BALIKESIR LANDFILL GAS (LFG) CAPTURE AND UTILIZATION PROJECT

Document Prepared by

BIO SOLUTIONS Yenilenebilir Enerji ve Danışmanlık Hizmetleri San. Ve Tic. Ltd. Şti

Project Title	*BALIKESİR LANDFILL GAS (LFG) CAPTURE AND UTILIZATION PROJECT*
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CONTENTS

1. PROJECT DETAILS

1.1 Summary Description of the Project

Balıkesir Landfill Gas (LFG) Capture and Utilization Project is being implemented by Landfill Enerji Sanayi ve Ticaret A.Ş. within the boundaries of Balıkesir Solid Waste Disposal Site (SWDS) in Balıkesir province in Turkey.

The proposed project activity has the installed capacity of 14.14 MWe/h[1].
It is planned to rehabilitate the SWDS that receives around 1,200 tons of municipal waste generated at Balıkesir province per day and to generate renewable electric power by capturing and utilizing landfill gas.

Whilst providing sustainable development benefits to the host communities and the host country, the proposed project activity will reduce greenhouse gas (GHG) emissions mainly by

- preventing GHG emissions, methane in particular, from being emitted directly to the atmosphere from waste at the Balıkesir SWDS that would be otherwise left to be decomposed;
- replacing the electricity that would have otherwise been generated by the national grid which is heavily dependent on fossil-fuel-based resources, through generating renewable energy and feeding it to the grid.

The project began to generate electricity on October 27th, 2019, which is regarded as the project start date.
This project adopts a renewal crediting period of 7 years. The expected average annual emission reductions are 334,913 tCO2eq/y. Accordingly, the project is expected to generate 2,344,393 tCO_{2eq} emissions reduction throughout the first crediting period.

1.2 Sectoral Scope and Project Type

The project falls into sectoral scope 01: Energy industries (renewable - / non-renewable sources) (Type I Component), sectoral scope 13: Waste handling and disposal (Type III Component). The project is not a grouped project.

1.3 Project Eligibility

The project is an LFG power generation, utilizing landfill gas (LFG), which consists mainly of methane, for electricity generation, which is eligible under the scope of the Version 4.1 of VCS Standard[2].

1.4 Project Design

[1] Please refer to the capacity statement document

[2] https://verra.org/wp-content/uploads/2021/04/VCS-Standard_v4.1.pdf

The project is not a grouped project.

1.5 Project Proponent

Organization name	BIOTREND Çevre ve Enerji Yatırımları Anonim Şirketi
Contact person	Zülfikar Koç
Title	Project Manager
Address	Kavacık Mahallesi, Ekinciler Caddesi, Ertürk Sokak No: 3/1, İç Kapı NO:1, Beykoz, 34810, İstanbul/TURKEY
Telephone	+90 538 403 84 61
Email	zulfikar.koc@biotrendenerji.com.tr

Organization name	BIO SOLUTIONS Yenilenebilir Enerji ve Danışmanlık Hizmetleri Sanayi ve Ticaret Limited Şirketi (LLC.)
Contact person	Adrian CADUFF
Title	Managing Partner
Address	AKDENİZ MAH. ŞEHİT FETHİBEY CAD. NO: 55 İÇ KAPI NO: 091 KONAK, 35210, İZMİR/TURKEY
Telephone	+905383384626
Email	a.caduff@biosolutions.com.tr

1.6 Other Entities Involved in the Project

NA

1.7 Ownership

The Electricity Generation License (EGL) issued by the Energy Market Regulatory Authority (EMRA) in Turkey on October 17th, 2019, established the project ownership to Balıkesir Landfill Gas (LFG) Capture and Utilization project to Landfill Enerji Sanayi ve Ticaret A.Ş. of which Biotrend Çevre ve Enerji Yatırımları A.Ş., as the project proponent, is a shareholder. These official documents are accordingly establishing the property and contractual right both in the plant and equipment that generate GHG emission reductions.

1.8 Project Start Date

The project start date is October 27th, 2019[3], as the operation start date on which the project began to eliminate the negative effects of municipal solid wastes on environment and human health, but also to generate emission reductions, to create economic value and to establish a sustainable waste management system.

1.9 Project Crediting Period

This project adopts the renewal crediting period of 7 years from 27/10/2019 to 26/10/2026 (the start and end dates are included).

1.10 Project Scale and Estimated GHG Emission Reductions or Removals

Project Scale	
Project	
Large project	√

Table 1. Estimated GHG emission Reductions or removals (tCO2e)

Year	Estimated GHG emission reductions or removals (tCO_2e)
1	207,155
2	259,740
3	289,390
4	325,491
5	376,155
6	419,203
7	467,259
Total estimated ERs	**2,344,393**

[3] Please refer to document "commission Certificate"

Total number of crediting years	7
Average annual ERs	**334,913**

1.11 Description of the Project Activity

For the purpose of sustainable waste management, it was planned to rehabilitate the Balıkesir Solid Waste Disposal Site (SWDS) Area and with the completion of the rehabilitation project by phases and the commissioning of the Landfill Gas Power Generating Plant. Electric power will be generated from landfill gas and a significant investment will be realized in terms of renewable energy resources and an ecological restoration.
The mechanical sorting of the waste is under planning and should be operating in 2024. In addition, the pilot composting plant is in planning as well. There is no distribution of Natural gas through pipelines nor trucks to end users and it is not used for heat generation. Figure 1 shows a simplified flow process chart of the Balıkesir Solid Waste Landfill Area and Electric Power Generation

Rehabilitation of Balıkesir Solid Waste Landfill Area and Electric Power Generation from Landfill Gas" work has been delivered by Balıkesir Metropolitan Municipality to Enerji Sanayi ve Ticaret A.Ş. on 31.05.2018 with site delivery protocol.

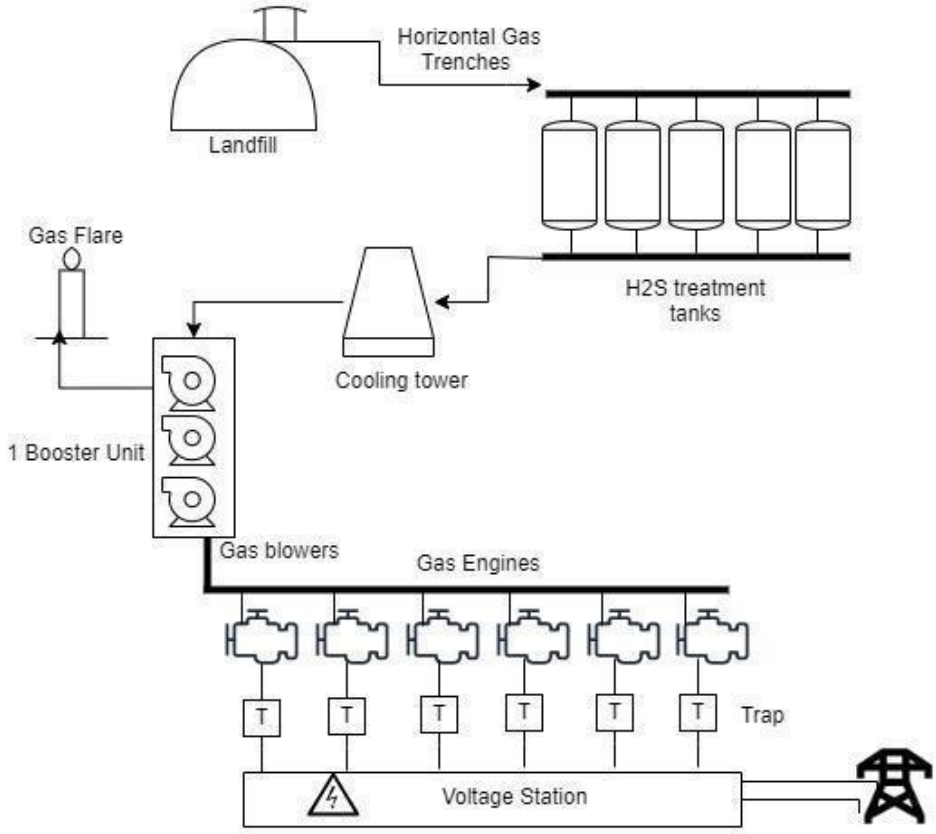


Figure 1. Simplified Flow process chart for the Balıkesir LFG Facility

The different units conforming the whole Balikesir LFG System are presented in the following sections:

a. Landfill gas collection area:

The process of power generation from landfill gas is composed of various phases. The landfill gas is collected in sanitary landfill areas. The collected landfill gases are absorbed by the blowers and transferred to gas cooling and gas cleaning unit of the facility.

Figure 2. Landfill Gas collection areas. Section a. area expansion for more waste depositing. Section b. Old waste deposition area (2005-2021)

b. Gas cooling and cleaning area

In the gas cleaning unit, landfill gas is processed and cleared of particles and moisture inside. The condensates (water) are sent to the water treatment plant of the municipality together with the leakage water. The cleaning unit is where the desulfurization of the gas takes place leaving the LFG with around 103 ppm of H2S.

c. Power generation by burning Landfill Gas in Internal combustion engines:

Out of 10 gas engines, 8 has been installed and another 2 will be commissioned by 2023. PP has planned 10 gas engines with an installed capacity of 1.414 MWe each, total capacity 14.14 MWe., where the LFG is burnt and converted into electric power. The generated power is fed into the Grid and it is further delivered to the consumers through power transmission lines.
Since the internal combustion engines require less gas flow rate and are easier to switch on and off when compared to the gas turbines, they are more suitable for landfill gas power plants. Mostly all of the landfill gas power plants in our country consist of internal combustion engines.

- **Internal Combustion Gas engines (ICE):**

Internal combustion engines are the most suitable method for the utilization in landfill gas power plants.
The engines installed in the project are Genset JGS 420 GS-L-L characterized by a high-power density and efficiency.

Table 2. Technical specifications Janbacher Genset JGS 420 GS-L-L[4]

Technical specifications	
Electrical output	1414 kW
Voltage	480V-13.8kV
Thermal Output	980-1.720kW
Thermal Efficiency	Up to 43%
Fuel Type	Flexible
	

- **Technology Units**

The technology to be employed will be the improvement of landfill gas collection and flaring, through the installation of an active recovery system composed by:

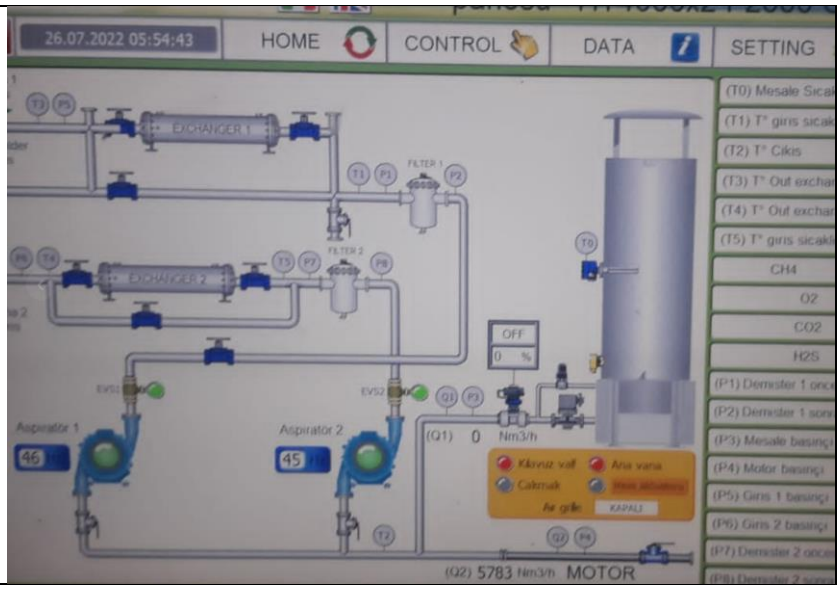
Table 3. List of Units

Number Installed	MACHINE AND EQUIPMENT (Type and Technical Properties)	Total Capacity (kW)
8	JENBACHER Gas Engine	11,312
8	Transformer (2000 kVA)	0
8	Alternator	1400
8	Turbo (ABB)	0
1	Transformer (internal need) (800 kVA) (Maksan)	0
1	Chiller (122.18 kW/h)	0
1	Chiller (255 kW/h)	0
1	Exchanger (3-4,5 bar)	0
1	Exchanger (1-9 bar)	0
3	Blower	3*55
1	CONVECO Booster and Flare Unit	0

[4] See document Balikesir Gas Engines Datasheet.

Table 4. Technical specification CONVECO S. r. l. Static closed chamber flare

Technical specifications	
Capacity range	Designed for combustion of 300 m3/h of biogas Flow capacity rage (50-2,500 m3/h)
Combustion temperatures	850-1100 °C
Flame retention	>0.3 sec
Operation	PLC
	Static closed chamber flare 
On-site installation of flare	

Control panel visualization from flare system.	

1.12 Project Location

The project will be implemented in totally 137 hectares of area within acceptance boundary of Balıkesir Solid Waste Landfill Facility in Balıkesir Province, Altıeylül District, Gökköy village.

The central coordinated of the project location are longitude of +27.853139 and latitude of +39.612806.

Figure 3. Location of the project. Source: Google Earth

Figure 4. Project Site. Source: Google Earth

Figure 5. Panoramic of the Balikesir project. Source: Google Earth

1.13 Conditions Prior to Project Initiation

The scenario existing prior to the start of the implementation of the project activity is:
Before the project activity, Solid Waste was dumped into landfill, unattended. Hence, greenhouse gases generated from solid waste were released directly into atmosphere. In addition, the quantity of electricity produced using LFG would have been produced by power plants connected to the national grid in Turkey which is heavily dependent on fossil fuel resources.
The baseline scenario is the same as the scenario existing prior to the start of the implementation of the project activity. Please refer to Section 3.4 (Baseline Scenario) for details.

1.14 Compliance with Laws, Statutes and Other Regulatory Frameworks

The two of main regulatory approvals for such project types to prove that they are in compliance with relevant laws, statues and regulatory frameworks in Turkey are the Environmental Impact Assessment and the Electricity Generation License whose obtainments are required for projects being in compliance with other relevant legal requirements. *Environmental Permit and License application will be made within the scope of Environmental Permits and Licenses Regulation and Communique on Mechanical Sorting, Biodrying and Biomethanization Facilities and Fermented Product Management.*

The project has obtained the approval of Environmental Impact Assessment (EIA) issued by the Ministry of Environment and Urbanization in Turkey on May 26th, 2008, and the Electricity Generation License (EGL) issued by the Energy Market Regulatory Authority (EMRA) in Turkey on October 17th, 2019.

Hence, the project is in compliance with laws, status and other regulatory frameworks.

1.15 Participation under Other GHG Programs

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

The project has not been registered or is seeking registration under any other GHG programs. A declaration has been submitted to the DOE by PP.

1.15.2 Projects Rejected by Other GHG Programs

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

1.16 Other Forms of Credit

1.16.1 Emissions Trading Programs and Other Binding Limits

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

1.16.2 Other Forms of Environmental Credit

The project has not sought or received another form of GHG-related credit or renewable energy certificates.

1.17 Sustainable Development Contributions

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

- Increasing labor demand of skilled labor for the fabrication, installation, operation and maintenance of the methane recovery and electricity generation system and thus, contributing to the sustainable economic growth of the region,
- Generating and dispatching electricity from a renewable and sustainable energy source to a grid nowadays reliant on fossil,
- Contributing to the climate change fight by reducing CH_4 emissions.
- Constituting a new, clean and efficient technology model for the disposal and handling of waste
- Improving air quality (i.e. by reducing odor) and therefore having positive effects on the local environment.

Nevertheless, it is still possible to note that the project will make positive contributions to at least three Sustainable Development Goals (SDGs). These are:

- **SDG Goal 7: Affordable and Clean Energy**

The proposed Project is a waste to power project that will generate renewable energy by capturing methane from municipal waste and utilizing it to produce thermal and electric energy through gas engine systems. By supplying renewable energy generated at the plant to the national grid, the proposed Project will contribute to increasing the share of renewable energy in the global energy mix and the proportion of the population with primary reliance on clean fuels and technology.

- **SDG Goal 8: Decent Work and Economic Growth**

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

- **SDG Goal 13: Climate Action**

The proposed project activity will reduce GHG emissions by capturing and utilizing methane, one of the most potent GHGs triggering climate change. It is estimated that the average annual emission reduction that the proposed Project will generate is around 324,625 tCO2eq.

1.18 Additional Information Relevant to the Project

Leakage Management

There are two possible leakage sources, one is the liquid leakage of the SWDS that is captured and sent to the water treatment facility of the municipality, and second, the CH4 emissions that are sent to flare in case of an emergency or an unlikely case of run out of the gas engines.

Commercially Sensitive Information

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

Further Information

NA

2. SAFEGUARDS

2.1 No Net Harm

The Environmental Impact Assessment (EIA) Report has been approved and issued by the Ministry of Environment and Urbanization in Turkey on May 26th, 2008. In accordance with the Turkish laws and regulations, EIA's approval shall be only made if a project subjected to the approval does not make any negative environmental and socio-economic impacts. Considering the fact that the proposed project activity already obtained EIA approval by the Ministry of Environment and Urbanization in Turkey, it is therefore possible to claim that there is no net harm linked to the project.

2.2 Local Stakeholder Consultation

It was decided by the Project Personnel to organize a local stakeholder consultation meeting to inform the stakeholders about technical and non-technical issues about the facility. Considering the cases due to the Covid-19 pandemic in the world, it was decided to hold the meeting online. The meeting date was determined as 30.09.2021.
Invitation has been sent to the stakeholders between 14-16 September 2021 via, newspaper, Email, notice at public place and personal invitations.

A few invitation samples are here:


Kuraklık alarmı...'Zeytinde az su isteyen yerli çeşitler tercih etmeliyiz

"Yeni sezonu büyük umutlarla karşılıyoruz"

Postam

AKIN: 'İKTİDARIN UYGULADIĞI EN İYİ POLİTİKA ZAM YAPMAK'

"VATANDAŞLAR LEHİNE TERCİH YAPIN"

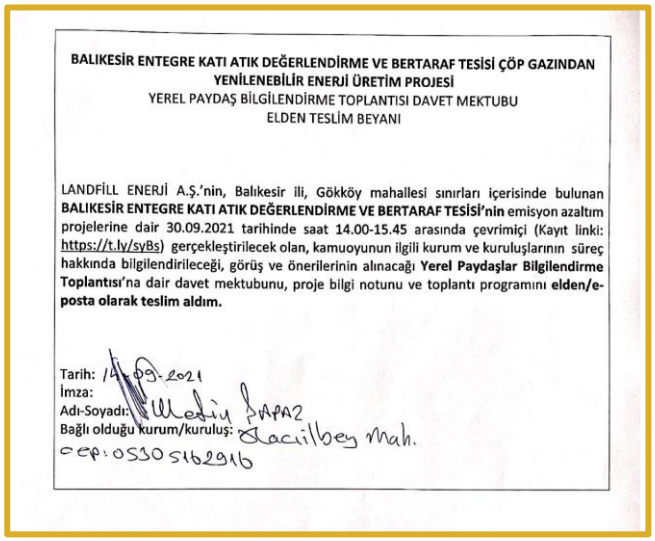
ÖZHASEKİ BALIKESİR'DE 220 BAŞKAN KÖRFEZ'DE BULUŞACAK

Özhaseki bugünden illeceğ yola çıktı!

Yücel Yılmaz'a ağır misafirler

1. Newspaper

2. At public place


BALIKESİR ENTEGRE KATI ATIK DEĞERLENDİRME VE BERTARAF TESİSİ ÇÖP GAZINDAN YENİLENEBİLİR ENERJİ ÜRETİM PROJESİ
YEREL PAYDAŞ BİLGİLENDİRME TOPLANTISI DAVET MEKTUBU
ELDEN TESLİM BEYANI

LANDFİLL ENERJİ A.Ş.'nin, Balıkesir ili, Gökköy mahallesi sınırları içerisinde bulunan **BALIKESİR ENTEGRE KATI ATIK DEĞERLENDİRME VE BERTARAF TESİSİ'nin** emisyon azaltım projelerine dair 30.09.2021 tarihinde saat 14.00-15.45 arasında çevrimiçi (Kayıt linki: https://t.ly/syBs) gerçekleştirilecek olan, kamuoyunun ilgili kurum ve kuruluşlarının süreç hakkında bilgilendirileceği, görüş ve önerilerinin alınacağı **Yerel Paydaşlar Bilgilendirme Toplantısı**'na dair davet mektubunu, proje bilgi notunu ve toplantı programını **elden/e-posta olarak teslim aldım.**

Tarih: 14.09.2021
İmza:
Adı-Soyadı: Vedat ŞAPAZ
Bağlı olduğu kurum/kuruluş: Acıilbey Mah.
Cep: 0530 516 29 16

3. Personal invitations

The Agenda which was shared with the local stakeholders before and during the LSC meeting can be seen below:

Date of the Meeting: 30.09.2021
Time: 14:00 - 15.45

Location: Online Webinar, Microsoft Teams

Agenda:

14:00 14:05	- Opening of the meeting & Introduction
14:05 14:20	- Explanation of the project
14:20 14:40	- Brief introduction to climate change, sustainable development, carbon offsetting mechanisms and certification processes
14:40 15:00	- Q&A Session about the project
15:00 15:15	- Discussion of continuous input/grievance mechanism
15:15 15:30	- Sustainable Development Contributions (SDC) explanation
15:30 15:45	- Discussion on monitoring SD & Closure of the meeting

2.2.1 Minutes of the LSC Meeting

The local stakeholder information meeting was held on 30th September 2021 as agreed. At the beginning of the meeting, it was explained in detail to the participants of the online meeting, which was held due to the Covid-19 outbreak, how questions about the project would be collected during the meeting and how they could give feedback.

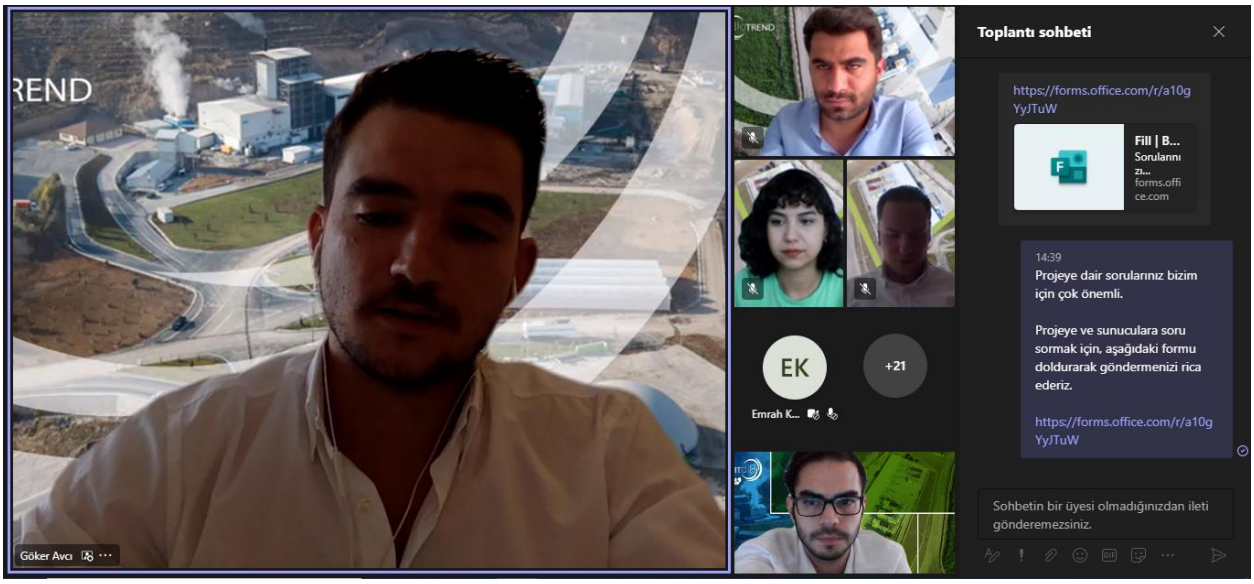
The demographic information of the participants was received during the registration for the online meeting. On the registration page of the meeting held over Microsoft Teams, non-technical information about the project is also summarized and explained.

The English translations of the personal information received at the registration page of the stakeholder consultation meeting are respectively: ‘Name’; ‘Surname’; ‘E-mail address’; ‘Gender’; ‘Age’; ‘Job Title’ and ‘City and District of Residence’

Registration page is viewed 84 times and total number of registrants to the meeting is 26.

(a) Opening of the meeting & Introduction (14:00-14:05):

The person appointed as the Moderator of the meeting greeted the participants and shared the purpose and agenda of the meeting. Then, site manager of the Project, Mr. Zülfikar Koç, who are actively working in the project and its field, was invited to present the technical description of the project.



Opening of the meeting & Introduction

(b) Project Introduction and Description (14:05-14:20):

The site manager Mr. Zülfikar Koç made a presentation of the improvements at the project site. They provided detailed information on how the Balıkesir Landfill Gas Plant functions and talked about the technical information in a way that could easily be understood by the audience. His presentation included the following points:

The rules of the webinar, question submission links and feedback form links about the project were continuously shared by the moderator in the "chat" section. Also, Dr. Önder's mail address was continuously shared as a part of continuous feedback mechanism.

(c) Brief introduction to climate change, sustainable development, carbon offsetting mechanisms and registration processes (14:20-14:40):

Climate & Sustainability Consultant Mrs. Yüzer, provided insights into the historical backgrounds of Sustainable Development and Climate Change at the international arena, including, the establishment of UNFCCC in 1994 and the 1997 Kyoto Protocol. Then, he briefly explained what the UN's Sustainable Development Goals were. During her presentation, the audience were informed about how they could learn more about the SDGs by showing the official UN's web-sites in Turkish, the local language. She continued by explaining main greenhouses gas types and results of this gases on the world and gave an end to her speech by providing insight about how to manage a landfill site in an environmentally friendly manner.

Mr.Göker Avcı started his speech later on by explaining the audience that one of the central subjects and aims in organizing the meeting was to assess the Project's contribution in achieving sustainable development goals and in tackling climate crisis. He sketchily explained what VERRA/VCS was, how it functioned and what the main requirements were for projects like Balıkesir Landfill Gas Plant to access to its certification.

He continued by explaining MRV – Monitoring, Measuring, Reporting and Verifying processes. He then clarified the two main requirements which a carbon offsetting activity needs to fulfil: 'contribution to sustainable development in host country/communities' and 'additionality'. While doing so, in order to simplify these complex terms to an appropriate level that met the stakeholders' understanding.

Brief introduction to climate change, sustainable development by Climate & Sustainability Consultant Mrs. Yüzer

(d) Questions and Answers (14:40-15:00):

Majority of the questions was linked to the technical details of the project. The questions asked by attendees are as follows;

- Will you hire new people?

With the realization of the planned investments in our facility, the staff will be recruited from the local population.

- Can we visit the facility whenever we want? - a student?

Anyone wishing to visit our facility can enter by filling out the visitor forms at the security booth at the entrance of the facility.

- What kind of process does the wastewater from the field enter? Do these wastewaters mix with our soil?

Wastewater collected with special pipeline systems is fed into the seepage basin, the collected water is cleaned and fed into the sewer system.

- What type of garbage comes to your site the most?

If we evaluate on a country basis, 50% is organic and the remaining 50% is considered inorganic.

- Can you evaluate the waste oils in our house? What should we do with waste oils? It is recommended to contact the municipal information line for the delivery of used oils.

- Is there any landscape work in the area?
The facility, which started its operations in 2020, will concentrate on afforestation in the upcoming years. We aim to be a green facility.

- Will a certificate of participation be given at the end of the event?
There is no certificate of participation for this webinar.

- To get energy, you need to use energy. How much water and energy is used in this facility?
Part of the energy generated is used for our own needs. In addition, our water consumption is 30 m3 per day and is provided from water supply networks.

(e) Discussion of continuous input/grievance mechanism (15:00-15:15):

With the links shared by the moderator during the webinar, feedback on the project and meeting started to be received. Stating that during the project, feedback forms were left at the security booth at the project site entrance so that the stakeholders could give feedback, and project consultant Dr. Umut Önder's e-mail information (image 17) has been shared continuously. In addition, the participants were informed that the project will be published on the VCS website for 1 month and that they can give feedback on the VCS website during this time.

(f) Discussion on Monitoring Sustainable Development & Closure of the Meeting (15:15-15:45):

At the final section, Sustainable Development Contributions of the project and the monitoring method were presented by the moderator, Mr. Göker Avcı.
The audience were invited to make comments about the Project's sustainable development impacts. The audience was reminded the Project's proposed positive impacts on the sustainable development, which were discussed earlier at the meeting during the climate crisis information section. The moderator ensured that the audience was aware that they, as the stakeholders, had responsibilities to monitor these impacts. He reminded the stakeholders that their voices would be heard, and their concerns would be considered in every single phase of the proposed Project activity, particularly via the Continuous Input and Grievance Mechanisms explained earlier.

Following the discussion on the Project's impacts on sustainable development, the audience was invited to complete the Local Stakeholder Consultation Meeting Feedback Form. 6 out of 22 attendees completed the forms which were shared on the chat.

The answer list of the feedback forms which were completed by attendees during the meeting can be seen below:

ID	Start time	Completion time	Name-Surname	Has enough information been given about the project?	Do you think the planned project will provide improvement?	Do you think that the planned project will provide an improvement in the employment rate?	What effect do you think the project might have on you and your family?	What do you think will be the impact of the project on local people?	Select at least three goals that you think have a positive relationship with the project when evaluated with the 17 Global Goals.
1	30.09.2021 14:47	30.09.2021 15:02	Onur Akdeniz	Yes	Yes	Yes	Positive (Positive Impact)	Develops Waste Management systems	Sustainable Cities and Communities; Reducing Inequality; Affordable and Clean Energy; Climate Action;
2	30.09.2021 15:16	30.09.2021 15:17	Ece Kömürcü	Yes	Yes	Yes	Positive (Positive Impact)	Develops Waste Management systems	Clean Water and Sanitation; Affordable and Clean Energy; Sustainable Cities and Communities;
3	30.09.2021 15:17	30.09.2021 15:17	Engin Özdemir	Yes	Yes	Yes	Positive (Positive Impact)	Provides improvements in access to electricity	Decent Work and Economic Growth; Industry, Innovation and Infrastructure; Sustainable Cities and Communities;
4	30.09.2021 15:23	30.09.2021 15:26	Buğday Sağlık	Yes	Yes	Yes	Positive (Positive Impact)	Provides improvements in access to electricity	Sustainable Cities and Communities; Reducing Inequality; Affordable and Clean Energy; Partnerships for the Goals; Climate Action;
5	30.09.2021 15:13	30.09.2021 15:15	Kürşat Turan	Yes	Yes	Yes	Positive (Positive Impact)	Develops Waste Management systems	Affordable and Clean Energy; Decent Work and Economic Growth; Industry, Innovation and Infrastructure; Climate Action;
6	30.09.2021 15:44	30.09.2021 15:46	Fatma Arıkan	Yes	Yes	Yes	Positive (Positive Impact)	Supports economic development	Affordable and Clean Energy; Industry, Innovation and Infrastructure; Climate Action; Partnerships for the Goals;

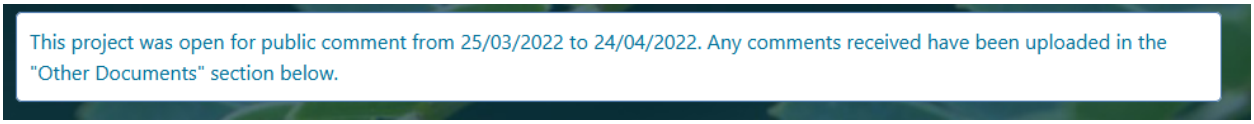
2.3 Environmental Impact

The environmental matters in Turkey are jurisdiction of the Ministry of Environment and Urbanization. The Law defines among others the general requirements of the Environmental Impact Assessment (EIA) states specific requirements according to the type of project, location, size and other characteristics. The Environmental Impact Assessment and any and all administrative and technical procedures and principles to be followed within the scope of this process are regulated by the Environmental Law No: 2872 and by the Regulation on Environmental Impact Assessment published in Official Gazette dated 25.11.2014 and numbered 29186 based on such Law. To carry out environmental impact assessment of the project intended to be implemented, it is required to initiate the environmental impact assessment process in accordance with the application process mentioned in relevant articles of the Regulation on Environmental Impact Assessment.

The Environmental Impact Assessment (EIA) certificate has been approved and issued by the Ministry of Environment and Urbanization in Turkey on May 26th, 2008. In accordance with the Turkish laws and regulations, EIA's approval shall be only made if a project subjected to the approval does not make any negative environmental and socio-economic impacts. Considering the fact that the proposed project activity already obtained EIA approval by the Ministry of Environment and Urbanization in Turkey, it is therefore possible to claim that there is no net harm linked to the project.

2.4 Public Comments

The project was open for public comment from 25/03/2022/ to 24/04/2022 as shown in the picture below. No comments were received, there is no document in "other documents"



Please find the statement here: https://registry.verra.org/app/projectDetail/VCS/2645

2.5 AFOLU-Specific Safeguards

Since the project is a non-AFOLU project, this section is not required.

3. APPLICATION OF METHODOLOGY

3.1 Title and Reference of Methodology

Applied approved baseline and monitoring methodologies:
The large-scale methodology ACM0001 Version 19, "Consolidated baseline and monitoring methodology for landfill gas project activities[5]" has been employed in the project activity.
Applied tools:

- TOOL02 "Combined tool to identify the baseline scenario and demonstrate additionality" (Version 07.0) (hereafter also referred to as "Additionality tool").
- TOOL03 "Tool to calculate project or leakage CO2 emissions from fossil fuel combustion" (Version 03.0).
- TOOL04 "Emissions from solid waste disposal sites" (Version 08.0).
- TOOL05 "Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation" (Version 03.0).
- TOOL06 "Project emissions from flaring" (Version 04.0).
- TOOL08 "Tool to determine the mass flow of a greenhouse gas in a gaseous stream" (Version 03.0):
- TOOL11 "Assessment of the validity of the original/current baseline and update of the baseline at the renewal of the crediting period" (Version 03.0.1).

3.2 Applicability of Methodology

The project meets the applicability conditions of the selected methodologies, standardized baseline and tools as demonstrated in the Table 4:

[5] https://cdm.unfccc.int/methodologies/DB/JPYB4DYQUXQPZLBDVPHA87479EMY9M

Table 5. Applicability Criteria

Application Criteria	Applicability
As per paragraph 3.a of ACM0001: Install a new LFG capture system in an existing or new (Greenfield) SWDS where no LFG capture system was or would have been installed prior to the implementation of the project activity instance. The project design consists of the development of new LFG capture systems. The baseline scenario at all five sites is the atmospheric release of LFG. The project the	The project design consists of the development of new LFG capture systems. The baseline scenario at landfill site is the atmospheric release of LFG. The project therefore complies with this criterion.
As per paragraph 3.b of ACM0001: Make an investment into an existing LFG capture system to increase the recovery rate or change the use of the captured LFG, provided that: (i) The captured LFG was vented or flared and not used prior to the implementation of the project activity instance; and (ii) In the case of an existing active LFG capture system for which the amount of LFG cannot be collected separately from the project system after the implementation of the project activity instance and its efficiency is not impacted on by the project system: historical data on the amount of LFG capture and flared is available.	The baseline scenario is the atmospheric release of LFG at site, that was vented and not used prior to the implementation of the project activity. The project design consists of the installation of new extraction infrastructure to recover LFG at site. The project therefore complies with criterion (i). Criterion (ii) does not apply because there was no existing active LFG capture system prior to the implementation of the project activity.
As per paragraph 3.c of ACM0001: Flare LFG and/or use the captured LFG in any (combination) of the following ways: (i) Generating electricity; (ii) Generating heat in a boiler, air heater or kiln (brick firing only) or glass melting furnace; and/or (iii) Supplying the LFG to consumers through a natural gas distribution network; (iv) Supplying compressed/liquefied LFG to consumers using trucks (v) Supplying the LFG to consumers through a dedicated pipeline.	The project design consists of LFG flaring and electricity generation only The project therefore complies with these criteria, specifically (i).
As per paragraph 3.d of ACM0001: Do not reduce the amount of organic waste that would be recycled in the absence of the project activity instance.	The project does not reduce the amount of organic waste that would be recycled in the absence of the project activity. Based on the feasibility report there are no major organic waste recycling practices within the province. The project therefore complies with this criterion.

Application Criteria	Applicability
As per paragraph 4.a of ACM0001: Atmospheric release of the LFG or capture of LFG and destruction through flaring to comply with regulations or contractual requirements, to address safety and odour concerns, or for other reasons.	In this project the baseline scenario is the total atmospheric release of the gas (see further explanation below) and in the current project activities, the captured gas is being flared and used to produce electricity. Therefore, the project complies with this criterion.
As per paragraph 4.b of ACM0001: In the case that the LFG is used in the project activity instance for generating electricity and/or generating heat in a boiler, air heater, glass melting furnace or kiln: For electricity generation: that electricity would be generated in the grid or in captive fossil fuel fired power plants; and/or (ii) For heat generation: that heat would be generated using fossil fuels in equipment located within the project boundary;	The electricity generated from the project activity is supplied to the grid. The generated electricity displaces electricity generated by the fossil fuel fired power plants in the grid. The project therefore complies with these criterion (i). Criterion (ii) does not apply because the project does not generate heat.
As per paragraph 4.c of ACM0001: In the case of LFG supplied to the end user(s) through natural gas distribution network, trucks or the dedicated pipeline, the baseline scenario is assumed to be displacement of natural gas.	This criterion is not applicable. The project does not supply LFG to the end user(s) through a natural gas distribution network, trucks or dedicated pipeline.
As per paragraph 4.d of ACM0001: In the case of LFG from a Greenfield SWDS, the identified baseline scenario is atmospheric release of the LFG or capture of LFG in a managed SWDS and destruction through flaring to comply with regulations or contractual requirements, to address safety and odour concerns, or for other reasons.	This applicability criterion does not apply to the project activity because the LFG arises from existing SWDSs. Furthermore, there are no requirements to capture LFG or destroy LFG through flaring in order to comply with regulations or contractual requirements, to address safety and odour concerns, or for other reasons.

Application Criteria	Applicability
As per paragraph 4 of TOOL02 “Combined tool to identify the baseline scenario and demonstrate additionality” (Version 07.0): The tool is applicable to all types of proposed project activities. However, in some cases, methodologies referring to this tool may require adjustments or additional explanations as per the guidance in the respective methodologies. This could include, inter alia, a listing of relevant alternative scenarios that should be considered in Step 1, any relevant types of barriers other than those presented in this tool and guidance on how common practice should be established.	The project activity complies with this criterion. Additionality was proven by using the TOOL02 “Combined tool to identify the baseline scenario and demonstrate additionality”.
As per paragraph 5 of ACM0001, this methodology is not applicable: a) In combination with other approved methodologies. b) If the management of the SWDS in the project activity instance is deliberately changed during the crediting in order to increase methane generation compared to the situation prior to the implementation of the project activity instance.	a) The project only utilizes one methodology which is ACM0001 version 19. b) The project retains the same waste disposal practices for waste and the management of the landfill remains unchanged. The project therefore complies with these criteria.
As per paragraph 2 of TOOL03 “Tool to calculate project or leakage CO2 emissions from fossil fuel combustion” (Version 03.0): This tool provides procedures to calculate project and/or leakage CO2 emissions from the combustion of fossil fuels. It can be used in cases where CO2 emissions from fossil fuel combustion are calculated based on the quantity of fuel combusted and its properties. Methodologies using this tool should specify to which combustion process j this tool is being applied.	The project activity complies with this criterion. The tool is applicable to the project as diesel may be used in generators for on-site power backup for the flares. This tool is used to calculate project and/or leakage CO2 emissions from the combustion of diesel in backup generations. It is used in cases where CO2 emissions from fossil fuel combustion are calculated based on the quantity of diesel combusted.

Application Criteria	Applicability
As per paragraphs 3.a and 3.b of TOOL04 "Emissions from solid waste disposal sites" (Version 08.0), the tool can be used to determine emissions for the following types of applications: 3 (a) Application A: The project mitigates methane emissions from a specific existing SWDS. Methane emissions are mitigated by capturing and flaring or combusting the methane (e.g. "ACM0001: Flaring or use of landfill gas" version 19). The methane is generated from waste disposed in the past, including prior to the start of the CDM project activity. In these cases, the tool is only applied for an ex ante estimation of emissions in the project design document (CDM-PDD). The emissions will then be monitored during the crediting period using the applicable approaches in the relevant methodologies (e.g. measuring the amount of methane captured from the SWDS); 3 (b) Application B: The project avoids or involves the disposal of waste at a SWDS. An example of this application of the tool is ACM0022, in which municipal solid waste (MSW) is treated with an alternative option, such as composting or anaerobic digestion, and is then prevented from being disposed of in a SWDS. The methane is generated from waste disposed or avoided from disposal during the crediting period. In these cases, the tool can be applied for both ex ante and ex post estimation of emissions. These project activities may apply the simplified approach detailed in 0 when calculating baseline emissions.	The project activity complies with paragraph 3 (a) Application A because the project mitigates methane emissions from specific existing SWDSs. The tool is applied for the ex-ante estimation of emissions in the project description. Emissions will be monitored during the crediting period using the appropriate approaches referenced in the methodology ACM0001 Version 19.0. The project therefore complies with this criterion. Application B is not applicable because the project mitigates emissions from an existing SWDS, not the avoidance of waste at a SWDS.
As per paragraph 4 of TOOL04 "Emissions from solid waste disposal sites" (Version 08.0): These two types of applications are referred to in the tool for determining parameters.	The project activity meets the applicability criterion Application A, as described above.

Application Criteria	Applicability
As per paragraph 5 of the tool TOOL04 "Emissions from solid waste disposal sites" (Version 08.0): In the case that: (a) different types of residual waste are disposed or prevented from disposal; or that (b) both MSW and residual waste(s) are prevented from disposal, then the tool should be applied separately to each residual waste and to the MSW.	Not applicable because the existing SWDSs are classified as general waste sites, meaning that they comprise of MSW and do not accept residual waste. Therefore the tool is applied only to the MSW in the absence of residual waste.
As per paragraph 5 of TOOL05 "Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation" (Version 03.0): The tool is only applicable if one out of the following three scenarios applies to the sources of electricity consumption: (a) Scenario A: Electricity consumption from the grid. The electricity is purchased from the grid only, and either no captive power plant(s) is/are installed at the site of electricity consumption or, if any captive power plant exists on site, it is either not operating or it is not physically able to provide electricity to the electricity consumer; (b) Scenario B: Electricity consumption from (an) off-grid fossil fuel fired captive power plant(s). One or more fossil fuel fired captive power plants are installed at the site of the electricity consumer and supply the consumer with electricity. The captive power plant(s) is/are not connected to the electricity grid; or (c) Scenario C: Electricity consumption from the grid and (a) fossil fuel fired captive power plant(s). One or more fossil fuel fired captive power plants operate at the site of the electricity consumer. The captive power plant(s) can provide electricity to the electricity consumer. The captive power plant(s) is/are also connected to the electricity grid. Hence, the electricity consumer can be provided with electricity from the captive power plant(s) and the grid.	The tool is applicable to the project since the tool is used to estimate project CO2 emissions associated with the consumption of electricity. Scenario C applies to the project. The landfills may use standby diesel generators (captive power plants) for on-site power backup for the flares. The diesel generators. Hence, the project can be provided with electricity from the captive power plant(s) and the grid. The project therefore complies with this criterion.

Application Criteria	Applicability
As per paragraph 6 of TOOL05 "Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation" (Version 03.0): This tool can be referred to in methodologies to provide procedures to monitor amount of electricity generated in the project scenario, only if one out of the following three project scenarios applies to the recipient of the electricity generated: (a) Scenario I: Electricity is supplied to the grid; (b) Scenario II: Electricity is supplied to consumers/electricity consuming facilities; or (c) Scenario III: Electricity is supplied to the grid and consumers/electricity consuming facilities	The project complies with Scenario 1: all generated electricity is supplied to the national grid in Turkey.
As per paragraph 7 of TOOL05 "Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation" (Version 03.0): This tool is not applicable in cases where captive renewable power generation technologies are installed to provide electricity in the project activity, in the baseline scenario or to sources of leakage. The tool only accounts for CO2 emissions.	The project complies with this criterion: There are no captive renewable power generation technologies installed to provide electricity in the project activity in the baseline scenario or to sources of leakage. Only CO2 emissions are accounted for.
As per paragraph 2 of TOOL06 "Project emissions from flaring" (Version 04.0.0): This tool provides procedures to calculate project emissions from flaring of a residual gas. The tool is applicable to enclosed or open flares and project participants should document in the CDM-PDD the type of flare used in the project activity.	The project complies with this criterion: project emissions are calculated in relation to the flaring of residual gas (LFG). All the flares in the project activity are enclosed flares, as documented in this PDD.

Application Criteria	Applicability
As per paragraph 3 of TOOL06 “Project emissions from flaring” (Version 04.0.0): This tool is applicable to the flaring of flammable greenhouse gases where: (a) Methane is the component with the highest concentration in the flammable residual gas; and (b) The source of the residual gas is coal mine methane or a gas from a biogenic source (e.g. biogas, landfill gas or wastewater treatment gas).	a) The composition of the Landfill gas is around 60% (Methane) 40% CO2. (according to Prefeasibility study and planning concept for landfill gas collecting Balikesir). According to measurements is (57.4% CH4, 2.6% O2 and 26.9% CO2) b) The residual gas is a biogenic source, it is a Landfill gas.
As per paragraph 4 of TOOL06 “Project emissions from flaring” (Version 04.0.0): The tool is not applicable to the use of auxiliary fuels and therefore the residual gas must have sufficient flammable gas present to sustain combustion. In the case of an enclosed flare, there shall be operating specifications provided by the manufacturer of the flare and these shall be followed by the project participant.	All the flares in the project activity are enclosed flares, Conveco is the manufacturer and the flare specification are attached to the document (BIOGAS EXHAUST AND COMBUSTION SYSTEM.pdf)
As per paragraph 5 of TOOL08 “Tool to determine the mass flow of a greenhouse gas in a gaseous stream” (Version 03.0): Typical applications of this tool are methodologies where the flow and composition of residual or flared gases or exhaust gases are measured for the determination of baseline or project emissions.	The methodological tool ACM0001 Version 19.0 refers to this tool for measurement of flow and composition of the residual or flared gases to determine baseline and project emissions. The tool is applicable to the project as the flow and composition of residual or flared gases will be measured for the determination of baseline or project emissions. The gaseous stream that the tool will be applied to is the LFG delivery pipeline to each item of equipment at each site. The greenhouse gas for which the mass flow will be determined is methane.

Application Criteria	Applicability
As per TOOL08 “Tool to determine the mass flow of a greenhouse gas in a gaseous stream” (Version 03.0): Methodologies where CO2 is the particular and only gas of interest should continue to adopt material balances as the means of flow determination and may not adopt this tool as material balances are the cost effective way of monitoring flow of CO2.	This criterion is not applicable as CO2 is not the only gas of interest in the project activity
As per TOOL08 “Tool to determine the mass flow of a greenhouse gas in a gaseous stream” (Version 03.0): The underlying methodology should specify: (a) The gaseous stream the tool should be applied to; (b) For which greenhouse gases the mass flow should be determined; (c) In which time intervals the flow of the gaseous stream should be measured; and Situations where the simplification offered for calculating the molecular mass of the gaseous stream (equations (3) or (17)) is not valid (such as the gaseous stream is predominantly composed of a gas other than N2).	The project complies with these criteria: (a) The tool is applied to the residual gas stream in the landfill. The option F of the “Tool to determine the mass flow of a greenhouse gas in a gaseous stream” (Version 03.0) is used to calculate the mass flow of the gaseous stream. (b) The mass flow is determined for methane. (c) Monitoring is continuous.
As per section I of TOOL11 “Assessment of the validity of the original/current baseline and update of the baseline at the renewal of the crediting period”, version 03.0.1: This tool provides a stepwise procedure to assess the continued validity of the baseline and to update the baseline at the renewal of a crediting period, as required by paragraph 49 (a) of the modalities and procedures of the clean development mechanism. The tool consists of two steps. The first step provides an approach to evaluate whether the current baseline is still valid for the next crediting period. The second step provides an approach to update the baseline in case that the current baseline is not valid anymore for the next crediting period.	The project activity complies with the applicability criteria of this tool. The steps to assess the continued validity of the baseline and to update the baseline at the renewal of a crediting period have been undertaken in the baseline selection section of the PD.

3.3 Project Boundary

In accordance with these Methodologies, the project boundary includes:

- Waste management systems;
- Facilities which recover and flare/combust or use LFG;

The project power plant and all power plants connected physically to the electricity system that the proposed project power plant is connected to.
The relevant GHG sources included in or excluded from the project boundary are shown on the Table 5.

Table 6. Relevant GHG Sources in or excluded

Source		Gas	Included?	Justification/Explanation
Baseline	Emissions from decomposition of waste at the SWDS site	CO_2	No	CO_2 emissions from the decomposition of organic waste are not accounted since the CO_2 is also released under the project activity
		CH_4	Yes	The major source of emissions in the baseline
		N_2O	No	N_2O emissions are small compared to CH_4 emissions from SWDS. This is conservative.
		Other	-	-
	Emissions from electricity generation	CO_2	Yes	Major source of emissions in the baseline
		CH_4	No	Excluded for simplification. This is conservative.
		N_2O	No	Excluded for simplification. This is conservative.
		Other	-	N/A
Project	Emissions from fossil fuel consumption for purposes other than electricity generation or transportation due to the project activity	CO_2	Yes	Included. This system is used when the grid cannot be utilized in case of power failures.
		CH_4	No	Excluded for simplification. This emission source is assumed to be very small
		N_2O	No	Excluded for simplification. This emission source is assumed to be very small
		Other	-	N/A
	Emissions from electricity consumption	CO_2	Yes	The emission from use of electricity is accounted for, since the proposed project may consume electricity for its own operation. However, since the proposed project activity does not involve fossil fuel

Source		Gas	Included?	Justification/Explanation
	due to Project activity			consumption, the emission form use of fossil fuel (above) is not included.
		CH_4	No	Excluded for simplification. This emission source is assumed to be very small.
		N_2O	No	Excluded for simplification. This emission source is assumed to be very small.
		Other	-	N/A
	Emissions from flaring or combustion of the gas stream	CO_2	Yes	The flare system would be used only in exigencies. In case the flare operation, the emission reduction will be excluded during this period, and thus emission source is not included.
		CH_4	No	Emissions are considered negligible
		N_2O	No	Emissions are considered negligible
		Other	-	N/A
	Emissions from distribution of LFG using trucks and dedicated pipelines	CO_2	No	Excluded for simplification since LFG captured at the project site is utilised via gas engines to generate electricity which is directly fed to the national grid.
		CH_4	No	Excluded for simplification. This emission source is assumed to be very small.
		N_2O	No	Excluded for simplification. This emission source is assumed to be very small.
		Other	-	N/A

Complementary, in the Figure 6 a simplified project boundary is presented.

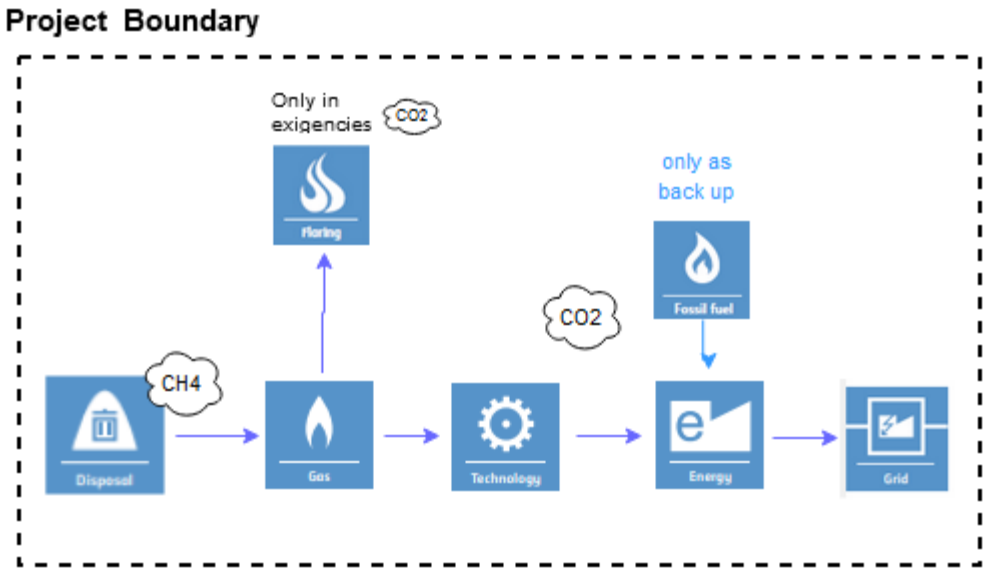


Figure 6. Simplified diagram of the Project Boundary

3.4 Baseline Scenario

ACM0001, Large-scale Consolidated Methodology: Flaring or use of landfill gas, Version 19.0, states that the methodology is only applicable if the application of the procedure to identify the baseline scenario confirms that the most plausible baseline scenario is:

(a) Atmospheric release of the LFG or capture of LFG and destruction through flaring to comply with regulations or contractual requirements, to address safety and odour concerns, or for other reasons; and

(b) In the case that the LFG is used in the project activity for generating electricity and/or generating heat in a boiler, air heater, glass melting furnace or kiln

(i) For electricity generation: that electricity would be generated in the grid or in captive fossil fuel fired power plants; and/or

(ii) For heat generation: that heat would be generated using fossil fuels in equipment located within the project boundary;

(c) In the case of LFG supplied to the end-user(s) through natural gas distribution network, trucks or the dedicated pipeline, the baseline scenario is assumed to be displacement of natural gas.

(d) In the case of LFG from a Greenfield SWDS, the identified baseline scenario is atmospheric release of the LFG or capture of LFG in a managed SWDS and destruction through flaring to comply with regulations or contractual requirements, to address safety and odor concerns, or for other reasons.

In accordance with the applied methodology, baseline alternatives for the destruction of LFG, shall take into consideration inter alia, the following alternatives:

Alternatives to LFG Component	Alternatives to Electricity Generation Component
LFG1: The project activity (LFG capture and utilization) implemented without being registered as a VCS project activity	E1: Electricity generation from LFG, undertaken without being registered as VCS project activity
LFG2: Atmospheric release of the LFG or capture of LFG in a managed SWDS and destruction through flaring to comply with regulations or contractual requirements, to address safety and odour concerns, or for other reasons	E2: Electricity generation in existing or new renewable or fossil fuel based captive power plant(s)
LFG3: Atmospheric release of the LFG or capture of LFG in an unmanaged SWDS and destruction through flaring to comply with regulations or contractual requirements, to address safety and odour concerns, or for other reasons	E3: Electricity generation in existing and/or new grid-connected power plants
LFG4: LFG generation is partially avoided because part of the organic fraction of the solid waste is recycled and not disposed in the SWDS	
LFG5: LFG generation is partially avoided because part of the organic fraction of the solid waste is treated aerobically and not disposed in the SWDS	
LFG6: LFG generation is partially avoided because part of the organic fraction of the solid waste is incinerated and not disposed in the SWDS	

Balıkesir SWDS has been receiving municipal solid waste since 2003 in one sector and form 2014 on the other (see Figure 2. Landfill Gas collection areas. Section a. area expansion for more waste depositing. Section b. old waste deposition area (2005-2021).). Considering that there is no regulation or law mandating the capture and utilization of the LFG in a SWDS in Turkey, the most plausible baseline scenario to the implementation of the Balıkesir LFG Capture and Utilization Project is the continuum of atmospheric release of the LFG generated at the Balıkesir SWDS. In other words, LFG3 and E3 represent the baseline scenario.

3.5 Additionality

Section 3.13 in VCS v4.1[6] states that "A project activity is additional if it can be demonstrated that the activity results in emission reductions or removals that are in excess of what would be achieved under a 'business as usual' scenario and the activity would not have occurred in the absence of the incentive provided by the carbon markets" (2021:33). Moreover, Section 3.13.1 clearly mandates that "Additionality shall be demonstrated and assessed in accordance with the requirements set out in the methodology applied to the project" (ibid.)

In the case of the proposed project activity, the Methodology of ACM0001 "Large-scale Consolidated Methodology: Flaring or use of landfill gas", Version 19.0[7], is applied to the proposed project activity. Demonstration of additionality is accordingly carried as per the methodological Tool: "Combined tool to identify the baseline scenario and demonstrate additionality", Version 07.0[8].

The following steps from the Tool are completed below:

STEP 0 – Demonstration whether the proposed project activity is the First-of-its-kind;

STEP 1 – Identification of alternative scenarios;

STEP 2 - Barrier analysis;

STEP 3 – Investment analysis;

STEP 4 – Common practice analysis.

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

The proposed project activity shall not be considered as the first-of-its-kind in accordance with the methodological tool: "Additionality of first-of-its-kind project activities", Version 03.0[9], since the proposed project activity is not the first that applies LFG capture and utilization technology in Turkey, as the host country. Indeed, other previous projects are able to deliver the same output and have started commercial operation in Turkey before the start date of the proposed project activity.

Outcome of Step 0:

Conclusion: The proposed project activity is not the first-of-its-kind.

Step 1 and Step 2

[6] https://verra.org/wp-content/uploads/2021/04/VCS-Standard_v4.1.pdf

[7] https://cdm.unfccc.int/methodologies/DB/JPYB4DYQUXQPZLBDVPHA87479EMY9M

[8] https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-02-v7.0.pdf

[9] https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-23-v1.pdf

These steps are completed in the Section 3.4 of the PDD, Baseline Scenario. Hence, Step 3 will be completed below.

Step 3: Investment analysis

Investment analysis is carried as per the methodological Tool: "Combined tool to identify the baseline scenario and demonstrate additionality", Version 07.0[10]*. In addition, the latest approved version of the "Methodological tool: Investment analysis", version 10.0*[11]*, is also considered as* per the methodological Tool: "Combined tool to identify the baseline scenario and demonstrate additionality", Version 07.0.

The "Combined tool to identify the baseline scenario and demonstrate additionality", Version 07.0, states that "the choice between the Benchmark Analysis versus the Investment Comparison Analysis and Simple cost analysis is determined by whether the output can only be provided by the project proponent" (pg. 13).

Sub-step 3a: Determine appropriate analysis method

There are three options which can be applied for the investment analysis. These are as follow:

- Option I. Simple Cost Analysis;
- Option II. Investment Comparison Analysis;
- Option III. Benchmark Analysis

Since the Project generates economic benefits from sales of electricity, the simple cost analysis is not applicable. Also, since the baseline of the project is generation of electricity by the grid, no alternative investment is considered at issue. In this regard, it has been decided to use the benchmark analysis for the evaluation of the project investment. To conclude, the benchmark analysis will be used to identify whether the financial indicators (Equity IRR in this case) of the proposed project is better than relevant benchmark value in compliance with the latest approved version of the "Methodological tool: Investment analysis", version 11.0.

Sub-step 3b: Option III. Apply benchmark analysis

While applying the Benchmark Analysis, Option III, the Equity IRR is selected as the financial indicator for the demonstration of the additionality of the project as permitted in the additionality tool.

In the Section of Selection and Validation of Appropriate Benchmarks of the "Methodological tool: Investment analysis", version 11.0, it is stated that "the applied benchmark shall be

[10] https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-02-v7.0.pdf

[11] https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-27-v10.0.pdf

appropriate to the type of IRR calculated. Local commercial lending rates or WACC are appropriate benchmarks for a project IRR. Required/expected returns on equity are appropriate benchmarks for an equity IRR" (pg. 5).

In addition, *the methodological Tool: "Tool for the demonstration and assessment of additionality", Version 07.0*[12] *also states that benchmarks shall be derived from (b) "Estimates of the cost of financing and required return on capital (e.g. commercial lending rates and guarantees required for the country and the type of project activity concerned), based on bankers views and private equity investors/funds' required return on comparable projects" (pg. 10).*

In the Table 3.3, titled as 'Prototype Sub-projects for CTF Financing', in the report on 'Private Sector Renewable Energy and Energy Efficiency Project in Turkey' published by the World Bank in 2017[13] , the threshold IRR on Equity (%) for similar project types (Biomass gas) is given as 20% (pg. 40).

For the benchmark analysis conducted here, this figure is taken as a benchmark. Taking this figure as a benchmark is in compliance not only with the latest version of UNFCCC's "Guidelines on the assessment of investment analysis"[14], version 05.0, but also with the latest approved version of the "Methodological tool: Investment analysis", version 10.0 and the methodological Tool: "Combined tool to identify the baseline scenario and demonstrate additionality", Version 07.0.

The guaranteed tariff of USD $13.3 per MWe/h is provided by the Turkish state during only 10 years following the proposed project's commissioning date. After the subjected ten years, such projects are expected to directly sell the electricity they generate to the secondary market whose prices[15], as mentioned above, are way lower than the guaranteed tariff. Nevertheless, in the project's IRR calculations the guaranteed tariff has been remained even after the ten years of the project's operation to be conservative in the additionality analysis.

As seen on the proposed project activity's IRR Excel documentation which will be submitted to the Designated operational Entities (DoEs) in time of validation and verification, the project's additionality is demonstrated in line with the applied Tool's additionality requirement (Table 6).

Table 7. Additionallity Requirements

Parameters	Unit	Data Value

[12] https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-01-v7.0.0.pdf

[13] http://documents1.worldbank.org/curated/en/799701498842988254/pdf/ICR00004069-06192017.pdf

[14] https://cdm.unfccc.int/Reference/Guidclarif/index.html

[15] https://rapor.epias.com.tr/rapor/xhtml/ptfSmfGunluk.xhtml

Installed Capacity	MWe/h	14.14[16]
Equity Investment	Million $	21.10[17]
Income tax rate	%	20[18]
Expected Feed-in-Tariff	$ Cents/kWh	13.3[19]
Operation & Maintenance Cost	Million $ / Year	4.49[20]

Calculation and estimations have been made conservatively, therefore IRR value represents the most optimistic scenario in terms of capital investment and electricity generation. Capital investment involves the construction works, generator costs, other equipment and commissioning, consultancy and contingency. Construction costs have been determined as per construction tender, generator set costs have been determined as per the gas engines tender and other costs were estimated by using separate contracts for other equipment, as well as the revenue share to the Balıkesir Metropolitan Municipality which is 10% in accordance with the contract between Landfill Enerji Sanayi Ticaret A.Ş. and Balıkesir Municipality. The IRR is calculated as equity IRR.

The equity IRR for the proposed project activity has been calculated as 14.90%.

Sub-step 3c: Sensitivity Analysis

Sensitivity analysis has been carried out as per four main parameters identified:

- Operational Cost,
- Project Cost
- Annual Generation.
- Tariff

In accordance with the paragraph 27 of methodological tool: "Investment Analysis", Version 11.0[21], for a range of ±10% fluctuations in parameters, Tariff, Project costs, operational costs

16 The electricty generation capacity subjected to be fed to the national grid.

17 IRR Sheet

18 http://www.invest.gov.tr/en-US/investmentguide/investorsguide/Pages/Taxes.aspx

19 http://www.lawsturkey.com/law/law-on-utilization-of-renewable-energy-sources-for-the-purpose-of-generating-electrical-energy-5346

20 IRR Sheet

21 https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-27-v10.0.pdf

and annual generation, the Table 7 shows sensitivity analysis for the proposed project activity without VCU revenue:

Table 8- Sensitivity Analysis Results

Sensitivity Analysis	Equity IRR			
Variation %	**-10%**	**Normal**	**+10%**	**Breaching Value**
PLF	12.31%	14.90%	17.59%	**22.00%**
O&M	15.21%	14.90%	14.97%	**-800.00%**
Project Cost	16.43%	14.90%	13.91%	**-32.50%**
Tariff Rate	12.31%	14.90%	17.59%	**22.00%**

The sensitivity analysis shown in the Table above determines that the proposed project activity is additional in the sense that the sensitivity analysis is concluded that the project is unlikely to be (the most) financially/economically attractive.

Therefore, the IRR remains below the benchmark with 10% variations of the key parameters, which can already be considered conservative variations for sensitivity analysis. In addition, an increase or decrease of in these key input parameters that would result in the IRR exceeding the benchmark is highly unlikely to occur for the following reasons:

1. The total investment cost is based on the most recent information available prior to the investment decision date and actual purchase order placed for equipment's and construction by an experienced developer. Investment cost is fixed, therefore unlikely that the investment cost would be lower than 32%.
2. O&M costs are based our experience from other projects. O&M cost is based on the most recent information available prior to the investment decision date and actual purchase order placed with service provider. O&M cost is fixed, therefore unlikely that the investment cost would be lower than 800%.
3. The PPA signed and rate is fixed for the next 10 years, hence change in tariff is highly unlikely scenario.
4. PLF[22] considered in financials is from the Third Party SEF-Energietehnik GmbH in line with "Guidelines for the reporting and validation of Plant load factors" stated in EB48 Annex11 option 3(b). Hence, variation in PLF of more than 22% is unlikely to happen as the PLF has been reported as per the third-party report based on long term data.

Outcome of Step 3:

This substantiates that the investment is not financially attractive (Equity IRR for the project activity is less than the Benchmark) for any of the investor. Thus, it can be easily concluded that project activity is additional & is not business as usual scenario.

[22] Declaration of compliance of the Plant Load Factor (PLF) of landfill gas project in Balikesir

Step 4: Common practice analysis

Common practice analysis for the proposed project activity is conducted as per the methodological tool: "Common practice", Version 03.1[23]. This methodological tool provides a step-wise approach for the analysis of the extent to which a proposed project type (e.g. technology or practice) has already diffused in the relevant sector and region (pg. 2).

Step 4.1: Calculate applicable capacity or output range as +/-50% of the total design capacity or output of the proposed project activity

The design capacity of the proposed project activity is 14.14MWe/h. Accordingly, the applicable output range is from 7.07 MWe/h to 21.21 MWe/h.

Step 4.2: Identify similar projects (both CDM and non-CDM) which fulfill all of the following conditions:

(a) The projects are located in the applicable geographical area;

(b) The projects apply the same measures as the proposed project activity;

(c) The projects use the same energy source/fuel and feedstock as the proposed project activity, if a technology switch measure is implemented by the proposed project activity;

(d) The plants in which the projects are implemented produce goods and services with comparable quality, properties and application areas (e.g. clinker) as the proposed project plant;

(e) The capacity or output of the projects is within the applicable capacity or output range calculated in Step 4.1.;

(f) The projects started commercial operation before the project design document (CDM-PDD) is published for global stakeholder consultation or before the start date of proposed project activity, whichever is earlier for the proposed project activity.

According to the official report of "Final List on Renewable Energy Plants, 2020"[24], published by Republic of Turkey Energy Market Regulatory Authority (EPDK), there are only 10 operational biogas/biomass/LFG plants whose installed capacities are within the proposed project activity's applicable capacity range calculated in Step 4.1. (7.07 MWe/h to 21.21 MWe/h) in 2020. The list of the plants is given in the Table 8 below:

[23] https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-24-v1.pdf

[24] https://www.epdk.gov.tr/Detay/DownloadDocument?id=FLl6KOxdaT8= (EPDK 2020 yılı YEKDEM listesi)

Table 9. Operational biogas/biomass plants whose installed capacities are within the proposed project activity's

No.	Name of the Plant	Total Installed Capacity[25] (MWe)	Voluntary Emission Reductions Certification Scheme(s) Registry[26] (ID No.)
1	Zeus Biyokütle Enerjisine Dayalı Elek. Ürt. Tesisi	12.00	N/A
2	Samsun Avdan Biyogaz Tesisi	8.4	GS935
3	OYKA ENERJİ BİYOKÜTLE SANTRALİ	21	N/A
4	Afyon-1 Biyogaz Santrali	8.4	N/A
5	Kömürcüoda Çöp Gazı Santralı	19.810	GS707
6	Bientaş Kaşınhanı Elektrik Üretim Tesisi	9.360	N/A
7	ITC Adana Enerji Üretim Tesisi	15.565	GS715
8	ITC-KA Biyokütle Gazlaştırma Tesisi	10.850	GS1016
9	ITC Bursa Hamitler Tesisi	9.800	GS1068
10	FBY BES YÜREĞİR	9.300	N/A
11	Burak-1 Biyokütle Elektrik Santrali	15.250	N/A
12	Mavibayrak Doğu Biyokütle Enerji Santrali	12.00	N/A
13	Düzce Biyokütle Enerji Üretim Tesisi	12.00	N/A
14	Mamak Katı Atık Alanı Enerji Üretim Tesisi	16.956	GS440

Step 4.3: within the projects identified in Step 2, identify those that are neither registered CDM project activities, project activities submitted for registration, nor project activities undergoing validation. Note their number N_{all}.

Within the projects identified in the Table above, the projects which are neither registered CDM project activities, project activities submitted for registration, nor project activities undergoing validation are as follow:

1) Zeus Biyokütle Enerjisine Dayalı Elek. Ürt. Tesisi

[25] https://www.epdk.gov.tr/Detay/DownloadDocument?id=FLl6KOxdaT8=

[26] https://registry.goldstandard.org/projects

2) OYKA ENERJİ BİYOKÜTLE SANTRALİ
3) Afyon-1 Biyogaz Santrali
4) Bientaş Kaşınhanı Elektrik Üretim Tesisi
5) FBY BES YÜREĞİR
6) Burak-1 Biyokütle Elektrik Santrali
7) Mavibayrak Doğu Biyokütle Enerji Santrali
8) Düzce Biyokütle Enerji Üretim Tesisi

Accordingly, it is noted that

$N_{all} = 8$

Step 4.4: within similar projects identified in Step 3, identify those that apply technologies that are different to the technology applied in the proposed project activity. Note their number N_{diff}.

Amongst the ten projects identified in Step 4.3 above, those that apply technologies that are different to the technology applied in the project activity, which is LFG capture and utilization.

1) Zeus Biyokütle Enerjisine Dayalı Elek. Ürt. Tesisi
2) OYKA ENERJİ BİYOKÜTLE SANTRALİ
3) Afyon-1 Biyogaz Santrali
4) FBY BES YÜREĞİR
5) Burak-1 Biyokütle Elektrik Santrali
6) Mavibayrak Doğu Biyokütle Enerji Santrali
7) Düzce Biyokütle Enerji Üretim TesisiAccordingly, it is noted that

Accordingly, it is noted that

Ndiff = 7

Step 4.5: calculate factor $F=1-N_{diff}/N_{all}$ representing the share of similar projects (penetration rate of the measure/technology) using a measure/technology similar to the measure/technology used in the proposed project activity that deliver the same output or capacity as the proposed project activity.

In Step 4.3., Nall is noted as 8

In Step 4.4., Ndiff is noted as 7

Accordingly, factor F=1-Ndiff/Nall is calculated as follows:

$F = 1 – 7/8$

$F = 0.125$

Whilst F is equivalent to 0.125, Nall-Ndiff is equivalent to 1.

Outcome of Step 4:

The paragraph 18 of the methodological tool "Common practice", Version 03.1[27] states that

"the proposed project activity is a 'common practice' within a sector in the applicable geographical area if the factor F is greater than 0.2 and N_{all}-N_{diff}f is greater than 3" (pg. 5).

For the proposed project activity, F=0.125 is less than 0.2, whilst N_{all}-N_{diff}=1 which is not greater than 3. Hence, the proposed project activity shall be considered as not a common practice in the region.

Hence, in accordance with the methodological tools, the proposed project activity shall be considered additional.

3.6 Methodology Deviations

No methodology deviation is applied in the project.

4. QUANTIFICATION OF GHG EMISSION REDUCTIONS AND REMOVALS

4.1 Baseline Emissions

Baseline emissions scenario of the project is the methane from the open-air SWDS, and the electricity supplied by the grid to be substituted, which will be calculated as follows according to the methodology ACM0001 V. 19.

It comprise the following sources:

(a) Methane emissions from the SWDS in the absence of the project activity;

(b) Electricity generation using fossil fuels or supplied by the grid in the absence of the project activity;

(c) Heat generation using fossil fuels in the absence of the project activity; and

(d) Natural gas used from the natural gas network in the absence of the project activity.

$$BE_y = BE_{CH4,y} + BE_{EC,y} + BE_{HG,y} + BE_{NG,y} \quad \text{Equation 1}$$

[27] https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-24-v1.pdf

Where:

BE_y	=	Baseline emissions in year y (t CO2e/yr)
$BE_{CH4,y}$	=	Baseline emissions of methane from the SWDS in year y (t CO2e/yr)
$BE_{EC,y}$	=	Baseline emissions associated with electricity generation in year y (t CO2/yr)
$BE_{HG,y}$	=	Baseline emissions associated with heat generation in year y (t CO2/yr)
$BE_{NG,y}$	=	Baseline emissions associated with natural gas use in year y (t CO2/yr)

The project does not involve heat and natural gas $BE_{HG,y}$. = 0, $BE_{NG,y}$ = 0. Therefore:

$$BE_y = BE_{CH4,y} + BE_{EC,y}$$

Baseline emissions of methane from the SWDS (BECH4,y)

Baseline emissions of methane from the SWDS are determined as follows, based on the amount of methane that is captured under the project activity and the amount that would be captured and destroyed in the baseline (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:

$$BE_{CH4} = \left(\left(1 - OX_{top\_layer}\right) \times F_{CH4,PJ,y} - F_{CH,BL,y}\right) \times GWP_{CH4}$$

Equation 2

Where:

$BE_{CH4,y}$	=	Baseline emissions of methane from the SWDS in year y (t CO2e/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)
$F_{CH4,PJ,y}$	=	Amount of methane in the LFG which is flared and/or used in the project activity in year y (t CH4/yr)
$F_{CH4,BL,y}$	=	Amount of methane in the LFG that would be flared in the baseline in year y (t CH4/yr)
GWP_{CH4}	=	Global warming potential of CH4 (t CO2e/t CH4)

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

During the crediting period, FCH4,PJ,y is determined as the sum of the quantities of methane flared and used in power plant(s), boiler(s), etc as follows:

$$F_{CH4,PJ,y} = F_{CH4,flared,y} + F_{CH4,EL,y} + F_{CH4,HG,y} + F_{CH4,NG,y}$$

Equation 3

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 (t CH4/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 and/or dedicated pipeline and/or to the trucks in year y (t CH4/yr)

The working hours of the boiler and power plants are monitored and no emission reduction should be claimed for methane destruction during non-working hours.

The project utilizes the LFG only for power generation. Therefore:

$$F_{CH4,PJ,y} = F_{CH4,EL,y}$$

$F_{CH4,EL,y}$ is determined using the "Tool to determine the mass flow of a greenhouse gas in a gaseous stream". The following requirements apply:

(e) As per the gaseous stream tool, if the LFG is used for multiple purposes (e.g. flaring or energy generation), and all methane destruction devices are verified to be operational (e.g. by means of flame detectors records, energy generated), a single flow meter may be used to record the flow into multiple destruction devices. The destruction efficiency of the least efficient among the destruction devices shall be used as the destruction efficiency for all destruction devices monitored by this flow meter. If there are any periods for which one or more destruction devices are not operational, paragraph 5 (a) and (b) of the Appendix of the "Tool to determine the mass flow of a greenhouse gas in a gaseous stream" tool shall be followed;

(f) CH4 is the greenhouse gas for which the mass flow should be determined;

(g) The simplification offered for calculating the molecular mass of the gaseous stream is valid (equations (3) or (17) in the tool);

(h) The mass flow should be calculated on an hourly basis for each hour h in year y;

(i) The mass flow calculated for hour h is 0 if the equipment is not working in hour h (Opj,h=not working), the hourly values are then summed to a yearly unit basis.

Amount of the methane used for power generation ($F_{CH4,EL,y}$) The "Tool to determine the mass of a greenhouse gas in a gaseous stream" provides following 6 options for measuring mass flow of a greenhouse gas i in a gaseous stream Table 9.

Table 10. Measurement Options and bold option for the project

Option	Flow gaseous stream	Volumetric Fraction
A	**Volume flow – dry basis**	**Dry or wet basis**

B	Volume flow-wet basis	Dry basis
C	Volume flow-wet basis	Wet basis
D	Mass flow- dry basis	Dry or wet basis
E	Mass flow-wet basis	Dry basis
F	Mass flow-wet basis	Wet basis

Ex ante estimation of $F_{CH4,PJ,y}$

An ex ante estimate of FCH4,PJ,y is required to estimate baseline emission of methane from the SWDS (according to equation (2)) in order to estimate the emission reductions of the proposed project activity in the PD. It is determined as follows:

$$F_{CH4,PJ,y} = n_{PJ} \times BE_{CH4,SWDS,y}/GWP_{CH4}$$

Equation 4

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)
$BE_{CH4,SWDS,y}$	=	Amount of methane in the LFG that is generated from the SWDS in the baseline scenario in year y (t CO2e/yr)
n_{PJ}	=	Efficiency of the LFG capture system that will be installed in the project activity
GWP_{CH4}	=	Global warming potential of CH4 (t CO2e/t CH4)

$BE_{CH4,SWDS,y}$ is determined using the methodological tool “Emissions from solid waste disposal sites”. The following guidance should be taken into account when applying the tool:

(j) fy in the tool shall be assigned a value of 0 because the amount of LFG that would have been captured and destroyed is already accounted for in equation (2) of this methodology;

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

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

Application A of the Tool is used (i.e., the project activity mitigates methane emissions from a specific existing SWDS-solid waste disposal site). A yearly selection has been chosen as the Balikesir landfill started receiving wastes in 1994.

The amount of methane that would in the absence of the project activity be generated From disposal of waste at the solid waste disposal site ($BE_{CH4,SWDS,y}$) is calculated with a multi-phase model. The calculation is based on a first order decay (FOD) model.

$$BE_{CH4,SWDS,y} = \varphi y\,(1 - fy\,) * GWP\,CH4 * (1 - OX\,) * 16/12 * F * DOCf,y * MCFy * \sum\sum Wj,x * DOCj * exp(-kj\,(y - x)) * (1 - exp(-kj))$$

Equation 5

Where,

$BE_{CH4,SWDS,y}$	=	Baseline methane emissions occurring in year y generated from waste disposal at the solid waste disposal site (SWDS) during a period ending in year y (tCO2e/y)
φ	=	Model correction factor to account for model uncertainties (default value of 0.75),Option 1 in the Tool has been selected, value as per Table 3 of the Tool (Application A and humid wet conditions).
f	=	Fraction of methane captured at the SWDS and flared, combusted or used in another manner that prevents the emissions of methane to the atmosphere in year y. As this is already accounted for in FCH4,BL,y, "f" in the Tool shall be assigned a value of 0.
GWP_{CH4}	=	Global warming potential of CH4 (t CO2e/t CH4)
OX	=	Oxidation factor (reflecting the amount of methane from SWDS that is oxidized in the soil or other material covering the waste)
F	=	Fraction of methane in the SWDS gas (volume fraction) (0.5)
$DOCf,y$	=	Fraction of degradable organic carbon (DOC) that decomposes under the specific conditions occurring in the SWDS for year y (weight fraction). Default value of 0.5 used as per page 65 of the Tool.
$MCFy$	=	Methane correction factor for year y (1.0)
Wj,x	=	Amount of solid waste type j disposed or prevented from disposal in the SWDS in the year x (t)
DOC	=	Fraction of degradable organic carbon (by weight fraction) in the waste type j
kj	=	Decay rate for the waste type j (1/yr)
j	=	Type of residual waste or types of waste in the MSW
x	=	Years in the time period in which waste is disposed at the SWDS, extending from the first year in the time period (x=1) to year (x = y)
y	=	Year for which methane emissions are calculated (considering a consecutive period of 12 months)

Determination of FCH4,BL,y

This section provides a procedure to determine the amount of methane that would have been captured and destroyed (by flaring) in the baseline due to regulatory or contractual requirements, to address safety and odour concerns, or for other reasons (collectively referred

to as requirement in this section). The four cases in Table 10 are distinguished. The appropriate case should be identified, and the corresponding instructions followed.

Table 11. Cases for determining methane captured and destroyed in the baseline

Situation at the start of the project activity	Requirement to destroy methane	Existing LFG capture and destruction system
Case 1	**No**	**No**
Case 2	Yes	No
Case 3	No	Yes
Case 4	Yes	Yes

Case 1: No requirement to destroy methane exists and no existing LFG capture system
In this situation:

$$F_{CH4,BL,y} = 0$$

Equation 6

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

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

(a) The electricity sources k in the tool correspond to the sources of electricity generated identified in the selection of the most plausible baseline scenario; and

(b) ECBL,k,y in the tool is equivalent to the net amount of electricity generated using LFG in year y (EGPJ,y).

Taking into account the approach provided by the tool, baseline emissions are then calculated using the generic approach based on the quantity of electricity dispatched into the National Grid, an emission factor for electricity generation and a factor to account for transmission losses, as follows:

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

Equation 7

Where;

$EC_{BL,k,y}$ = Net amount of electricity generated using LFG in year y (MWh/yr)
$EF_{EL,k,y}$ = Emission factor for electricity generation for source k in year y (tCO2/MWh)
$TDL_{k,y}$ = Average technical transmission and distribution losses for providing electricity to source k in year y
k = Sources of electricity generated in the baseline

The Emission Factor is given from Turkish National Electricity Network calculated annually and for the year 2019 the combined emission factor is 0.5706 tCO2/MWh[28].

Emission Factor calculation

The Emission Factor is calculated as the Combined Margin (CM), comprised by two components: the Built Margin (BM) and the Operation Margin (OM). The BM evaluates the contribution of the power plants which would have been built if the project plant would not have been implemented. The OM evaluates the contribution of the power plants which would have been dispatched in the absence of the project activity. TOOL07 presents the following steps to calculate the Emission Factor:

- STEP 1: Identify the relevant electricity systems:

The sources of power in the Turkish electric system were taken from the Turkish Electricity transmission corporation. https://www.teias.gov.tr/en-US

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

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

Option I of the tool is chosen, which is to include only grid power plants in the calculation.

- STEP 3 - Select a method to determine the operating margin (OM). The calculation of the operating margin emission factor ($EF_{grid,OM,y}$) is based on one of the following methods:

(a) Simple OM, or

(b) Simple adjusted OM, or

(c) Dispatch data analysis OM, or

(d) Average OM. The simple operating margin can only be used where low-cost/must-run resources15 constitute less than 50% of total grid generation in: 1) average of 5 most recent years, or 2) based on long-term normalities for hydroelectricity production. Figure 10 shows

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

the share of the electricity production in the turkey interconnected system. The results show the applicability of the simple operating margin.

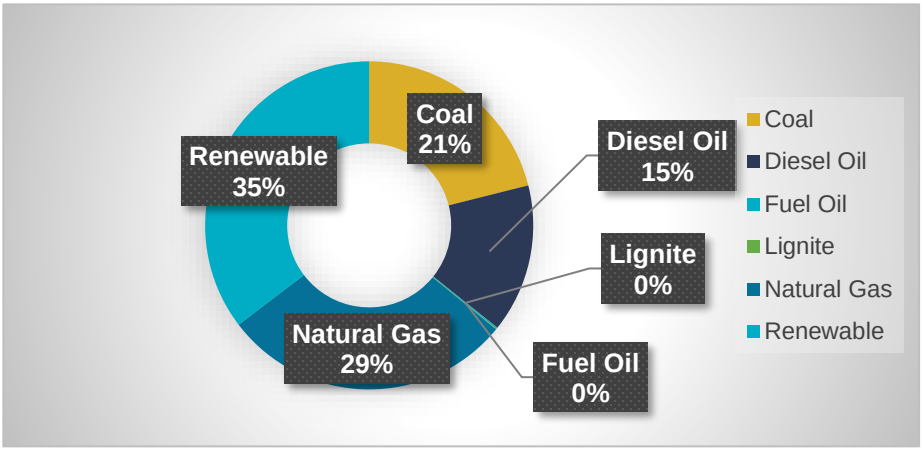


Figure 7. Electricity generation in Turkish interconnected system by source. Source: http://www.teias.gov.tr/sites/default/files/2019-03/56%2893-2017%29.xls

- STEP 4 - Calculate the operating margin emission factor according to the selected method

Simple OM

The simple OM emission factor is calculated as the generation-weighted average CO_2 emissions per unit net electricity generation (tCO2/MWh) of all generating power plants serving the system, not including low-cost/must-run power plants/units.

The simple OM may be calculated by one of the following two options:

(a) Option A: Based on the net electricity generation and a CO_2 emission factor of each power unit[29]; or

(b) Option B: Based on the total net electricity generation of all power plants serving the system and the fuel types and total fuel consumption of the project electricity system. Option B can only be used if:

a. The necessary data for Option A is not available; and

b. Only nuclear and renewable power generation are considered as low-cost/must-run power sources and the quantity of electricity supplied to the grid by these sources is known; and

[29] Power units should be considered if some of the power units at the site of the power plant are low- cost/must-run units and some are not. Power plants can be considered if all power units at the site of the power plant belong to the group of low-cost/must-run units or if all power units at the site of the power plant do not belong to the group of low-cost/must-run units.

c. Off-grid power plants are not included in the calculation (i.e. if Option I has been chosen in Step 2)

Under this option, the simple OM emission factor is calculated based on the net electricity generation of each power unit and an emission factor for each power unit, as follows:

$$EF_{grid,OM\ simple,y} = \frac{\sum EG_{m,y} * EF_{EL,m,y}}{\sum EG_{m,y}}$$

Where:

$EF_{grid,OM\ simple,y}$	=	Simple adjusted operating margin CO2 emission factor in year y (tCO2/MWh)
$EG_{m,y}$	=	Net quantity of electricity generated and delivered to the grid by power unit m in year y (MWh)
$EF_{EL,m,y}$	=	CO2 emission factor of power unit m in year y (t CO2/MWh)
m	=	All power units serving the grid in year y except low-cost/must-run power units
y	=	The relevant year as per the data vintage chosen in Step 3

- STEP 5 - Calculate the build margin (BM) emission factor The sample group of power units m used to calculate the build margin was determined following the procedure provided by the tool and BM emission factor shall be calculated based on the equation below:

$$EF_{grid,BM\ simple,y} = \frac{\sum EG_{m,y} * EF_{EL,m,y}}{\sum EG_{m,y}}$$

Where:

$EF_{grid,BM,y}$=	=	Build margin CO_2 emission factor in year y (tCO2/MWh)
$EG_{m,y}$	=	Net quantity of electricity generated and delivered to the grid by power unit m in year y (MWh)
$EF_{EL,m,y}$	=	CO2 emission factor of power unit m in year y (t CO2/MWh)
m	=	All power units serving the grid in year y except low-cost/must-run power units
y	=	The relevant year as per the data vintage chosen in Step 3

- STEP 6 – Calculate the combined margin (CM) emissions factor The calculation of the combined margin (CM) emission factor is based on one of the following methods:

(a) Weighted average CM; or
(b) Simplified CM.
Since power grid is not located in LDC/SIDs/URC and the weighted average CM method (option A) is the preferred option, this method was considered. The combined margin emissions factor is calculated as follows:

$$EF_{grid,CM,y} = EF_{grid,OM,y} * w_{OM} + EF_{grid,BM,y} * w_{BM}$$

Where:

$EF_{grid,OM,y}$	=	Operating margin CO_2 emission factor in year y (tCO_2/MWh)
w_{OM}	=	Weighting of operating margin emissions factor (%)
$EF_{grid,BM,y}$	=	Build margin CO_2 emission factor in year y (tCO_2/MWh)
w_{BM}	=	Weighting of build margin emissions factor (%)

As per the applicable "Tool to calculate the emission factor for an electricity system", version 07.0, the default weights for the operating margin and build margin emission factors for the proposed project activity is defined as:

w_{OM} = 0.50

w_{BM} = 0.50

Based on 2019 data published in 2021, Ministry of Energy and Natural resources of Turkey has calculated combined margin and published the data [34] :

Emission Factor is given from Turkish National Electricity Network, which is calculated annually and for the year 2019 the combined margin Emission factor was 0.5706 tCO2/MWh[30].

4.2 Project Emissions

In this section all project emission sources are taken into account; assumptions and simplifications are justified. Project emissions are calculated as follows:

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

Equation 8

Where:

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 purpose other than electricity generation, in year y (t CO2/yr)
$PE_{DT,y}$	=	Emissions from the distribution of compressed/liquefied LFG using trucks, in year y (t CO2/yr)

[30] Informing the Turkish national electricity grid emission factor calculated annually. TÜRKİYE ULUSAL ELEKTRİK ŞEBEKESİ EMİSYON FAKTÖRÜ BİLGİ FORMU (2020), EVÇED, Çevre ve İklim Daire Başkanlığı, İklim Grubu Telefon: +90 312 212 64 20 – 6992 e-posta: cevre.iklim@enerji.gov.tr https://enerji.gov.tr//Media/Dizin/EVCED/tr/ÇevreVeİklim/İklimDeğişikliği/TürkiyeUlusalElektrikŞebekesiEmisyonFaktörü/Belgeler/EK-2.pdf

$PE_{SP,y}$ = Emissions from the supply of LFG to consumers through a dedicated pipeline, in year y (t CO2/yr)

$PE_{FC,j,y}$ = Are the CO2 emissions from fossil fuel combustion in process j during the year y (tCO2/yr)

$PE_{flare,y}$ = Project emissions from flaring of the residual gas in year *y*

The project does not involve the distribution of compressed/liquefied LFG using trucks nor pipelines. Therefore, $PE_{DT,y}$, $PE_{SP,y}$,y will be 0. Hence, PE_y will be equal to $PE_{EC,y}$+$PE_{FC,y}$.

$PE_{EC,y}$ is determined by "Tool to calculate baseline, project and/or leakage emissions from electricity consumption" as follow:

$$PE_{EC,y} = \sum_j EC_{PJ,j,y} * EF_{EL,j,y} * (1 + TDL_{j,y}) \quad \text{Equation 9}$$

Where:

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

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

$EF_{EL,j,z}$ = 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

The "Tool to calculate baseline, project and/or leakage emissions from electricity consumption" provides 3 scenarios for different sources of electricity consumption. Since the electricity generated through the project is partly consumed by the project scenario A is applicable. In the case of applying scenario A, two options are available for determining emission factor. For this project, Option A1 ($EF_{EL,j,y}$=$EF_{grid,CM,y}$) is chosen.

In reality The Balikesir LFG project does not take electrical energy from the grid, since it is not allowed. but the emissions generated by the project are calculated as if they were fed into the grid first and then taken from it.

Project emissions from fossil fuel combustion

$PE_{FC,j,y}$ is determined by "TOOL03 Methodological tool: Tool to calculate project or leakage CO2 emissions from fossil fuel combustion. Version 03.0". They are the CO2 emissions from fossil fuel combustion in process j during the year y (tCO2/yr).

According to regulation there is to have a captive power plant or urgency diesel generator in case of shortage on methane for electricity production in case the electricity needs to be maintained and the engines don't provide it temporarily.

CO2 emissions from fossil fuel combustion in process j are calculated based on the quantity of fuels combusted and the CO2 emission coefficient of those fuels, as follows:

$$PE_{FC,j,y} = \sum_{j} FC_{PJ,j,y} * COEF_{i,y} \qquad \text{Equation 10}$$

Where:

$PE_{FC,j,y}$ = Are the CO2 emissions from fossil fuel combustion in process j during the year y (tCO2/yr)

$FC_{PJ,j,y}$ = Is the quantity of fuel type i combusted in process j during the year y (mass or volume unit/yr)

$COEF_{i,y}$ = Is the CO2 emission coefficient of fuel type i in year y (tCO2/mass or volume unit)

i = Are the fuel types combusted in process j during the year y

As per tool 3, in order to determine the parameter COEF, option A is the preferred approach as the necessary data is available.$COEF$[31] $= 0{,}00268 \frac{\text{tCO2}}{\text{L}} fuel$

The fuel used in the project is commercial diesel fuel and the quantities are shown below:

Table 12. Balikesir Generator opational hours

	Generator Operation Schedule				
	Date	working hours Initial	working hours final	Difference	Difference Fuel (Lt/s)
2019	30/10/2019	0	2	2	56
	22/11/2019	2	10	8	70
	2/12/2019	10	14	4	72
	19/12/2019	14	20	6	65

[31] Source: For Diesel Oil fuel.GHG protocol: Emission Factors from Cross-Sector Tools https://ghgprotocol.org/calculation-tools (consulted 25.07.2022)

2020	6/02/2020	20	28	8	58
	16/04/2020	28	34	6	53
	25/09/2020	34	41	7	58
	12/07/2020	41	47	6	62
	16/11/2020	47	52	5	59
	18/12/2020	52	59	7	68
2021	14/02/2021	59	67	8	59
	19/03/2021	67	77	10	69
	26/10/2021	77	83	6	56
	29/11/2021	83	89	6	54
	16/12/2021	89	96	7	62
	29/12/2021	96	101	5	66
2022	19/01/2022	101	107	6	68
	26/02/2022	107	112	5	61
	3/03/2022	112	118	6	59
	25/05/2022	118	126	8	62
	19/06/2022	126	131	5	66

Table 13. Emissions from fossil fuel consumption

	year	Diesel oil consumption (L , y)	COEF CO2 emission factor (Kg CO2/L)[32]	PE $_{FC}$ (tCO2)
1	2019	1350	2.68	3.61
2	2020	2331	2.68	6.24
3	2021	2586	2.68	6.92
4	2022	1893	2.68	5.07
5	2023	2270	2.68	6.08
6	2024	2270	2.68	6.08
7	2025	2270	268	6.08

In Table 13 are accounted the emissions form fossil fuel consumption ex post project activity. Values for fuel consumption in year 5, 6 and 7, are based on an averages value of the hours actually consumed in years (2,3,4).

Project emissions from flaring

Methodological TOOL06 show the calculation procedure to determine the project emissions form flaring the residual gas PE, flare based on the flare efficiency (flare) and the mass flow

[32] Source: For Diesel Oil fuel.GHG protocol: Emission Factors from Cross-Sector Tools https://ghgprotocol.org/calculation-tools (consulted 25.07.2022)

of methane to the flare (FCH4,RG,m). The flare efficiency is determined based on monitored data or default values.
In the annex is attached an example of the store data form the monitoring values

The methodological TOOL shows a procedure form three steps to calculate those emissions. The excel tool EB102_repan06_Tool06_Emissions from flare_ was planned to be used to calculates the project emissions form flaring, if working hours wouldn't have been 0.

(a) STEP 1: Determination of the methane mass flow of the residual gas;

(b) STEP 2: Determination of the flare efficiency;

(c) STEP 3: Calculation of project emissions from flaring.

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

The residual gas is monitored continuously in normal conditions (Nm3/h) every 10 min for 24/7. The mass flow of methane in the residual gas in (kg/m) is calculated

$F_{CH\,4,RG,t} = V_{t,db} * v_{CH\,4,wb,t} * \rho_{CH\,4,n}$	Equation 11

Where:

$F_{CH4,\,t}$	=	Mass flow of greenhouse gas (*CH4)* in the gaseous stream in time interval *t* (kg gas/h)
$V_{t,\,wb}$	=	Volumetric flow of the gaseous stream in time interval *t* on a dry basis (m^3 dry gas/h)
$v_{CH4,\,t,\,wb}$	=	Volumetric fraction of greenhouse gas *CH4* in the gaseous stream in a time interval *t* on a dry basis (m^3 gas *i*/m^3 dry gas)
$\rho_{CH\,4,n}$		Density of greenhouse gas CH4 in the gaseous stream at normal conditions t (kg gas i/m^3 gas i)

b. STEP 2: Determination of the flare efficiency;

- ✓ Enclosed flare

In this case the project implemented an enclosed flare, there are two options to determine the flare efficiency for minute m (ŋflare,m)

(a) Option A: Apply a default value for flare efficiency;

(b) Option B: Measure the flare efficiency.

Option A is chosen because:

(a) The temperature of the flare (TEG.m) and the flow rate of the residual gas to the flare (FRG,m) is within the convecos's operating specification for the flare (SPECflare) in the minute m;

- the operating temperature of convecos flare system is 850 – 1100 °C, and according to records temperature were from (0°C to 40°C) due to weather conditions it means it was not operating,.

(b) The flame is detected in the minute m (Flame).

The set of thermocouples, measure continuously temperature and allow the detection of the presence and absence of flame, which can be cross check with the flare working hours and amount of residual gas to flare. T (0) flare is the parameter can be read form the compiled store data from the control system.

Since the enclose flare could be define as low height (8.40 m Heigh) flare the efficiency is adjusted 10 percentile points less form the default value:

Ɒ flare,m	80%

c. STEP 3: Calculation of project emissions from flaring.

$PE_{flare,y} = GWP_{CH4} * \sum_{m=1}^{525600} F_{CH4,RG,m} * \left(1 - \eta_{flare,m}\right) * 10^{-3}$	Equation 12

Where:

$PE_{flare,y}$ = Project emissions from flaring of the residual gas in year y (tCO2e)

GWP_{CH4} = Global warming potential of methane valid for the commitment period (tCO2e/tCH4)

$FCH4,RG,m$ = Mass flow of methane in the residual gas in the minute m (kg)

$\eta flare,m$ = Flare efficiency in the minute m

Table 14.

According to the records presented on the excel sheet 'Balikesir Boster Data Flare working hours' it is shown that since 2020 and (so it was since comissiong date) the working hours of flare have been in zero, the thermocouples installed (T 0) see Table 3, have shown values form (0 – 40 °C) corresponding to ambient temperatures and not the working flare range of (850°C -1100°C), the 0 working hours can be crosschecked with the temperature to validate this.

Therefore:

Flare working hours (h)[33]	0
$PE_{flare,y}$ ((tCO2e))	0

4.3 Leakage

No leakage effects are accounted for under the ACM0001 Methodology.

4.4 Net GHG Emission Reductions and Removals

Emission reductions are calculated as follows:

$$ER_y = BE_y - PE_y$$

Equation 13

Where:

ER_y = Emission reductions in year y (t CO_2e/yr)
BE_y = Baseline emissions in year y (t CO_2e/yr)
PE_y = Project emissions in year y (t CO_2/yr)

Base on section 4.1, the baseline emissions are calculated as follows:

$$BE_y = BE_{CH4,y} + BE_{EC,y}$$

Baseline emissions of methane from the SWDS are calculated as follows:

$$BE_{CH4} = \left(\left(1 - OX_{top\_layer}\right) \times F_{CH4,PJ,y} - F_{CH,BL,y}\right) \times GWP_{CH4}$$

Year	$F_{CH4,PJ,y}$ (tCH4)	$F_{CH4,BL,y}$ (tCH4)	GWP_{CH4} (tCO_2e/tCH_4)	$BE_{CH4,y}$ (tCO_2e/yr)
1	6,006	0	28	151,363
2	8,818	0	28	222,221
3	10,234	0	28	257,903
4	11,607	0	28	292,509
5	13,139	0	28	331,092

[33] Data records 'Balikesir Booster Data Flare Working Hours'

6	14,847	0	28	374,140
7	16,754	0	28	422,196

The ex ante estimate of FCH4,PJ,y is determined as follows:

$$F_{CH4,PJ,y} = n_{PJ} \times \frac{BE_{CH4,SWDS,y}}{GWP_{CH4}}$$

$BE_{CH4,SWDS}$,y is determined using the methodological tool "Emissions from solid waste disposal sites", details please refer to the ER sheet.

Baseline emissions associated with electricity generation in year y (BEEC,y) are calculated as follows:

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

Year	Installed capacity (MWe)	TDL k,y	EF grid,CM,y (t CO2/MWh)	$BE_{EC,y}$ (tCO_2e/yr)
1	11.76	0.11	0.5706	58,204
2	11.76	0.11	0.5706	58,204
3	11.76	0.11	0.5706	58,204
4	11.76	0.11	0.5706	59,697
5	14.14	0.11	0.5706	71,778
6	14.14	0.11	0.5706	71,778
7	14.14	0.11	0.5706	71,778

Project emissions are calculated as follows:

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

Project emissions from consumption of electricity by the project activity (PEEC,y) are calculated as follows:

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

Table 15. Project emissions from consumption of electricity by the project activity

Year	Working hours (h)	Electricity consumption (MWh)				EF grid,CM,y (t CO_2/MWh)	PEEC, y (t CO_2/yr)
		Gas Engine	Blowers	Chillers	Total		
1	1,296	3,124	157	513	3,795	0.5706	2,408
2	7,884	28,510	957	3,122	32,590	0.5706	20,679
3	7,884	38,013	957	3,122	42,093	0.5706	26,709
4	7,884	38,013	957	3,122	42,093	0.5706	26,709
5	7,884	38,013	957	3,122	42,093	0.5706	26,709
6	7,884	38,013	957	3,122	42,093	0.5706	26,709
7	7,884	38,013	957	3,122	42,093	0.5706	26,709

Table 16. Net GHG Emission Reductions

Year	Estimated baseline emissions or removals (tCO_2e)	Estimated project emissions or removals (tCO_2e)	Estimated leakage emissions (tCO_2e)	Estimated net GHG emission reductions or removals (tCO_2e)
1	209,567	2,412	-	207,155
2	280,426	20,686	-	259,740
3	316,107	26,717	-	289,390
4	352,205	26,715	-	325,491
5	402,871	26,716	-	376,155
6	445,919	26,716	-	419,203
7	493,975	26,716	-	467,259

Total	**2,501,069**	**156,676**	**-**	**2,344,393**

5. MONITORING

5.1 Data and Parameters Available at Validation

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Data / Parameter	φ
Data unit	-
Description	Model correction factor to account for model uncertainties
Source of data	First order decay model from the "Tool to determine methane emissions avoided from dumping waste at a solid waste disposal site".
Value applied	0.75
Justification of choice of data or description of measurement methods and procedures applied	For baseline emissions: according to the "Tool to determine methane emissions avoided from dumping waste at a solid waste disposal site". The appropriate factor was taken based on the application of the tool (A).See table below and the climate where the SWDS is located (Dry conditions).
Purpose of Data	*Calculation of baseline emissions*
Comments	-

	Humid/wet conditions	**Dry conditions**
Application A	0.75	0.75
Application B	0.85	0.80

Data / Parameter	OX_{top_layer}
Data unit	-

Description	Fraction of methane that would be oxidized in the top layer of the SWDS in the baseline
Source of data	Consistent with how oxidation is accounted for in the methodological tool “Emissions from solid waste disposal sites” which is based on an extensive review of published literature on this subject, including the IPCC 2006 Guidelines for National Greenhouse Gas Inventories
Value applied	0.1
Justification of choice of data or description of measurement methods and procedures applied	$OX_{top\text{-}layer}$ is the fraction of the methane in the LFG that would oxidize in the top layer of the SWDS in the absence of the project activity. Under the project activity, this effect is reduced as a part of the LFG is captured and does not pass through the top layer of the SWDS. This oxidation effect is also accounted for in the methodological tool “Emissions from solid waste disposal sites”.
Purpose of Data	The oxidation factor shall be included in the calculation of baseline emissions whereas the effect of oxidation is, as a conservative assumption, neglected under the project activity.
Comments	The oxidation factor represents the proportion of methane that is oxidized to CO_2 This should be distinguished from the methane correction factor (MCF) which is to account for the situation that ambient air might intrude into the SWDS and prevent methane from being formed in the upper layer of SWDS.

Data / Parameter	F
Data unit	-
Description	Volume fraction of methane in the SWDS gas.
Source of data	First order decay model from the “Tool to determine methane emissions avoided from dumping waste at a solid waste disposal site”.
Value applied	0.5

Justification of choice of data or description of measurement methods and procedures applied	The default value 0,5 is recommended by the Tool to determine methane emissions avoided from dumping waste at a solid waste disposal site is applied.
Purpose of Data	*Calculation of baseline emissions*
Comments	-

Data / Parameter	MCF
Data unit	-
Description	Methane correction factor.
Source of data	First order decay model from the “Tool to determine methane emissions avoided from dumping waste at a solid waste disposal site”.
Value applied	0.8
Justification of choice of data or description of measurement methods and procedures applied	For baseline emissions: according to the “Tool to determine methane emissions avoided from dumping waste at a solid waste disposal site” and to the IPCC Guidlines for National Greenhouse Gas Inventories (2006). The following values are to be considered: 1.0 for anaerobic managed solid waste disposal sites. These must have controlled placement of waste (i.e., waste directed to specific deposition areas, a degree of control of scavenging and a degree of control of fires) and will include at least one of the following: (i) cover material; (ii) mechanical compacting; or (iii) leveling of the waste; 0.5 for semi-aerobic managed solid waste disposal sites. These must have controlled placement of waste and will include all of the following structures for introducing air to waste layer: (i) permeable cover material; (ii) leachate drainage system; (iii) regulating pondage; and (iv) gas ventilation system; 0.8 for unmanaged solid waste disposal sites ñ deep and/or with high water table. This comprises all SWDS not meeting the criteria of managed SWDS and which have depths of greater than or equal to 5 meters and/or high water table at

	near ground level. Latter situation corresponds to filling inland water, such as pond, river or wetland, by waste; 0.4 for unmanaged-shallow solid waste disposal sites. This comprises all SWDS not meeting the criteria of managed SWDS and which have depths of less than 5 metres. Any comment: The methane correct. Due to the fact that the baseline emissions corresponds to an unmanaged SWDS. The value taken was 0,8.
Purpose of Data	*Calculation of baseline emissions*
Comments	-

Data / Parameter	DOCf
Data unit	-
Description	Fraction of degradable organic carbon that can decompose
Source of data	First order decay model from the “Tool to determine methane emissions avoided from dumping waste at a solid waste disposal site”.
Value applied	0.5
Justification of choice of data or description of measurement methods and procedures applied	The default value 0.5 is recommended by the Tool to determine methane emissions avoided from dumping waste at a solid waste disposal site is applied.
Purpose of Data	*Calculation of baseline emissions*
Comments	-

Data / Parameter	DOCj
Data unit	-
Description	Fraction of degradable organic carbon (by weight) in the waste type j.

<table>
<tr><td>Source of data</td><td>First order decay model from the “Tool to determine methane emissions avoided from dumping waste at a solid waste disposal site”.</td></tr>
<tr><td>Value applied</td><td>DOCj See table below</td></tr>
<tr><td>Justification of choice of data or description of measurement methods and procedures applied</td><td>For baseline emissions: according to the “Tool to determine methane emissions avoided from dumping waste at a solid waste disposal site” .The following values for the different waste types j are applied
<table>
<tr><td>Waste type j</td><td>DOC j (% wet waste)</td></tr>
<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, park and yard waste</td><td>20</td></tr>
<tr><td>Glass, plastic, metal, other inert</td><td>0</td></tr>
</table></td></tr>
<tr><td>Purpose of Data</td><td>Calculation of baseline emissions</td></tr>
<tr><td>Comments</td><td>-</td></tr>
</table>

Data / Parameter	*k*
Data unit	-
Description	*Decay rate for the waste type j.*
Source of data	*First order decay model from the “Tool to determine methane emissions avoided from dumping waste at a solid waste disposal site”.*
Value applied	*DOCj See table below*
Justification of choice of data or description	*For baseline emissions: according to the “Tool to determine methane emissions avoided from dumping waste at a solid waste*

of measurement methods and procedures applied

disposal site" .The following values for the different waste types j are applied (grey highlighted).

Type of Waste		*Climate Zone*			
		Boreal and Temperate		*Tropical*	
		(MAT ≤ 20 C)		*(MAT > 20 C)*	
		Dry	*Wet*	*Dry*	*Moist and Wet*
		(MAP/PET < 1)	*(MAP/PET > 1)*	*(MAP < 1000 mm)*	*(MAP >= 1000mm)*
		Default	*Default*	*Default*	*Default*
Slowly degrading waste	*Paper/textiles waste*	*0.04*	*0.06*	*0.045*	*0.07*
	Wood/straw waste	*0.02*	*0.03*	*0.025*	*0.035*
Moderately degrading waste	*Other (non-food) organic putrescible/ Garden and park waste*	*0.05*	*0.1*	*0.065*	*0.17*
Rapidly degrading waste	*Food waste/Sewage sludge*	*0.06*	*0.185*	*0.085*	*0.4*
Bulk Waste		*0.05*	*0.09*	*0.065*	*0.17*

Purpose of Data	Calculation of baseline emissions
Comments	MAT - mean annual temperature, MAP -Mean annual precipitation, PET - potential evapotranspiration. MAP/PET is the ratio between the mean annual precipitation and the potential evapotranspiration. The values applied are for Climate Zone: Boreal and temperate (MAT ≤ 20 C), and dry (MAP/PET < 1)

Data / Parameter	W_{total}
Data unit	tons
Description	The amount of waste disposed in the landfill sites in year x .
Source of data	Historical waste data and waste projections
Value applied	

	W_total (t/y)
2003	35.000
2004	35.700
2005	36.414
2006	37.142
2007	37.885
2008	38.643
2009	39.416
2010	40.204
2011	41.008
2012	41.828
2013	42.665
2014	43.518
2015	44.309
2016	67.560
2017	84.937
2018	315.850
2019	377.303
2020	423.338
2021	474.139
2022	531.035
2023	594.759
2024	666.131
2025	746.066
2026	835.594
2027	935.865
2028	1.048.169
2029	1.173.950
2030	1.314.824
2031	1.472.602
2032	1.649.315
2033	1.847.232
2034	2.068.900
2035	2.317.168
2036	2.595.229
2037	2.906.656
2038	3.255.455
2039	3.646.109
2040	4.083.642

Purpose of Data	Calculation of baseline emissions
Comments	The estimated amount of waste to be received is based on the Environmental Impact Assessment related to the landfill expansion. The characterization of the municipal solid waste is based on the study performed by Dr. A Seyfert (2019).[34] The Balikesir Landfill has an old deposition area since 2003, and in 2014 the waste deposition progress at the west and south side of the old area, receiving only the disposal of the city center.. From the beginning of 2017 up to the end 2018 the main focus of the waste deposition was the expansion to receive 3 more transfer stations. in 2020, 5 more transfer station were directed to the Balikesir LFG.

[34] Prefeasibility study and roughly planning concept for landfill gas collecting and utilization. Dr. Ing. A. Seyfert. (2019)

Data / Parameter	GWP_{CH4}
Data unit	t CO2 e/t CH4
Description	Global warming potential of methane.
Source of data	Decisions under UNFCCC and the Kyoto Protocol (a value of 28 is to be applied)
Value applied	28
Purpose of Data	Calculation of baseline emissions
Comments	-

Data / Parameter	$EF_{CO2,grid, y}$
Data unit	tCO_2e/MWh
Description	Emission factor for the Turkish National Grid
Source of data	*Published data from The Ministry of the Energy and Natural Resources in Turkey*[35]
Value applied	*0.5706*
Justification of choice of data or description of measurement methods and procedures applied	*Obtained from the most recent official national grid emission factor data published by the Ministry of the Energy and Natural Resources in Turkey*[36]
Purpose of Data	Used in • Calculation of baseline emissions • Calculation of project emissions

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

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

Comments	-
Data / Parameter	$TDL_{j,y}$
Data unit	-
Description	*Average technical transmission and distribution losses for providing electricity to source j in year y*
Source of data	*Calculated from the Data Provided by Turkish Electricity Transmission Corporation (TEİAŞ)[37] in accordance with Methodological Tool: Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation, Version 3.0[38]*
Value applied	*0.11*
Justification of choice of data or description of measurement methods and procedures applied	*The annual average value based on the most recent data available within Turkey is used from the data provided by TEİAŞ. In accordance with the Methodological Tool, for the data from the relevant year, 2021, is absent, most recent figures are used, but not older than 5 years. Accordingly, the annual network losses for the years 2019, 2018, and 2017 are taken into account in calculating $TDL_{j,y}$.*
Purpose of Data	*Used in* • *Calculation of project emissions*
Comments	-

Data / Parameter	ρ CH4, n
Data unit	kg/m3
Description	Density of methane gas at reference conditions
Source of data	Default Value of TOOL06
Value applied	0.716
Justification of choice of data or description of	

[37] https://webapi.teias.gov.tr/file/512cbf1d-0ca3-4492-b901-3722c7b682f7?download

[38] https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-05-v3.0.pdf

measurement methods and procedures applied	
Purpose of Data	Determination of the methane mass flow of the residual gas
Comments	

Data / Parameter	$SPEC_{flare}$
Data unit	- °C m3/h
Description	Stainless steel burner with multiple nozzle • Combustion range: 25-50% methane • Combustion temperature: 850 - 1100 °C • Designed for combustion of 300 m3/h of biogas. (Flow range 50 to 1500 m3/h) • Flame retention >0.3 sec The operator will decide whether to start and ignite the Flare with Cogeneration either on or off (see settings page on Data sheet specifications).
Source of data	Conveco – specialist in Biogas technology
Value applied	The ones specified on the technical
Justification of choice of data or description of measurement methods and procedures applied	*High temperature combustion and extraction system*
Purpose of Data	Calculation of project emissions from residual gas
Comments	Please find the specifications on the Folder Data sheet of equipment. This in an enclosed flare.

5.2 Data and Parameters Monitored

Data / Parameter	Management of SWDS
Data unit	-
Description	Management of SWDS
Source of data	Original design of the landfill
Description of measurement methods and procedures to be applied	Project participants should refer to the original design of the landfill to ensure that any practice to increase methane generation have been occurring prior to the implementation of the project activity. Any change in the management of the SWDS after the implementation of the project activity should be justified by referring to technical or regulatory specifications
Frequency of monitoring/recording	Annually
Value applied	-
Monitoring equipment	•
QA/QC procedures to be applied	
Purpose of data	Calculation of baseline emissions
Calculation method	
Comments	-

Data / Parameter	$EG_{PJ,y}$
Data unit	*MWh*
Description	Amount of electricity generated using LFG by the project activity in year y

Source of data	Electricity meter data records
Description of measurement methods and procedures to be applied	Monitor net electricity generation by the project activity using LFG
Frequency of monitoring/recording	Continuous measurement every 10 min (24/7) all year and data can be downloaded and saved anytime
Value applied	-
Monitoring equipment	Calibrated Electricity meter
QA/QC procedures to be applied	Electricity meter is subject to regular (in accordance with stipulation of the meter supplier) maintenance and testing to ensure accuracy. The readings are double checked by the electricity distribution company. The calibration of meter, including the frequency of calibration, will be done in accordance with national standards or requirements set by the meter supplier or requirements set by the grid operators. The accuracy class of the meter is in accordance with the stipulation of the meter supplier and/or as per the requirements set by the grid operators or national requirements.
Purpose of data	Calculation of baseline emissions
Calculation method	
Comments	This parameter is required for calculating baseline emissions associated with electricity generation (BEEC,y) using the methodological tool “Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation”

Data / Parameter	$EC_{PJ,y}$
Data unit	*MWh*
Description	Amount of electricity consumed by the project activity in year y

Source of data	Electricity meters
Description of measurement methods and procedures to be applied	Sources of consumption shall include, where applicable, electricity consumed for the operation of the LFG capture system, for any processing and upgrading of the LFG, for transportation of the LFG to the flare or other applications (boilers, power generators), for the compression of the LFG into the natural gas network, etc.
Frequency of monitoring/recording	Continuous measurement and monthly recording
Value applied	-
Monitoring equipment	Electricity meter
QA/QC procedures to be applied	Electricity meter will be subject to regular (in accordance with stipulation of the meter supplier) maintenance and testing to ensure accuracy. The readings will be double checked by the electricity distribution company. The calibration of meter, including the frequency of calibration, will be done in accordance with national standards or requirements set by the meter supplier or requirements set by the grid operators. The accuracy class of the meter should be in accordance with the stipulation of the meter supplier and/or as per the requirements set by the grid operators or national requirements.
Purpose of data	Calculation of project emissions
Calculation method	
Comments	This parameter is required for calculating project emissions from electricity consumption due to an alternative waste treatment process t PEEC,y) using the methodological tool “Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation”

Data / Parameter	Opj,h
Data unit	-
Description	Operation of the equipment that consumes the LFG

Source of data	Project participants
Description of measurement methods and procedures to be applied	For each equipment unit j using the LFG monitor that the plant is operating in hour h by the monitoring any one or more of the following three parameters: (a) Temperature. Determine the location for temperature measurements and minimum operational temperature based on manufacturer's specifications of the burning equipment. Document and justify the location and minimum threshold in the PDD; (b) Flame. Flame detection system is used to ensure that the equipment is in operation; (c) Products generated. Monitor the generation Opj,h = 0 when: (a) One of more temperature measurements are missing below the minimum threshold in hour h (instantaneous measurements are made at least every minute); (b) Flame is not detected continuously in hour h (instantaneous measurements are made at least every minute) Otherwise, Opj,h = 1
Frequency of monitoring/recording	Hourly
Value monitored	N/A
Monitoring equipment	Flare program logic controller
QA/QC procedures to be applied	-
Purpose of the data	Calculation of baseline emissions
Calculation method	Calculated in the workbook using a formula that checks the flow from the flow meters against the flare temperature and UV sensor and or electricity flow meter.
Comments	None

Data / Parameter	$v_{i,t,wb}$
Data unit	m^3 gas i/m^3 wet gas
Description	Volumetric fraction of greenhouse gas i in a time interval t on a wet basis
Source of data	Measurement
Description of measurement methods and procedures to be applied	Continuous in-situ analyzers
Frequency of monitoring/recording	Continuous measurement and hourly recording
Value monitored	
Monitoring equipment	Infrared Gas Analyzer 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.
QA/QC procedures to be applied	
Purpose of the data	Calculation of Baseline Emissions
Calculation method	Not Applicable
Comments	This parameter will be monitored in Option F as per the applied "Tool to determine the mass flow of a greenhouse gas in a gaseous stream" (Version 02.0.0).

Data / Parameter	CAPEX and OPEX

Data unit	Currency (USD, EUR, etc.)
Description	Total investment to implement the project and total cost to operate the project.
Source of data	Engineering, procurement and construction contracts; and maintenance contracts.
Description of measurement methods and procedures to be applied	Measured and calculated
Frequency of monitoring/recording	At the first issuance request after each phase of the project is fully implemented.
Value monitored	
Monitoring equipment	Not applicable
QA/QC procedures to be applied	Audited by professional, independent financial auditors. The DOE should only verify that the data provided corresponds to the data from independent financial auditors.
Purpose of the data	In order to collect the information that is required for the update of the provisions in section 5.3.1 of ACM0001 (version 19). Project activities that are registered using these simplified procedures are required to report cost and revenue information at the first issuance request after each phase of the project is fully implemented.
Calculation method	Not Applicable
Comments	-

Data / Parameter	Tariff or electricity exported
Data unit	Currency – Lira

Description	Tariff of electricity exported
Source of data	Power Purchase Agreement
Description of measurement methods and procedures to be applied	Monitored annually. In the absence of data from the relevant year, most recent figures should be used, but not older than 5 years.
Frequency of monitoring/recording	At the first issuance request after each phase of the project is fully implemented
Value monitored	-
Monitoring equipment	-
QA/QC procedures to be applied	Audited by professional, independent financial auditors. The DOE should only verify that the data provided corresponds to the data from independent financial auditors
Purpose of the data	-
Calculation method	-
Comments	The monitoring of this parameter is only required for projects applying the simplified procedures to identify the baseline scenario and demonstrate additionality. Parameter in accordance with the applied ACM0001.

Data / Parameter	$v_{,t,wb}$
Data unit	m^3 gas / hours
Description	Volumetric flow of the gaseous stream in time interval t on a wet basis
Source of data	Measurement
Description of measurement methods and	Volumetric flow measurement should always refer to the actual pressure and temperature. Instruments with recordable electronic signal (analogical or digital) are required

procedures to be applied	
Frequency of monitoring/recording	Continuous measurement and hourly recording
Value monitored	
Monitoring equipment	Flow meter Periodic calibration against a primary device provided by an independent accredited laboratory is mandatory for all projects applying large scale methodology(ies). Calibration and frequency of calibration is according to manufacturer's specifications.
QA/QC procedures to be applied	
Purpose of the data	Calculation of Baseline Emissions
Calculation method	Not Applicable
Comments	-

Data / Parameter	T
Data unit	°C
Description	Temperature of the gaseous stream in time interval t
Source of data	Measurement
Description of measurement methods and procedures to be applied	Flow meter
Frequency of monitoring/recording	Continuous measurement and hourly recording

Value monitored	
Monitoring equipment	Flow meter Periodic calibration against a primary device provided by an independent accredited laboratory is mandatory for all projects applying large scale methodology(ies). Calibration and frequency of calibration is according to manufacturer's specifications.
QA/QC procedures to be applied	
Purpose of the data	Calculation of Baseline Emissions
Calculation method	Not Applicable
Comments	-

Data / Parameter	P
Data unit	Pascals (Pa)
Description	Pressure of the gaseous stream in time interval t
Source of data	Measurement
Description of measurement methods and procedures to be applied	Flow meter
Frequency of monitoring/recording	Continuous measurement and hourly recording
Value monitored	
Monitoring equipment	Flow meter

	Periodic calibration against a primary device provided by an independent accredited laboratory is mandatory for all projects applying large scale methodology(ies). Calibration and frequency of calibration is according to manufacturer's specifications.
QA/QC procedures to be applied	
Purpose of the data	Calculation of Baseline Emissions
Calculation method	Not Applicable
Comments	-

Data / parameter:	$FC_{i,j,y}$
Data unit:	tC/mass unit of the fuel
Description:	Weighted average mass fraction of carbon in fuel type i in year y
Source of data:	Onsite measurements
Description of measurement methods and procedures to be applied	Measurements should be undertaken in line with national or international fuel standards
Frequency of monitoring/recording	Continuously
Value monitored	
Monitoring equipment	
QA/QC procedures to be applied	The consistency of metered fuel consumption quantities should be cross-checked by an annual energy balance that is based on purchased quantities and stock changes.
Purpose of the data	
Calculation method	
Comments	This parameter has not been used for diesel generators yet.

Data / parameter:	$W_{c,l,y}$
Data unit:	Mass unit/volume unit
Description:	Weighted average density of fuel type i in year y
Source of data:	Measurements by the project participants
Description of measurement methods and procedures to be applied	Measurements should be undertaken in line with national or international fuel standards
Frequency of monitoring/recording	
Value monitored	
Monitoring equipment	
QA/QC procedures to be applied	
Purpose of the data	
Calculation method	
Comments	-

Data / parameter:	$\rho_{i,y}$
Data unit:	Mass unit/volume unit
Description:	Weighted average density of fuel type i in year y
Source of data:	Measurements by the project proponent
Description of measurement methods and procedures to be applied	Measurements should be undertaken in line with national or international fuel standards
Frequency of monitoring/recording	The density of the fuel should be obtained for each fuel delivery, from which weighted average annual values should be calculated
Value monitored	

Monitoring equipment	
QA/QC procedures to be applied	
Purpose of the data	
Calculation method	
Comments	-

Data / Parameter:	$NCV_{i,y}$
Data unit:	GJ per mass or volume unit (e.g. GJ/m^3, GJ/ton)
Description:	Weighted average net calorific value of fuel type i in year y
Source of data:	Measurements by the project proponent
Description of measurement methods and procedures to be applied	Measurements be undertaken in line with national or international fuel standards
Frequency of monitoring/recording	The NCV be obtained for each fuel delivery, from which weighted average annual values be calculated.
Value monitored	
Monitoring equipment	
QA/QC procedures to be applied	
Purpose of the data	
Calculation method	
Comments	-

Data / Parameter:	$EF_{CO2,I,y}$
Data unit:	tCO2/GJ
Description:	Weighted average CO2 emission factor of fuel type *i* in year *y*
Source of data:	Measurements by the project proponent

Description of measurement methods and procedures to be applied	Measurements be undertaken in line with national or international fuel standards
Frequency of monitoring/recording	The CO_2 emission factor be obtained for each fuel delivery, from which weighted average annual values be calculated.
Value monitored	
Monitoring equipment	
QA/QC procedures to be applied	
Purpose of the data	
Calculation method	
Comments	-

Data / Parameter:	$F_{CH4,EG,t}$
Data unit:	kg
Description:	Mass flow of methane in the exhaust gas of the flare on a dry basis at reference conditions in the time period *t*
Source of data:	Measurements undertaken by a third-party accredited entity
Description of measurement methods and procedures to be applied	Values taken form the system that has been calibrated
Frequency of monitoring/recording	Biannual
Value monitored	
Monitoring equipment	
QA/QC procedures to be applied	According to standard applied
Purpose of the data	
Calculation method	
Comments	The project implements an enclosed flare therefore, there is monitoring.

Data / Parameter:	$T_{EG,m}$
Data unit:	°C
Description:	Temperature in the exhaust gas of the enclosed flare in the minute *m*
Source of data	Project operator's Monitoring reports
Description of measurement methods and procedures to be applied	Values display on the PLC of calibrated instruments
Frequency of monitoring/recording	Once per minute if the flare in is on meaning 100% operation
Value monitored	
Monitoring equipment	
QA/QC procedures to be applied	Temperature measurement equipment should be replaced or calibrated in accordance with their maintenance schedule
Purpose of the data	
Calculation method	
Comments	The project implements an enclosed flare therefore, there is monitoring.

Data / Parameter:	$V_{i,RG,m}$
Data unit:	-
Description:	Volumetric fraction of component *i* in the residual gas on a dry basis in the minute *m* where *i* = CH4, CO, CO2, O2, H2, H2S, NH4, N2
Source of data	Measurements by project operator using a continuous gas analyzer (values are recorded with the same frequency as the flow).
Description of measurement methods and procedures to be applied	Measurement may be made on wet basis. Analyzers are periodically calibrated according to the manufacturer's recommendation.
Frequency of monitoring/recording	Continuously. Values are to be averaged on a minute basis if flare is on operation 100% status

Value monitored	
Monitoring equipment	
QA/QC procedures to be applied	Analyzers must be periodically calibrated according to the manufacturer's recommendation.
Purpose of the data	
Calculation method	
Comments	Project operator measure the content CH4, CO ,CO2 and H2S

Data / Parameter:	$V_{RG,m}$
Data unit:	m^3
Description:	Volumetric flow of the residual gas on a dry basis at reference conditions in the minute *m*
Source of data:	Measurements by project participants using a flow meter
Description of measurement methods and procedures to be applied	Measurements by project operator using a calibrated flow meter
Frequency of monitoring/recording	Continuously. In flare operation is 100% or on.
Value monitored	
Monitoring equipment	
QA/QC procedures to be applied	Flow meters are to be periodically calibrated according to the manufacturer's recommendation
Purpose of the data	
Calculation method	
Comments	This parameter is monitored, project implements enclosed flare

Data / Parameter:	$M_{RG,m}$
Data unit:	kg
Description:	Mass flow of the residual gas on a dry basis at reference conditions in the minute *m*

Source of data	-
Description of measurement methods and procedures to be applied	Instruments with recordable electronic signal (analogical or digital) With calibrated instruments
Frequency of monitoring/recording	Continuous
Value monitored	
Monitoring equipment	
QA/QC procedures to be applied	Calibration and frequency of calibration is according to manufacturer's specifications
Purpose of the data	
Calculation method	
Comments	This parameter is monitored, project implements enclosed flare

Data / Parameter:	$V_{O2,EG,m}$
Data unit:	-
Description:	Volumetric fraction of O2 in the exhaust gas on a dry basis at reference conditions in the minute *m*
Source of data	Measurements by project operator using a continuous gas analyser
Description of measurement methods and procedures to be applied	Extractive sampling analysers with water and particulates removal devices or in situ analysers for wet basis determination.
Frequency of monitoring/recording	Continuous
Value monitored	
Monitoring equipment	
QA/QC procedures to be applied	Analysers must be periodically calibrated according to the manufacturer's recommendation.
Purpose of the data	
Calculation method	
Comments	This parameter is monitored, project implements enclosed flare

Data / Parameter:	$fc_{CH4,EG,m}$
Data unit:	mg/m3
Description:	Concentration of methane in the exhaust gas of the flare on a dry basis at reference conditions in the minute *m*
Source of data	Measurements by project operator using a continuous gas analyser
Description of measurement methods and procedures to be applied	Extractive sampling analysers with water and particulates removal
Frequency of monitoring/recording	Continuously
Value monitored	
Monitoring equipment	
QA/QC procedures to be applied	Analysers must be periodically calibrated according to the manufacturer's recommendation.
Purpose of the data	
Calculation method	
Comments	This parameter is monitored, project implements enclosed flare

Data / Parameter:	$Flame_m$
Data unit:	Flame on or Flame off (0% or 100%)
Description:	Flame detection of flare in the minute *m*
Source of data	Thermocouples installed in flare system indicating the presence of flame
Description of measurement methods and procedures to be applied	Calibrated Thermocouples Recorded every 10 minute. 24/7 all year.
Frequency of monitoring/recording	Every 10 min stored records (24/7) alle year
Value monitored	
Monitoring equipment	

QA/QC procedures to be applied	Equipment is maintained and calibrated in accordance with manufacturer's recommendations. Every six moths all equipment are calibrate.
Purpose of the data	
Calculation method	
Comments	This parameter is monitored, project implements enclosed flare

Data / Parameter:	$Maintenance_y$
Data unit:	Calendar dates
Description:	Maintenance events completed in year *y*
Source of data	Project operator
Description of measurement methods and procedures to be applied	Record the date that maintenance events were completed in year *y*. Records of maintenance logs must include all aspects of the maintenance including the details of the person(s) undertaking the work, parts replaced, or needing to be replaced, source of replacement parts, serial numbers and calibration certificates
Frequency of monitoring/recording	Annual
Value monitored	
Monitoring equipment	
QA/QC procedures to be applied	Records must be kept in a maintenance log for two years beyond the life of the flare
Purpose of the data	
Calculation method	
Comments	This parameter is monitored, project implements enclosed flare

5.3 Monitoring Plan

The responsible entity for the monitoring system is Biotrend personnel. The monitoring activities will primarily involve four types of personnel: the Operation Site Manager, Field Operator, Electrical & Mechanical Operator and the Laboratory Operator.

The Field Operators will perform activities such as monitoring and adjusting LFG extraction wells, checking operations of the blower and flare, recording data at the blower/flare station, routine maintenance of collection system components, preparing daily logs and completing checklists, and send data to the Operation Site Manager.

The Operation Manager's responsibilities include reviewing the data collected both manually by the Field Technicians and the one recorded automatically by analytical equipment, making recommendations and/or implementing system adjustments to maximize methane capture and destruction, scheduling monitoring and O&M activities, performing quality assurance checks on operations, coordinating with system component manufacturers as needed, to maintain proper operations and calibration, and compiling data as required by the Methodology.

Only for manual data collection, the Operation Manager will be responsible for reviewing the data collected.

Project Management Responsibility

The operators of the LFG recovery and electricity generation system will be responsible for collecting all data monitored on-site. The operating and maintenance personnel will be skilled technicians, with extensive experience in equipment operation, maintenance and calibration, and emergency procedures. Overall responsibility for the monitoring and maintenance of all required

tasks and their adequate management lies with the project manager. Detailed roles and responsibilities of the relevant staff involved in VCS monitoring are placed.

Training of Monitoring Personnel

The monitoring personnel is trained in the beginning of the project; the purpose of this training is to operate the project in a well manner. Periodical training will be defined by Biotrend.

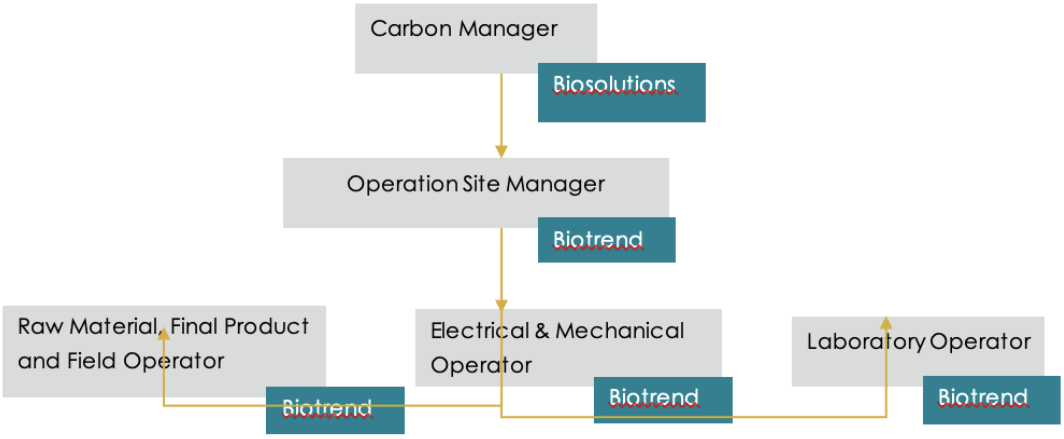

Figure 8. Organizational Structure of the Carbon Project

Data Analysis

The collected data will be reviewed and analyzed on a daily basis by the Operation Manager. In case of a drift of one parameter the Manager or Technician can react quickly to fix potential problems. All data required for the emission reduction calculations will be kept in the onsite-monitoring database. The Monitoring Manager will be the responsible to report the necessary information to Biotrend.

The quality actions that will guarantee the success of the monitoring plan are the following:

Maintenance Plan

The LFG plant's computerized management and control system includes: the management of level management in gas meters through the level indicators; monitoring and control of the heating system; alarm management of minimum and maximum levels and security; and monitoring of the data analysis of the LFG analysis. With regards to the electricity generation component of the project, given that it dispatches electricity to the National Grid, measuring, recording, storing, aggregating, collating and reporting data and parameters will follow the procedure described by the authorities.

The following aspects are core to the maintenance of the monitoring system in order to assure proper data

monitoring during the project:

• Equipment preventive maintenance

• Equipment calibration

All data collected as part of monitoring will be archived electronically and be kept at least for 2 years after the end of the last crediting period. Regarding the monitoring equipment of the methane recovery component of the project, maintenance and calibration will be performed in line with manufacturers' recommendations. With regards to the electricity meter, it is a high accuracy measurement device/s and meets all relevant metrological requirements prescribed by the state authority. Procedures for maintenance of the meter will be conducted in accordance with national procedures and standards.

Quality assurance and Control (QA/QC)

Quality control and quality assurance procedures will guarantee the quality of monitored data. All data is archived electronically, backed up regularly and kept at least for 2 years after the end of the last crediting period. There are corrective actions when the parameters are out of the permitted range.
Regarding the monitoring equipment of the methane recovery component of the project, maintenance and calibration will be performed in line with manufacturers' recommendations. With regards to the electricity meter, as mentioned above, it is a high accuracy measurement device/s and meets all relevant metrological requirements prescribed by the state authority. Procedures for maintenance of the meter will be conducted in accordance with national procedures and standards.

Calibration plans:

Staff of the LF Balikesir perform daily calibration reports from the gas flow meters in the booster unit, the values of O2%, H2S ppm, CO2% and CH4% are measured. Please see Calibration Control Schedule document.

Every 6 moths all equipment are calibrated for expert staff form the technology provider, delivering calibration and compliance reports.

The gas engines have their own monitoring system and parameters can be seen every time on the display. There is an internal storage of the data on PC and on the cloud. All data can be downloaded in an excel file.

Emergencies Procedures

The running hours of the power plants will be monitored as part of the monitoring procedures. In case of failure of one of the monitoring devices, portable instruments will be used in order to carry out periodic daily monitoring of the missing parameter(s). These data are recorded on paper. Biotrend defined emergency procedures according to the provider recommendations.

ANNEXES