCH4/yr)	01/03/2021 – 31/12/2021	5,741	N/A
	01/01/2022 – 31/12/2022	6,670	
	01/01/2023 – 31/12/2023	6,582	
	TOTAL	8,993	
W _{CH4} (%)	01/03/2021 – 31/12/2021	55.25	N/A
	01/01/2022 – 31/12/2022	53.98	
	01/01/2023 – 31/12/2023	54.43	
	Average	54.55	
PE _{flare,y} (tCO ₂ e)	01/03/2021 – 31/12/2021	0	N/A
	01/01/2022 – 31/12/2022	0	
	01/01/2023 – 31/12/2023	0	
	01/03/2021 – 31/12/2021	0	
V _{i,t,db} (Nm ³)	01/03/2021 – 31/12/2021	14,512,928	N/A
	01/01/2022 – 31/12/2022	16,860,595	
	01/01/2023 – 31/12/2023	16,636,902	

	Total	48,010,425	
<i>h</i> (hours)	01/03/2021 – 31/12/2021	7,344	N/A
	01/01/2022 – 31/12/2022	8,760	
	01/01/2023 – 31/12/2023	8,760	
	TOTAL	24,864	
<i>T_{EG,m}</i> (°C)	01/03/2021 – 31/12/2021	0	N/A
	01/01/2022 – 31/12/2022	0	
	01/01/2023 – 31/12/2023	0	
	TOTAL	0	
<i>TDL_{k,y}</i> (%)	2020	%14	N/A
	2021	%13.8	
	2022	%13.9	
	AVERAGE	%13.9	
<i>FC_{i,j,y}</i> (Lt)	01/03/2021 – 31/12/2021	0	N/A
	01/01/2022 – 31/12/2022	0	
	01/01/2023 – 31/12/2023	0	
	TOTAL	0	
<i>EGPJ,y</i> (MWh)	01/03/2021 – 31/12/2021	29,606	N/A
	01/01/2022 – 31/12/2022	32,704	
	01/01/2023 – 31/12/2023	30,834	
	TOTAL	93,144	
<i>EC_{PJ,y}</i> (MWh)	01/03/2021 – 31/12/2021	3.00	N/A
	01/01/2022 – 31/12/2022	2.00	
	01/01/2023 – 31/12/2023	3.00	
	TOTAL	8.00	
<i>W_x</i> (Tonnes)	01/03/2021 – 31/12/2021	220,044	N/A
	01/01/2022 – 31/12/2022	249,303	
	01/01/2023 – 31/12/2023	308,896	
	Total	778,243	

D.4. Implementation of sampling plan

N/A

SECTION E. CALCULATION OF SDG IMPACTS

E.1. Calculation of baseline value or estimation of baseline situation of each SDG Impact

FOR SDG-13

Baseline emissions are calculated as per the consolidated Methodology ACM0001 version 19 and determined according to equation 1 and comprise the following sources:

- (A) Methane emissions from the SWDS in the absence of the project activity;
- (B) Electricity generation using fossil fuels or supplied by the grid in the absence of the project activity;

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

Where;

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

For the year 2021, between 1 March 2021 – 31 December 2021 from the ER Excel spreadsheet Emission Reductions section, we can see that $BE_{CH_4, 2021} = 144,682$ t CO₂e and $BE_{EC, 2021} = 14,936$ t CO₂e;

For the year 2022, from the ER Excel spreadsheet Emission Reductions section, we can see that $BE_{CH_4, 2022} = 168,087$ t CO₂e and $BE_{EC, 2022} = 16,499$ tCO₂e;

For the year 2023, from the ER Excel spreadsheet Emission Reductions section, we can see that $BE_{CH_4, 2023} = 165,856$ tCO₂e and $BE_{EC, 2023} = 15,555$ tCO₂e;

Electricity Production Component:

The total emission reductions from electricity production can be calculated with the results of the below-described equations. The emission reduction equals the baseline emissions minus project and leakage emissions. Leakage emissions in this project are considered to be negligible. The general equation is as follows:

$$ER_y = BE_y - PE_y \quad \text{Equation (2)}$$

Where:

ER_y	Emission reduction
BE_y	Baseline emissions
PE_y	Project emissions
y	Refers to a given period

Baseline emissions associated with electricity generation are calculated using the ACM0002 as described in the registered PD. According to paragraph 39 of ACM0002, baseline emissions include only CO2 emissions from electricity generation in fossil fuel fired power plants that are displaced due to the project activity.

The baseline emissions are to be calculated as follows:

$$BE_y = EG_{PJ,y} \times EF_{grid,CM,y} \quad \text{Equation}$$

Where:

- BE_y = Baseline emissions in year y (t CO2/yr)
- $EG_{PJ,y}$ = Quantity of net electricity generation that is produced and fed into the grid as a result of the implementation of the CDM project activity in year y (MWh/yr)
- $EF_{grid,CM,y}$ = Combined margin CO2 emission factor for grid connected power generation in year y calculated using the latest version of "Tool to calculate the emission factor for an electricity system" (t CO2/MWh)

Therefore, In the registered PD "Tool to calculate the emission factor for an electricity system" (V 07.0) is applied to calculate combined margin. The six steps, provided in the Methodological Tool are applied to calculate the combined margin (CM) emission factor in the registered PD as 0.5045 tCO₂e/MWh:

$$EF_{grid,CM,y} = 0.5045 \text{ tCO}_2\text{e/MWh}$$

Period	EGPJ,y (MWh) ⁸	EFgrid,y	BElectricity,y
01/03/2021 – 31/12/2021	29,606	0.5045	14,936
01/01/2022 – 31/12/2022	32,704	0.5045	16,499
01/01/2023 – 31/12/2023	30,834	0.5045	15,555
TOTAL	93,144	Total	46,990

⁸ Baseline emissions for electricity generation are calculated using export & project emissions are calculated separately adding transmission losses.

Methane Destruction Component:

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

$$BE_{CH_4,y} = (1 - OX_{top-layer})(F_{CH_4,PJ,y})GWP_{CH_4} \quad \text{(Equation 4)}$$

Where:

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

For example, for the year 2021, between 1 March 2021 – 31 December 2021 as we can see from the ER Excel spreadsheet;

$$BE_{CH_4, 2021} = (1 - 0.1) * (5,741) * 28 = 144,682 \text{ tCO}_2\text{e}$$

For the year 2022, as we can see from the ER Excel spreadsheet;

$$BE_{CH_4, 2022} = (1 - 0.1) * (6,670) * 28 = 168,087 \text{ tCO}_2\text{e}$$

For the year 2023, as we can see from the ER Excel spreadsheet;

$$BE_{CH_4, 2023} = (1 - 0.1) * (6,582) * 28 = 165,856 \text{ tCO}_2\text{e}$$

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

gas distribution network, as follows based on the UNFCCC Methodology ACM0001 Version 19: ' Flaring or use of landfill gas⁹:

$$F_{CH\ 4,\ PJ,\ y} = F_{CH\ 4\ flared,\ y} + F_{CH\ 4,\ EL,\ y} + F_{CH\ 4,\ HG,\ y} + F_{CH\ 4,\ NG,\ y} \quad (\text{Equation 5})$$

Where:

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

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

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

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

$F_{CH4,NG,y}$: Amount of methane in the LFG which is sent to the natural gas distribution network in year y (t CH₄/yr)

The amount of methane that is destroyed/ combusted in the project scenario during year y is determined by monitoring the quantity of methane actually flared and by monitoring the gas used to generate electricity and the total quantity of methane captured. There is neither methane used to generate thermal energy (HG) nor sent to the pipeline for feeding to the natural gas (NG) distribution network or flared.

Thus, $F_{CH4,\ PJ,\ y}$ will be calculated as follow.

$$F_{CH\ 4,\ PJ,\ y} = F_{CH\ 4\ flared,\ y} + F_{CH\ 4,\ EL,\ y} \quad (\text{Equation 6})$$

While flare efficiency could not be confirmed for each minute as there was no flow recorded during the monitoring period, the efficiency was added as "zero" to the calculation. As per Tool 06 Project Emissions from Flaring Version 03.0 Paragraph 22, taking efficiency as zero for enclosed flares is possible and conservative. Due to the fact

that flare efficiency is assumed to be zero $F_{CH_4, flared, y}$ becomes zero also. And $F_{CH_4, EL, y}$ becomes equal to $F_{CH_4, PJ, y}$.

For the year 2021, between 1 March 2021 – 31 December 2021, as we can see from the ER Excel spreadsheet;

$F_{CH_4, PJ, 2021} = 5,741$; $F_{CH_4, EL, 2021} = 5,741$ tCH₄ and $F_{CH_4, flared, 2021} = 0$ for the year of 2021.

For year 2022; $F_{CH_4, PJ, 2022} = 6,670$; $F_{CH_4, EL, 2022} = 6,670$ tCH₄ and $F_{CH_4, flared, 2022} = 0$ for the year of 2022.

For year 2023; $F_{CH_4, PJ, 2023} = 6,582$; $F_{CH_4, EL, 2023} = 6,582$ tCH₄ and $F_{CH_4, flared, 2023} = 0$ for the year of 2021.

Period	BE _{CH₄, PJ, y}	BE _{electricity, y}	BE _y
01/03/2021 – 31/12/2021	144,682	14,936	159,618
01/01/2022 – 31/12/2022	168,087	16,499	184,586
01/01/2023 – 31/12/2023	165,856	15,555	181,411
TOTAL	478,625	46,990	525,615

FOR SDG 7

There is no electricity generation in the baseline scenario in which SEKAY LFG is not being implemented.

The project's contribution to SDG 7 is determined via a simple calculation that provides the overall renewable energy generation fed into the grid. This approach is based on the following calculation:

The quantity of net electricity generation supplied by the project plant to the grid in the related year has been calculated by subtracting the value of "Electricity consumption from the grid (MWh)" from "Electricity supplied to the grid (MWh)"

Calculation of Electricity Generation of SEKAY LFG:

Net Electricity Generation of SEKAY LFG= Electricity supplied to the grid (MWh) - Electricity consumption from the grid (MWh)

Period	Electricity Supplied to the Grid (MWh)	Electricity Consumption from the Grid (MWh)	Quantity of net electricity generated (MWh)
01/03/2021 – 31/12/2021	29,606	3	29,603
01/01/2022 – 31/12/2022	32,704	2	32,702

01/01/2023 – 31/12/2023	30,834	3	30,831
TOTAL	93,144	8	93,136

FOR SDG 11

If this power plant has not been installed the municipality waste will continue to be dumped in the same area and no electricity generation from municipal waste would have been occurred.

Municipal solid waste of Sakarya is regularly collected by the municipality's garbage compactors and are discharged to the SEKAY LFG project site. Each garbage truck which carries municipal waste is weighed and printed receipts are filed at the entrance of the LFG project site. Data by truck plate is also recorded and aggregated monthly to follow up the waste entered in the project site. According to the weighbridge records the yearly aggregated data is as follows:

Period	TOTAL MUNICIPAL SOLID WASTE ENTERED (Tonnes)
01/03/2021 – 31/12/2021	220,044
01/01/2022 – 31/12/2022	249,303
01/01/2023 – 31/12/2023	308,896
Total	778,243

E.2. Calculation of project value or estimation of project situation of each SDG Impact

FOR SDG 13

Project activity does not include, distribution of compressed/liquefied LFG and supply of LFG to consumers through a dedicated pipeline. Therefore, the only project emission are emissions from consumption of electricity, consumption of fossil fuels due to the existence of a diesel generator for emergency situations and flaring of the residual gas due to the project activity.

$$PE_y = PE_{EC,y} + PE_{FC,y} + PE_{flare,y} \quad \text{(Equation 7)}$$

Whereas:

- PE_y = Project emissions in year y (t CO₂/yr)
- $PE_{EC,y}$ = Emissions from consumption of electricity due to the project activity in year y (t CO₂/yr)
- $PE_{FC,y}$ = Emissions from consumption of fossil fuels due to the project activity for purposes other than electricity
- $PE_{Flare,y}$ = Project emissions from flaring of the residual gas in year y (t CO₂/yr)

Project Emissions from Flaring

As there has been no flow of LFG recorded during this monitoring period and flare was not burnt, there has been no project emissions from flaring. Therefore

$$PE_{\text{flare}} = 0$$

Project Emissions from Consumption of Fossil Fuels

The only emission source for the fossil fuel consumption within the project boundary is the emergency diesel generator. As the diesel generator has not worked during this monitoring period; no project emissions from consumption of fossil fuel has been observed during this monitoring period. Therefore

$$PE_{\text{FC}} = 0$$

Project Emissions from Consumption of Electricity from the Grid due to Project Activity

According to the methodological tool "Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation (V 03.0)" to calculate emissions from consumption of electricity due to the project activity and this tool directs to the methodological tool "Tool to calculate the emission factor for an electricity system (V 07.0)"

"Tool to calculate the emission factor for an electricity system (V 07.0)" is applied in the above section to calculate the combined margin emission factor of the applicable electricity system for the calculations of baseline emissions. Since the electricity to be consumed is being supplied by the same grid that the generated electricity fed into, same e combined margin emission factor is being used to calculate the project emissions from electricity consumption.

Thus:

$$PEEC_{j,y} = \sum ECP_{j,j,y} \times EFEF_{j,y} \times (1 + TDL_{j,y}) \quad \text{(Equation 8)}$$

Where;

$PEEC_{j,y}$ = Project emissions from electricity consumption in year y (tCO₂/yr)

$ECP_{j,j,y}$ = Quantity of electricity consumed by the project electricity consumption source j in year y (MWh/yr)

$EFEF_{j,y}$ = Emission factor for electricity generation for source j in year y (tCO₂/MWh)

$TDL_{j,y}$ = Average technical transmission and distribution losses for providing electricity to source j in year y

According to the TEIAS data⁹ the average of the total network losses published of the last 3 years, (2020-2021 and 2022) respectively are 14, 13.8 and 13.9, gives a result of 13.9 as a percentage.

Thus;

$TDL_j = 13.9 \%$. and $EF_{grid,CM,y} = 0.5045$ tCO₂e/MWh and therefore PEEC_y is calculated as

Period	EC _{project,y} (MWh)	EF _{grid,CM,y}	TDL _{j,y} + 1	PEEC _y
01/03/2021 – 31/12/2021	3.00	0.5045	1.139	2
01/01/2022 – 31/12/2022	2.00	0.5045	1.139	2
01/01/2023 – 31/12/2023	3.00	0.5045	1.139	2
TOTAL	8.00		Total	6

E.3. Calculation of leakage

No leakage needs to be considered.

E.4. Calculation of net benefits or direct calculation for each SDG Impact

SDG	SDG Impact	Baseline estimate	Project estimate	Net benefit
13	Climate Action	0 tCO ₂ e	525,609 tCO ₂ e	525,609 tCO ₂ e
7	Affordable and Clean Energy	0 MWh	93,136 MWh	93,136 MWh
11	Sustainable Cities and Communities	0 Tonnes	778,243 Tonnes	778,243 Tonnes

⁹<https://webim.teias.gov.tr/file/01638a5d-94aa-484b-9c48-b4c86fa99469?download>

E.5. Comparison of actual SDG Impacts with estimates in approved PDD

SDG	Values estimated in ex ante calculation of approved PDD for this monitoring period	Actual values ¹⁰ achieved during this monitoring period
13	196,128 tCO ₂ e	525,609 tCO ₂ e
7	106,268 MWh	93,136 MWh
11	535,139 Tonnes	778,243 Tonnes

E.5.1. Explanation of calculation of value estimated ex ante calculation of approved PDD for this monitoring period

Estimated emission reduction in ex ante calculation of registered PDD Version 10 is 69,089 tCO₂e for 2021, 69,014 tCO₂e for 2022 and 69,193 tCO₂e for 2023. If the 2021 ER estimate is to be apportioned (306 days) along with the emissions of 2022 and 2023, the value comes out to be $69,089 \times (306/365) + 69,014 + 69,193 = 196,128$ tCO₂e and actual emission reduction achieved during this monitoring period is 525,609 (for 01/03/2021-31/12/2023). The actual emission reductions achieved during the monitoring period exceed the estimated values. The percentage of the difference between actual and estimated is +168%.

E.6. Remarks on increase in achieved SDG Impacts from estimated value in approved PDD

Period	BEy	EGPJ,y	TOTAL MUNICIPAL SOLID WASTE ENTERED (Tonnes)
01/03/2021 – 31/12/2021	176%	-6%	43%
01/01/2022 – 31/12/2022	167%	-13%	32%
01/01/2023 – 31/12/2023	162%	-18%	60%
Average (cumulative value for total MP)	168%	-12%	45%

¹⁰ Whenever emission reductions are capped, both the original and capped values used for calculations must be transparently reported. Use brackets to denote original values.

The actual value of emission reduction has been more than estimated in registered PDD; this was since ex-ante estimations are based on conservative default values such as the "collection efficiency" which by default is 50%, and a "correction factor" of 0.75 etc. These default values provide a rough ex-ante estimation that is impossible to match precisely with ex-post measuring results. If the default values of the correction factor (0.75) and collection efficiency (50%) were not applied, the FOD model would have resulted in approximately 518,112 tCO₂e for this crediting period. Additionally, higher LFG capture results from high quality and efficient piping systems laid in the waste, professional engineering design and operation, careful waste terracing and a low percentage of repairs.

Also, feasibility study conducted during registration was taken as a basis for the calculation of emission reductions considering that the landfill would accept the incoming municipal wastes till 2021 and some of the MSW will be directed to the Biogas Plant that has been built in 2021 as It has been decided by Sakarya Metropolitan Municipality to build a separate plant next to Sakarya LFG plant which is not included in the boundary of this project and some of the MSW will be directed to the Biogas Plant that has been built in 2021. However, upon Sakarya Metropolitan Municipality's decision and due to the delay of the biogas plant completion and additionally not effectively working of the biogas plant in years 2021,2022 and 2023 Landfill site accepted more MSW than the expected amount in the registered PD by %45 in total during this monitoring period.

SECTION F. SAFEGUARDS REPORTING

There is no assessment that has been 'potentially' answered or where requirements require regular re-assessment

SECTION G. STAKEHOLDER INPUTS AND LEGAL DISPUTES

G. 1. List all Inputs and Grievances which have been received via the Continuous Input and Grievance Mechanism together with their respective responses/mitigations.

The Stakeholder Feedback Round was held between the 17th of December 2019 and the 17th of April 2020. Also, during the validation site visit, DOE met with local people and the mukhtar of Taskısıgı to confirm a physical meeting during the stakeholder feedback round. During the stakeholder feedback round, the local people of Taskısıgı village and the mukhtar of the village were informed about the project, and their questions were responded. A logbook for the grievance mechanism

and all project documents was left to the mukhtar office. There has been no input received via the Continuous Input and Grievance Mechanism during the approximately four years. Moreover, during this Monitoring Period, local people and the mukhtar were interviewed and asked for their opinions and concerns about the project activity. No negative feedback was received from the locals and the mukhtar during this monitoring period.

G.2. Report on any stakeholder mitigations that were agreed to be monitored.

There were no mitigations agreed to be monitored with stakeholders during the validation process of the project activity.

G.3. Provide details of any legal contest that has arisen with the project during the monitoring period

No legal contest has arisen with the project during the monitoring period.

Revision History

Version	Date	Remarks
1.1	14 October 2020	Hyperlinked section summary to enable quick access to key sections Improved clarity on Key Project Information Section for POA monitoring Forward action request section Improved Clarity on SDG contribution/SDG Impact term used throughout Clarity on safeguard reporting Clarity on design changes Leakage section added for VER/CER projects Addition of Comparison of monitored parameters with last monitoring period Provision of an accompanying Guide to help the user understand detailed rules and requirements
1.0	10 July 2017	Initial adoption