



**PROJECT DESIGN DOCUMENT FORM
FOR CDM PROJECT ACTIVITIES (F-CDM-PDD)
Version 04.1**

PROJECT DESIGN DOCUMENT (PDD)

Title of the project activity	Bursa-Hamitler Landfill Gas Collection and Energy Utilization Project
Version number of the PDD	Version ~~11~~ <u>12</u>
Completion date of the PDD	~~24.09~~ <u>18.12</u> .2013
Project participant(s)	ITC Bursa Enerji Üretim San. Ve Tic. A.Ş.
Host Party(ies)	Turkey
Sectoral scope and selected methodology(ies)	- Sectoral scope 13 “Waste handling and disposal” - ACM0001 version 13.0.0
Estimated amount of annual average GHG emission reductions	201,154

SECTION A. Description of project activity

A.1. Purpose and general description of project activity

Summary:

Bursa Landfill Gas Recovery and Utilization Project (hereafter referred to as “the Proposed Project”) is being developed by “ITC Bursa Enerji Üretim San. Ve Tic. A.Ş.” (hereafter referred to as the “Project Participant”).

The objective of the proposed project activity is to capture and utilize the LFG (Landfill Gas) from Hamitler Landfill Area for electricity generation which will be exported to the national grid. The Hamitler Landfill Area, is located in Bursa Province, has been established as a wild landfill area in 1996 and has been operational since then accepting approximately 2000 ton/day Municipal Waste (MSW) from approximately 2.6 million inhabitants of Bursa Province. As per 2011 it is estimated that a total of 8 million MSW has been accumulated in the landfill area. On 14.01.2011 Bursa Greater Municipality has transferred the right of use of the landfill area to the Project Participant.

The proposed project activity involves the covering of the landfill area and installation of a gas extraction system, capturing the LFG and feeding it to gas engines for electricity generation. Any excess of LFG will be flared in an enclosed flare system. The total installed capacity of the proposed project activity is estimated to reach 9.8 MW¹ with an estimated electricity generation of approximately 68.6 GWh/year². The generated electricity will be delivered to the national grid.

In the baseline situation the LFG was released into the atmosphere without any collection, flaring or utilization. Landfill gas is one of the largest sources of methane emissions to the atmosphere and typically contains approximately 50% methane,³ which is a potent greenhouse gas.

The baseline scenario is the same as the existing scenario, which the municipal waste is deposited and left for decay at the landfill site, leading to generate and release of large amounts of landfill gas. Landfill gas is one of the largest sources of methane emissions to the atmosphere and typically contains 50% of methane, a potent greenhouse gas. GHG emission reductions will be achieved by two means.

- By collection and destruction of methane by power generation, and;
- Displacing an equal amount of electricity generated by power plants connected to the electricity system.

The total estimated GHG emission reductions of the proposed project activity are estimated to reach a total of 1,401,683 tCO₂eq within the first crediting period.

Prior Consideration of GS VERs:

The important milestones of the project activity addressing the prior consideration are presented as follows:

<u>Date</u>	<u>Event</u>
<u>10.12.2010</u>	<u>Board Decision on GS VERs</u>
<u>14.01.2011</u>	<u>Transfer of Landfill to the PP</u>

¹ The Generation License obtained from EMRA (Electricity Market Regulatory Authority is available to the DOE)

² Based on the assumption of a 7000h operational hour when reaching full capacity of 9.8MW.

³ US Environmental Protection Agency: Facts About Landfill Gas
<http://www.epa.gov/programs/benviron/waste/central/lfgfact.pdf>



<u>21.04.2011</u>	<u>LSC meeting</u>
<u>20.06.2011</u>	<u>Start of construction</u>

Both awareness and consideration could be demonstrated transparently through the timeline of the project activity. The board has decided to put an offer to the tender of Bursa Landfill Management by the Municipality based on the GS VERs revenues. This decision has been documented very clearly and transparently through the board decision on 10.12.2010, which predates any kind of action towards implementation of the project activity.

Contribution to Sustainable Development:

The proposed project activity will also contribute significantly to the region's sustainable development:

- The project activity will significantly improve local air quality by reducing the amount of pollutants emissions contained in the LFG. Landfill areas cause odour nuisance and have a high risk of explosion and fire. By properly covering the landfill and extracting the landfill gas, the odour nuisance and risk of explosion and fire will be significantly reduced.
- The project activity will result in creation of local employment.
- The project activity will contribute to reduce global warming by reducing CH₄, which has a global warming potential 25 times of CO₂.
- The project results in the transfer of knowledge on waste management principles.

A.2. Location of project activity**A.2.1. Host Party(ies)**

Republic of Turkey

A.2.2. Region/State/Province etc.

Marmara Region, Bursa Province

A.2.3. City/Town/Community etc.

Bursa is located at the south of Marmara region and is the 4th largest city in Turkey with a population of approximately 2,600,000 inhabitants. The Hamitler landfill is the largest landfill area within Bursa Province and is located in Osmangazi District.

A.2.4. Physical/Geographical location



Coordinates of the project: Latitude: 40°15'50.23"N, Longitude: 28°58'24.36" E

A.3. Technologies and/or measures

Hamitler Landfill Area has opened in 1996 and operated by the municipality as an uncontrolled dumpsite without any LFG extraction, flaring or utilization. The scenario existing prior to the start of implementation of the proposed project activity is the same as the baseline scenario.

The purpose of the project activity is to recover the LFG gas accumulated in the landfill area and generate electricity via gas engines to generate electricity. In order to recover the LFG, the closed lots of the landfill will be covered by an appropriate layer to maximise the collection efficiency. The LFG will be collected actively via collection system.

7 sets of GE Jenbacher 1.4 MW gas engines will be installed within the scope of the project activity. An enclosed flare system will be installed to burn the excess LFG in a controlled environment and disposal of it safely to the atmosphere.

The generated electricity will be exported to the national grid, through Bursa II TM transformer station via Medium Voltage Level.

A.4. Parties and project participants

Party involved (host) indicates a host Party	Private and/or public entity(ies) project participants (as applicable)	Indicate if the Party involved wishes to be considered as project participant (Yes/No)
Turkey (host country)	ITC Bursa Enerji Üretim San. Ve Tic. A.Ş.	No

ITC Bursa Enerji Üretim San. Ve Tic. A.Ş.” is special purpose company for the proposed project activity.

OakDanışmanlık is the carbon consultant for this project⁴.

Full contact information for the project participants are provided in Annex 1.

A.5. Public funding of project activity

No public funding is obtained for the project.⁵

SECTION B. Application of selected approved baseline and monitoring methodology

B.1. Reference of methodology

⁴ OakDanışmanlık is not a project participant

⁵ The ODA declaration form is available to the DOE.

Applied approved baseline and monitoring methodologies:

- Approved consolidated baseline methodology ACM0001 “Flaring or Use of Landfill Gas” version 13.0.0;

Used tools:

- “Combined tool to identify the baseline scenario and demonstrate the additionality” version 05.0.0;
- “Tool to determine the mass flow of a greenhouse gas in a gaseous stream” version 02.0.0
- “Emissions from solid waste disposal sites” version 06.0.1;
- “Tool to calculate the emission factor for an electricity system” Version 03.0.0,
- ‘Tool to calculate baseline, project and/or leakage emissions from electricity consumption’ version 01.

For more information regarding the methodology please refer to <http://cdm.unfccc.int/methodologies/PAmethodologies/approved>

B.2. Applicability of methodology

The project activity involves LFG extraction and utilization and ACM0001 approved consolidated methodology “Flaring or Use of Landfill Gas” version 13.0.0 is considered applicable to the project activity. The applicability of the methodology and referred tools has been discussed in detail as follows:

Applicability of ACM0001 v13.0.0:

The emission reductions resulting from the capture and utilization of landfill gas are calculated using ACM0001 “Flaring or Use of Landfill Gas”. The applicability of ACM0001 “Flaring or Use of Landfill Gas” version 13.0.0 is discussed as follows:

Ref.	Applicability Criteria	Justification
The methodology is applicable to project activities which:		
a	Install a new LFG capture system in a new or existing SWDS	The proposed project activity involves installation of a new LFG capture system.
b	Make an investment into an existing LFG capture system to increase the recovery rate or change the use of captured LFG, providing that; i) The captured LFG was vented or flared and not used prior to the implementation of the project activity; and ii) In the case of an existing active LFG capture system for which the amount of LFG cannot be collected separately from the project system after the implementation of the project activity and its efficiency is not impacted on by the project system: historical data on the amount of LFG capture and flare is available.	Not applicable since the situation prior to the proposed project activity is wild landfilling where there is no LFG ventilation, capture or flaring.
c	Flare the LFG and/or use the captured LFG in any (combination) of the following ways:	The proposed project activity is designed in a way to make use of the LFG recovered for the delivery

	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.	of electricity, where the excess LFG will be flared for emergencies. There will be no heat generation or supply of LFG to consumers.
d	Do not reduce the amount of organic waste that would be recycled in the absence of the project activity.	There are no recycling activities within the project activity.
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	Release of the LFG from the SWDS; and	The most plausible baseline scenario is the total release of the LFG from the SWDS. Please refer to section B.4 of this PDD for more detailed description on the baseline scenarios.
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 on-site equipment.	The most plausible baseline scenario for electricity generation is that electricity would be generated in the grid. Please refer to section B.4 of this PDD for more detailed description on the baseline scenarios.
The methodology is not applicable:		
a	In combination with other approved methodologies. For instance, ACM0001 cannot be used to claim emission reductions for the displacement of fossil fuels in a kiln, or glass melting furnace where the purpose of the CDM project activity is to implement energy efficiency measures at a kiln or glass melting furnace;	This methodology is not used in a combination of other approved methodologies.
b	If the management of the SWDS in the project activity is deliberately changed in order to increase methane generation compared to the situation prior to the implementation of the project activity.	No changes or intervene has been made deliberately to increase generation compared to situation prior to the implementation of the project activity.

ACM0001 version 13.0.0 “Flaring or Use of Landfill Gas” is applicable to the proposed project activity since, the project activity involves the installation of a new LFG capture system in order to generate electricity, which otherwise the total LFG will be released to the atmosphere and the same amount of electricity will be generated by the national grid.

Applicability of “Combined tool to identify the baseline scenario and demonstrate the additionality” version 05.0.0:

The combined tool to identify the baseline scenario and demonstrate the additionality provides a step-wise approach to identify the baseline scenario and simultaneously demonstrate additionality. As referred in methodology ACM0001, the “Combined tool to identify the baseline scenario and demonstrate the additionality” is applicable for the proposed project activity.

Applicability of “Tool to determine the mass flow of a greenhouse gas in a gaseous stream” version 02.0.0:

This tool provides procedures to determine the mass flow of CH₄ in the LFG in time interval t. As referred in methodology ACM0001, the “Tool to determine the mass flow of a greenhouse gas in a gaseous stream” version 02.0.0 is applicable for the proposed project activity.

Applicability of “Emissions from solid waste disposal sites” version 06.0.1:

This tool provides procedures to calculate baseline, project or leakage emissions of the methane from solid waste disposed or prevented from disposal at a SWDS. The applicability of the tool “Emissions from solid waste disposal sites” version 06.0.1 is discussed as follows:

Ref	Applicability Criteria	Justification
The tool can be used to determine emissions for the following types of applications:		
Application A	The CDM project activity mitigates methane emissions from a specific existing SWDS.	Since the methane emissions are mitigated by capturing and flaring or combusting the methane, “Application A” implies to the proposed project activity. The methane is generated from waste disposed in the past, including prior to the start of the CDM project activity. In line with the requirements, this tool is only applied for an <i>ex-ante</i> estimation of emissions in the CDM-PDD. The emissions will be monitored during the crediting period using the applicable approaches in the relevant methodologies (ACM0001 in this case).
Application B	The CDM project activity avoids or involves the disposal of waste at a SWDS.	Since the MSW is not treated with an alternative option such as composting or anaerobic digestion, “Application B” is not relevant to the proposed project activity.

The tool “Emissions from solid waste disposal sites” version 06.0.1 is applicable since the proposed project activity mitigates methane emissions from a specific existing SWDS.

Applicability of “Tool to calculate baseline, project and/or leakage emissions from electricity consumption’ v 01:

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

Ref	Applicability Criteria	Justification
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a	Electricity consumption from the grid. The electricity is purchased from the grid only. Either no captive power plant is installed at the site of electricity consumption or, if any on-site captive power plant exists, it is not operating or it can physically not provide electricity to the source of electricity consumption.	In the proposed project activity, the electricity is purchased from the grid only and no captive power plant is installed at the site of electricity consumption.
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 electricity consumption source and supply the source with electricity. The captive power plant(s) is/are not connected to the electricity grid.	Not relevant to the project activity since there are no captive power plants installed at the site of electricity consumption source.
c	Electricity consumption from the grid and (a) fossil fired captive power plant(s). One or more fossil fuel fired captive power plants operate at the site of electricity consumption source. The captive power plant(s) is/are also connected to the electricity grid. Hence, the electricity consumption source can be provided with electricity from the captive power plant(s) and the grid.	Not relevant to the project activity since there are no captive power plants installed at the site of electricity consumption source.

Based on the above arguments it can be concluded that the “Tool to calculate baseline, project and/or leakage emissions from electricity consumption’ v 01 is applicable to the project activity.

Applicability of “Tool to calculate the emission factor for an electricity system” v 03.0.0:

This methodological tool determines the CO₂ emission factor for displacement of electricity generated by power plants in an electricity system, by calculating the “combined margin” emission factor (CM) of the electricity system. This tool maybe applied to estimate the OM, BM and/or CM when calculating baseline emissions for a project activity that substitutes grid electricity. As the proposed project activity supplies electricity to the national grid, the “Tool to calculate the emission factor for an electricity system” v 03.0.0 is applicable to the project activity.

Further information on the use of the “Project emissions from flaring” version 02:

In line with ACM0001 “Flaring or Use of Landfill Gas” version 13.0.0”, the project activity is eligible to claim emission reductions from its flaring activities. Within the project activity, there is an enclosed flare system installed to flare any excess of LFG. However the project participant opts to exclude the flare system from the project boundary and will not claim any emission reductions from the flaring activities (if any) within the crediting period, since the flare system is observed/envisaged to work none or for insignificant durations throughout the operational lifetime.

The exclusion of the emission reductions from flaring activities is conservative since it will result in no change (if there is no flaring activity) or decrease in the total emission reductions (if flaring activity is observed).

In accordance to the above explanation, the “Project emissions from flaring” version 02, is not applied to the proposed project activity and no emission reductions will be claimed from the flaring activity throughout the crediting period.

B.3. Project boundary

In line with the requirements of ACM0001 ‘Flaring or Use of Landfill Gas’ (version 13.0.0), the project boundary of the project activity include the site where the LFG is captured an, as applicable:

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

The geographic and system boundaries for the relevant electricity grid can be clearly identified and information on the characteristics of the grid is available as required by the “Tool to calculate the emission factor for an electricity system” (version 03.0.0). The electricity produced on-site will be delivered to the Turkish national grid⁶.

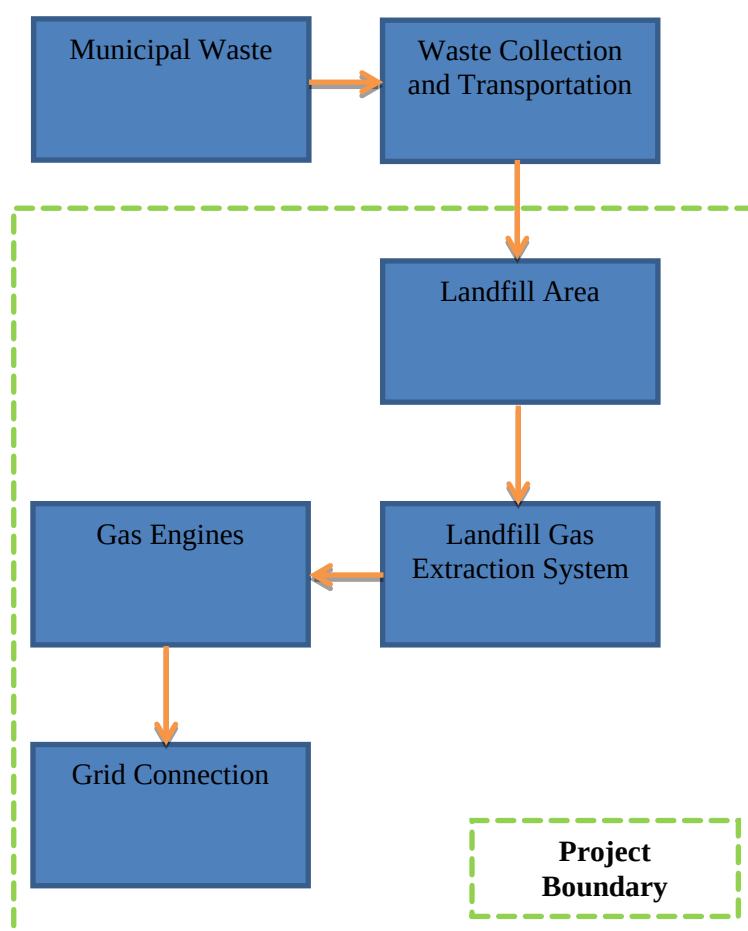
The gases and sources relevant to the proposed project activity are listed in the below table.

Table 3 Summary of greenhouse gases and sources included in and excluded from the project boundary

	Source	Gas	Included?	Justification / Explanation
Baseline	Emissions from decomposition of waste at the SWDS site	CH ₄	Yes	The major source of emissions in the baseline.
		N ₂ O	No	N ₂ O emissions are small compared to CH ₄ emissions from SWDS. This gas is conservative.
		CO ₂	No	CO ₂ emissions from the decomposition of organic waste are not accounted.
	Emissions from electricity consumption	CO ₂	Yes	Main emission source.
		CH ₄	No	Excluded for simplification. This is conservative.
		N ₂ O	No	Excluded for simplification. This is conservative.
Project Activity	Emissions from on-site electricity use	CO ₂	Yes	May be an important emission source
		CH ₄	No	Excluded for simplification. This emission source is assumed to be very small
		N ₂ O	No	Excluded for simplification. This emission source is assumed to be very small

⁶ Reference: Turkish National Grid Line Diagram <http://www.teias.gov.tr/4grupmd/atcharita.htm>

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



B.4. Establishment and description of baseline scenario

Procedures for the selection of most plausible baseline scenario

According to ACM0001 “Flaring or Use of Landfill Gas” version 13.0.0, the baseline scenario is identified using the “Combined tool to identify the baseline scenario and demonstrate additionality”⁷.

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

This step is not applied.

Step 1: Identification of alternative scenarios

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

Step 1a: Define alternative scenarios to the proposed project activity:

In line with ACM0001 “Flaring or Use of Landfill Gas” version 13.0.0, alternative scenarios that a) are available to the project participant, b) cannot be implemented in parallel to the proposed project activity, and c) provide outputs and with comparable quality, properties and application areas as the proposed project activity. In line with the requirements of ACM0001, these alternatives are defined as follows:

- LFG 1:** The project activity implemented without being registered as a VER project activity;
- LFG 2:** Atmospheric release of the LFG or capture of LFG and destruction through flaring to comply with regulations or contractual requirements, or to address safety and odour concerns;
- LFG 3:** LFG is partially not generated because part of the organic fraction of the solid waste is recycled and not disposed in the SWDS;
- LFG 4:** LFG is partially not generated because part of the organic fraction of the solid waste is treated aerobically and not disposed in the SWDS;
- LFG 5:** LFG is partially not generated because part of the organic fraction of the solid waste is incinerated and not disposed in the SWDS.

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

- E1:** Electricity generated from LFG undertaken without being registered as a VER project activity;
- E2:** Electricity generation in existing or new renewable or fossil fuel based captive power plant;
- E3:** Electricity generation in existing and/or new grid connected power plants;

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

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

Table 4 Alternative scenarios excluded from further consideration

Reference	Alternative	Justification
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⁷ This tool provides a step wise approach to identify the baseline scenario and simultaneously demonstrate additionality. Therefore step 1, which is the identification of alternative scenarios, will be discussed under section B.4 of this PDD and step 2, 3 and 4 will be discussed more in detail under section B.5 of the PDD.

LFG 3	LFG is partially not generated because part of the organic fraction of the solid waste is recycled and not disposed in the SWDS.	It is not realistic to consider recycling of solid waste which has been subject to decomposition for over 15 years as a realistic and credible alternative. Alternative LFG 3 has been excluded from further evaluation.
LFG 4	LFG is partially not generated because part of the organic fraction of the solid waste is treated aerobically and not disposed in the SWDS.	It is not realistic to consider aerobic treatment of solid waste which has been subject to decomposition for over 15 years as a realistic and credible alternative. Alternative LFG 4 has been excluded from further evaluation.
LFG 5	LFG is partially not generated because part of the organic fraction of the solid waste is incinerated and not disposed in the SWDS.	It is not realistic to consider incineration of solid waste which has been subject to decomposition for over 15 years as a realistic and credible alternative. Alternative LFG 4 has been excluded from further evaluation.
E 2	Electricity generation in existing or new on-site or off-site renewable based captive power plant.	There is no existing electricity generation in the SWDS. Also there are no available renewable energy resources (hydro, geothermal, wind etc) in or close to the vicinity of the SWDS. Alternative E 2 has been excluded from further evaluation.

Outcome of Step 1a:

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

Table 5 Alternative scenario combinations applicable to the project activity

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

Step 1.b: Consistency with mandatory laws and regulations

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

- Electricity Market Law⁸ [Law Number: 4628 Ratification Date: 20.02.2001 Enactment Date: 03.03.2001]
- Law on Utilization of Renewable Energy Resources for the Purpose of Generating Electricity Energy⁹ [Law Number: 5346 Ratification Date: 10.05.2005 Enactment Date: 18.05.2005]
- Environmental Law¹⁰ [Law Number: 2827 Ratification Date: 09.08.1983 Enactment Date: 11.08.1983]

⁸ Reference: The official web page of EMRA; <http://www.epdk.gov.tr/documents/10157/351a7a0c-52a9-40d5-8e12-f8e61afe7247>

⁹ Reference: The official web page of EMRA; <http://www.epdk.gov.tr/documents/10157/4b360128-53aa-4174-8104-a6c10434ac9c>

- o Regulation on Solid Waste Control¹¹ [Last updated on 05.04.2005]
- o Regulation on Managed Waste Land Filling¹² [Regulation number 27533 Enactment Date: 26.03.2010]

Relevance of mentioned Laws and Regulations

Electricity Market Law: The purpose of this Law is to ensure the development of financially sound and transparent electricity market operating in a competitive environment under provisions of civil law and the delivery of sufficient, good quality, low cost and environment-friendly electricity to consumers and to ensure the autonomous regulation and supervision of this market. Among others, the scope of the law also covers generation of electricity. As one of the important aspects of the proposed project activity is electricity generation, the Electricity Market Law is one of the regulating legislations regarding the project activity.

Law on Utilization of Renewable Energy Resources for the Purpose of Generating Electricity Energy: The purpose of this Law is to expand the utilization of renewable energy resources for generating electrical energy, to benefit from these resources in secure, economic and qualified manner, to increase the diversification of energy resources, to reduce greenhouse gas emissions, to assess waste products, to protect the environment and to develop the related manufacturing sector for realizing these objectives. At the time of the investment decision, the law guaranteed a tariff range of 5 – 5.5 ¢cent/kWh for 10 years¹³. On 29.12.2010 the Law has been revised and the guaranteed tariff has been amended as 13.3 ¢cent/kWh for electricity production based on biogas. As one of the important aspects of the proposed project activity is electricity generation from renewable energy sources the “Renewable Energy Law” is one of the regulating legislations regarding the project activity.

Environmental Law: This law outlines Turkey’s environmental policy in general terms. It aims to protect the environment and Turkey’s natural resources for the benefit of future generations. It includes the polluter pays principle. Regulations have been issued on air quality protection, water pollution control, environmental impact assessment, waste control, noise control, and the control of hazardous materials. The Environmental Law is one of the main legislations regarding the project activity as it relates to waste management activities. The following two sub regulations of this law are specifically related to the Project Activity:

- Regulation on Solid Waste Control: Summarizing, the regulation mentions the obligation of the party undertaking the solid waste management to respect the human health and welfare of the society. However it doesn’t prescribe any technology to achieve this (article 5 and article 27) nor does it mention any sanction or penalty if solid waste management projects are implemented otherwise. As such the regulation is instructive on the issue of solid waste management rather than normative. It does not mandate the destruction of methane. Although semi-controlled release of landfill gas to the air (a.k.a. ‘venting’) occurs at several landfills (also see B.5 step 4), the law and regulations does not mandate the destruction of methane.

¹⁰ Reference: The official web page of the Ministry of Environment and Forestry;
<http://www2.cevreorman.gov.tr/yasa/k/2872.doc>

¹¹ Reference: The official web page of the Ministry of Environment and Forestry;
<http://www.cygm.gov.tr/CYGM/Files/mevzuat/yonetmelik/kaky.doc>

¹² Reference: The official web page of the Ministry of Environment and Forestry;
http://www.cygm.gov.tr/CYGM/Files/mevzuat/yonetmelik/Duzenli_Depolama.doc

¹³ Reference: “Law on Utilization of Renewable Energy Resources for the Purpose of Generating Electricity” (18/04/2007), Article 6;
http://www.ibb.gov.tr/sites/aydinlatmaenerji/Documents/Enerji%20Mevzuat%C4%B1/1_YEKKanun_Temmuz2008.pdf

- Regulation on Sanitary Landfilling: The newly enacted regulation (26.03.2010) on sanitary waste landfilling aims to (1) minimize the impact of leachate and LFG on soil, air and water quality; (2) regulate waste acceptance to the landfill area; and (3) provide procedures for opening and closure of a landfill area.

In summary: although solid waste management regulation is being implemented in Turkey, it is neither compiled to nor enforced. The regulations don't define sanctions or penalties. In practice none of the landfill areas comply with these regulations, as indicated in statistics on landfill areas. The majority of landfill areas in Turkey are actually 'waste dumps' where no waste management (including covering of the landfill) implemented¹⁴.

Outcome of Step 1b:

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

Step 2: Barrier Analysis

Since the "Combined tool to identify the baseline scenario and demonstrate the additionality" version 05.0.0 is used to identify the baseline scenario, a barrier analysis has to be conducted to assess which alternative scenarios are prevented by defined barriers. When applying this step "Guidelines for objective demonstration of and assessment of barriers" version 01 has been taken into account.

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

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

Outcome of Step 2a:

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

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

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

Table 6 Assessment of alternative scenarios against the impact of identified barriers

Scenario	Identified Barriers
	Investment Barrier
	One of the major barriers related with project activity is defined as "limited access to finance".

¹⁴ Please refer to section B.5 Step 4, Common Practice for further details.

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

Outcome of Step 2a:

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

Table 7 Alternative scenario combinations that are not prevented by barriers

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

Outcome of Step 2:

There is only one alternative scenario that is not prevented by any barrier, which is Scenario 2; Atmospheric release of the LFG and electricity would have been generated by the existing grid connected power plants as continuation of the situation before the project activity. In line with the requirements of “Combined tool to identify the baseline scenario and demonstrate the additionality” version 05.0.0, Scenario 2 has been identified as the baseline scenario.

B.5. Demonstration of additionality

Approved consolidated baseline methodology ACM0001 “Flaring or use of landfill gas” version 13.0.0, requires the use of the latest “Combined tool to identify the baseline scenario and demonstrate the additionality” version 05.0.0 to demonstrate and assess the additionality of the proposed project.

The tool provides for a step-wise approach to demonstrate and assess additionality. These steps include:

- STEP 0. Demonstration that the proposed project activity is the First-of-its-kind.
- STEP 1. Identification of alternative scenarios;
- STEP 2. Barrier analysis;
- STEP 3. Investment analysis (if applicable)
- STEP 4. Common practice analysis

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

This step is not applied.

Step 1. Identification of alternative scenarios

This step has been covered extensively under section B.4. Credible and realistic alternative scenarios consistent with mandatory laws and regulations are identified as follows:

Table 8 Alternative scenarios to the project activity

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

Step 2: Barrier Analysis

In line with the requirements of “Combined tool to identify the baseline scenario and demonstrate the additionality” version 05.0.0, a barrier analysis has been conducted to identify barriers and to assess which alternative scenarios are prevented by these barriers. When applying this step “Guidelines for objective demonstration of and assessment of barriers” version 01 has been taken into account.

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

The major barriers could be mainly categorized under “investment barrier”, which is presented in detail as followed:

Limited access to project financing:

Waste management projects need a high level of financing and long repayment periods. In the proposed project activity, 80% of the investment is realised with debt funding with a repayment period of 6 years and 20% from equity. However the project developers face certain barriers to secure loan from finance institutions / creditor banks. The project participant¹⁵ was only able to obtain debt funding by demonstrating the additional revenues from VERs.

Waste management investments are still perceived as investments with high risks and unfavourable investment and finance structure due to several reasons. These unfavourable conditions could be considered as arguments which lead to the main barrier “limited access to project financing”.

Table 9 Identified barrier(s) for the implementation of the project activity

Type of barrier	Identified barrier	Unfavourable conditions
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¹⁵ The project participant is an incorporated private company established under the Turkish Law. The scope of the company activities cover energy generation through biogas, recycling and package waste managing. Ownership information is available under the generation license provided to the DOE. For more detail on the company please refer to <http://www.itcturkiye.com/index.php>.

		leading to limited access to finance
Financial Barrier	Limited Access to Finance	New technology
		Uncertainty in electricity generation
		Prevailing practice

The unfavourable conditions, which results in a high risk perception of the finance institutions / creditor banks are explained in more detailed as follows:

New technology:

The experiences with waste management technologies like electricity generation based on LFG recovery are limited in Turkey, resulting in substantially higher risks during construction, operation and maintenance than for a conventional waste management project. This added risk, often referred to as technical risk, can be described as the likelihood of failure in a technical project, and is based on the factors technical competency and experience, commercial viability, and how proven the technology is¹⁶. The higher the technological risk, the higher the market risk, and the more financial risk are connected to an investment. As to the proposed project and their implementation of advanced waste management methods, it is marked by a high risk profile.

Uncertainty in the electricity generation:

Another important risk factor is the complexity of determining the amount of landfill gas generated and hence the level of income from electricity generation. There are considerable margins of error connected to the estimation of gas generation, relying not only on the experience of the investigator, but also on the unpredictable behaviour of landfill gas.¹⁷ A World Bank LFG workshop, investigating the performance of LFG projects in developing countries, confirms the difficulty of correctly modelling LFG generation, due to lack in local know-how, the limited information required for the planning of a site and flaws in engineering.¹⁸

Adding to the difficulty in estimating landfill gas generation is the complexity of rehabilitating an uncontrolled waste dump; the installing of the gas extraction system is marked by uncertainty; the composition of the waste beneath is often unknown, hence decomposition behaviour may strongly vary over time. Water table levels within the landfill are unknown and can vary strongly, thus adding a lot of uncertainty to the ex-ante calculated gas generation potential.

The amount of electricity generated and sold to the grid is a major source of company income. As discussed above, a high level of uncertainty is connected to the prediction of landfill gas generation. The resulting uncertainty in electricity generation makes the project's forecasted cash flow highly unpredictable, which again increases the risk of the investment from the creditors' perception.

Prevailing practice:

The proposed project activity is among the first projects to introduce modern waste management treatment technologies to Turkey. As stated by a report on waste management in Turkey: "*The most frequent method for the disposal of wastes in Turkey is the irregular land filling ('dumping'), and the*

¹⁶ NIST 2000: Managing Technical Risk http://www.atp.nist.gov/eao/gcr_787.pdf

¹⁷ UKPS 1994: Technical Guidance Note CPE 07/94: Combined Landfill Gas and Leachate Extraction Systems <http://www.environmental-expert.com/Files%5C6283%5Carticles%5C4814%5Ccombinedlandfillgasandleachateextractionsystems.pdf>

¹⁸ World Bank 2007: Landfill Gas Capture; Design and Actual Performance and the Future for CDM Projects <http://siteresources.worldbank.org/INTLACREGTOPURBDEV/Resources/840343-1178120035287/EditedLFGWorkshopReportAugust14.pdf>

methods of regular landfilling, composting, incineration or recycling are not common... significant part of the waste, namely 70%, is disposed into seas through rivers or disposed in nature.”¹⁹

Although there are limited numbers of projects with the same layout, these are all developed as a GS VER project activity²⁰ and it is still very early to state that the waste management technologies are well known to, and accepted by, creditors as well as investors, who still have to overcome barriers. The common practice also reveals that there are no projects or companies which have managed to implement without benefiting (or taking into account) from VER revenues.

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

As defined under Step 1a, two alternative scenarios; Scenario 1 and 2, were identified:

Impact of defined barriers to the alternative scenarios and how the registration of the project activity as a VER project activity alleviates the barriers is presented as follows:

Table 10 Impact of barriers and VER registry to the alternative scenarios

Alternative scenario	Impact of Identified Barrier	Impact of GS VER
	“Limited Access to Finance”	
Scenario 1: Project activity including power generation from LFG without being registered as a VER project activity.	Modern waste management technologies such as LFG utilization is perceived as high risk technologies reducing financial attractiveness and thereby reducing its chances to obtain finance, and ultimately its chance of implementation.	As stated by the bank providing finance to the proposed project, the potential for VER revenues was a decisive factor behind the choice of investing in the project. ²¹ The instruments of the carbon mechanism have played a significant role in securing the finance that was necessary for the investment. The additionality of the proposed project activity is based on the fact that VER revenues were an essential factor in the decision of the bank to provide a loan and the Project Participant to invest in this project in order to overcome the identified risks.
Scenario 2: Atmospheric release of the LFG and electricity would have been generated by the existing grid connected power plants as continuation of the situation before the project activity.	This scenario corresponds to the continuation of the current practice, and it does not require any investment. Therefore this alternative scenario is not prevented by any of the identified barriers.	This scenario does not generate emission reductions.

Outcome of Step 2:

¹⁹ Köse, Ayaz, Körüglü 2007: Waste Management in Turkey – National Regulations and Evaluation of Implementation Results: http://www.environmental-auditing.org/Portals/0/AuditFiles/Turkey_f_eng_07Waste_Management_Report.pdf

²⁰ Please refer to “Common practice analysis” of the PDD for detailed information on similar Project activities.

²¹ Statements from bank, provided to validating DOE

Scenario 1 is prevented from the identified barriers as described in detail under section sub-step 2a, while Scenario 2 is not prevented since this scenario is the continuation of the current practice, and it does not require any investment.

Step 3. Investment analysis

According to the “Combined tool to identify the baseline scenario and demonstrate the additionality” version 05.0.0, Step 3 “Investment Analysis” is only applicable if there are still several alternative scenarios remaining, including the proposed project activity undertaken without being registered as a VER project activity after step 2. However the Project Participant wishes to proceed with step 3 Investment Analysis to provide a supportive argument for demonstration of additionality of the proposed project activity.

The analyses include all alternative scenarios remaining after step 2 (Scenario 1 and Scenario 2). The “Guidelines on the assessment of investment analysis” version 5 has been taken into account when applying this step.

Since Scenario 2 corresponds to continuation of the current situation not requiring any investment or expenses to maintain, the financial indicator (Equity IRR) of scenario 1 will be compared against the benchmark.

Identification of the financial indicator

The following benchmark analysis applies the equity IRR as financial indicator. The Equity IRR is considered to be a suitable and widely used financial indicator to determine the attractiveness of equity investments.

When analysing a potential project, investors compare the equity IRR of the project against their required rate of return.

Calculation of financial indicators for alternative scenarios

Scenario 2:

In line with the requirements of “Combined tool to identify the baseline scenario and demonstrate the additionality” version 05.0.0, the financial indicator of Scenario 2; continuation of the current situation not requiring any investment, has been determined following option (a) of the Tool: *“Government bond rates, increased by a suitable risk premium to reflect private investment and/or the project type, as substantiated by an independent (financial) expert or documented by official publicly available financial data; ...”*

The expected return on equity is determined as 20%. According to the Project Appraisal Document of World Bank to TSKB (Turkish Industrial Development Bank), technologies that are newer in the Turkish market, such as biomass are expected to require a higher risk adjusted returns. Therefore the threshold IRR on equity for biomass is proposed at 20%²².

Scenario 1:

²² Reference: World Bank Document http://www-wds.worldbank.org/external/default/WDSPContentServer/WDSP/IB/2009/05/11/000333037_20090511030724/Rendered/PDF/468080PAD0P112101Official0Use0Only1.pdf

In line with the requirements of “Combined tool to identify the baseline scenario and demonstrate the additionality” version 05.0.0, the equity IRR of Scenario 1; Project activity including power generation from LFG without being registered as a VER project activity, has been calculated based on the key financial indicators of the proposed project activity are listed as follows:

Table 11 Key financial parameters applied to the project activity

Parameter	Unit	Value
Total Investment Cost	\$	17,432,000 ²³
Loan	%	50
Equity	%	50
Installed Capacity	MW	9.8
Annual Electricity Generation	GWh/year	68.6
Electricity tariff	\$cent/kWh	7.28 ²⁴
Annual Operational Expenses	\$	1,764,000
Municipality Share	%	41

- The calculation of the equity IRR of the proposed project activity includes all relevant costs and revenues.
- In line with the requirements of “Guidance on the Assessment of Investment Analysis”, input values used in all investment analysis are valid at the time of investment decision taken by the project participant, which is referred as the date of Board Decision dated 10.12.2010.
- 50% debt and 50% equity financing has been assumed as a default²⁵.
- The equity IRR has been calculated over a 15 year period²⁶.
- Only the portion of the investment costs which is financed by equity have been considered as the net cash outflow and the portion of the investment cost which is financed by debt have not been considered as a cash outflow.
- Taxation has not been included as an expense in the equity IRR calculation²⁷.
- The technical lifetime of a gas engine is considered to be 50,000 hours which approximately corresponds to 7 years of operation. In the project case this means that the engines have to be renewed at least once throughout a 15 years of time span. This has not been taken into account in the financial analysis.
- The annual operational cost is assumed to be as 180\$/kW annually²⁸.
- The landfill area covers 83 hectares in total.

The result of the equity IRR calculated for Scenario 1²⁹:

²³ Reference: “Number and Types of Landfill Gas Plants Worldwide” Presented in the World Bank by Hans Willumsen LFG Consult / http://deponigas.dk/uploads/media/Number_and_Types_of_LFG_Plants_Worldwide.pdf (page 9 Section 4.1 Investment costs in LFG Recovery System)

²⁴ At the time of the investment decision the guaranteed electricity tariff was 5.5 €cent/kWh which is equal to 7.28 \$cent/kWh with an exchange rate of 1.3245 €/ \$ on 10.12.2010.

²⁵ 50% debt and 50% equity financing may be assumed as a default in line with the “Guidelines on the assessment of investment analysis” version 05.

²⁶ Although the technical lifetime of gas fired engines (the most critical equipment of the system) is estimated as 7-8 years (please refer to EB 50Annex 15), the financial analysis has been conducted over a conservative value of 15 years.

²⁷ There is no clear information on whether the Benchmark indicator is intended for post-tax comparison or not. Therefore as a conservative approach, the equity IRR has been calculated for pre-tax.

²⁸ Reference: http://www.epa.gov/lmop/documents/pdfs/pdh_chapter3.pdf (Table3-4).

Table 12 Equity IRR of Scenario 1

Equity IRR of Scenario 1: Project activity including power generation from LFG without being registered as a VER project activity	%	-3.68
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Comparison of financial indicators for alternative scenarios

In accordance with the requirements of “Combined tool to identify the baseline scenario and demonstrate the additionality” version 05.0.0, a clear comparison of the financial indicators for all alternative scenarios should be presented.

Table 13 Comparison of financial indicators

Alternative Scenario	Financial Indicator	Value
Scenario 1: Project activity including power generation from LFG without being registered as a VER project activity.	Equity IRR	-3.68%
Scenario 2: Atmospheric release of the LFG and electricity would have been generated by the existing grid connected power plants as continuation of the situation before the project activity.	Expected return on equity	20%

It could be seen that the equity IRR of -3.68% of Scenario 1 is far below the benchmark value of 20% (financial indicator representing Scenario 2) and cannot be considered to be a financially attractive alternative.

Sensitivity Analysis

The objective of the sensitivity analysis is to show whether the conclusion regarding the financial attractiveness is robust to reasonable variations in the critical assumptions. In line with the guidelines provided in the “Combined tool to identify the baseline scenario and demonstrate the additionality” version 05.0.0, important parameters that has an impact on the financial indicator of Scenario 1 are defined as total investment, electricity price, electricity generation and general overheads. The mentioned parameters have been changed significantly to result with equity IRR close or equal³⁰ to the benchmark value (financial indicator of Scenario 2) and the probability of the increase/decrease of the parameter has been discussed further on.

The following table demonstrates the value of the parameters that results with equity IRR close or equal to the benchmark.

Table 14 Sensitivity Analysis of the equity IRR with variations in total investment, electricity price, electricity generation, investment and general overheads.

²⁹ The financial analysis excel sheet is available to the DOE.

³⁰ The sensitivity analysis has been performed on the basis of the equity IRR without taking into account the GS VER revenues.

Parameter	Change	Value Applied	Equity IRR Reached
Electricity Price	196%	14.27 \$c/kWh	20.43%
Electricity Generation	196%	134,456 GWh	20.43%
Operational Expenses	0%	0 \$/year	13.63%
Total investment	50%	8,716,000 \$	3.96%

Discussion on the probability of the deviations:

Electricity Price:

The equity IRR reaches to the benchmark threshold only when electricity price of 14.27 \$cent/kWh consistently applied throughout over a 15 year period. At the time of the investment decision, the guaranteed electricity price for facilities generating electricity based on renewable energy sources including LFG was set as 7.28 \$cent/kWh (equivalent to 5.5 €cent/kWh). However the “Law on Utilization of Renewable Energy Resources for the Purpose of Generating Electricity Energy” has been revised and the guaranteed electricity price for electricity generated based on biomass resources (including LFG) have been set to 13.3 \$cent/kWh, which is now applicable for 10 years. The equity IRR of the project activity increases only to 10.62% in this scenario still significantly below the benchmark value. According to Article of the mentioned Law, the price applicable beyond 2015 will be determined by the Council of Ministers however cannot be higher than prices indicated currently under the Law. Therefore it is unlikely that the sales price would go higher within the first crediting period resulting with equity IRR reaching over the benchmark value.

Electricity Generation:

The equity IRR reaches to the benchmark threshold only when an electricity generation of 134,4 GWh/year is reached which corresponds to a load factor of 156%, which is scientifically impossible. Therefore it is not realistic to expect the electricity generation to reach 134,4 GWh/year.

Operational Expenses:

The calculation shows that the equity IRR only reaches to 13.63% when the general overhead costs are considered to be zero, which is not possible in practice.

Total Investment:

The Equity IRR only reaches to -3.96% if the total investment is assumed to be 8,716,000 \$ in total which is not a realistic scenario for the proposed project activity, since this scenario refers to an investment cost of 890 \$/kWe. According to widely accepted literature, investment costs in a LFG recovery system range between 1,550-2,250 \$/kWe³¹.

Outcome of Step 3:

The sensitivity analysis clearly demonstrates that the equity IRR of the proposed project activity without being registered as a VER project (Scenario 1) does not overcome the financial benchmark (Scenario 2) despite favourable conditions. The sensitivity analysis further substantiates that the project activity is not a financially attractive and therefore additional.

Step 4: Common practice analysis

³¹ Reference: “Number and Types of Landfill Gas Plants Worldwide” Presented in the World Bank by Hans Willumsen LFG Consult / http://deponigas.dk/uploads/media/Number_and_Types_of_LFG_Plants_Worldwide.pdf (page 9 Section 4.1 Investment costs in LFG Recovery System)

Since the proposed project activity applies methane destruction, the following step wise approach has been adopted to conduct the common practice analysis in line with the requirements of “*Combined tool to identify the baseline scenario and demonstrate additionality*” version 05.0.0.

Step 4a: The proposed CDM project activity(s) applies measures that are listed in the definitions section under the “*Combined tool to identify the baseline scenario and demonstrate additionality*” version 05.0.0.

Sub-step 4a(1): In line with the requirements of the tool, the applicable output range or the design capacity of the proposed capacity is calculated as **4.9 MW – 14.7 MW**³².

Sub-step 4a(2): In line with the requirements of the tool, plants that deliver the same output or capacity within the applicable range and applicable geographical area³³ are determined as follows³⁴:

Table 15. Plants within the range of common practice analysis, that delivers same output range³⁵

Plant Name	Capacity	Further Notes
ITC-KA Enerji Adana (Biyokütle)	9.9 (MW)	GS VER project activity currently listed under GS Registration.
Ortadoğu Enerji (Kömürcüoda)	5.8 (MW)	GS VER project activity currently listed under GS Registration.
IZAYDAŞ (İzmit Çöp)	5.2 (MW)	Hazardous waste incineration power plant.

Among the above three plants, both Adana and Kömürcüoda Plants are listed under Gold Standard project activities and therefore (N_{all}) has been identified as 1³⁶.

Sub-step 4a(3): Among the power plants under table 15, IZAYDAŞ plant is applying a different to the technology applied in the proposed project activity. The proposed project activity is electricity generation through captured LFG from a Municipal Solid Waste, while IZAYDAŞ power plant is based on electricity generation from incineration of Hazardous wastes³⁷. Therefore (N_{diff}) is identified as “1” in line with the requirements of the tool.

Sub-step 4a(4): in line with the requirements of the tool, factor F, representing the share of power plants using a technology similar to the technology used in the proposed project activity in all plants that deliver the same output as the proposed project activity is calculated as follows:

$$F=1-N_{all}/N_{diff}=1-1/1=0$$

³² The capacity of the proposed Project activity is 9.8 MW. Therefore the +/-50% range is calculated as 4.9 MW – 14.7 MW

³³ Turkey is considered as the applicable geographical area, which is the most conservative approach.

³⁴ “Guidelines on common practice” version 02.0 EB 69 Annex 8 has been taken into account conducting the common practice analysis.

³⁵ Reference: Turkish Electrical Energy Generation Capacity Projection for 10 Years 2011-2020, Annex I Current System (page 97 / Waste), 212.175.131.171/projeksiyon/KAPASITEPROJEKSIYONU2011.pdf

³⁶ Registered VER Project activities and Project activities undergoing validation have not been included under this step.

³⁷ Reference: <http://www.izaydas.com.tr/icerik.asp?id=37>

According to “Combined tool to identify the baseline scenario and demonstrate additionality” version 05.0.0, the proposed project activity is regarded as “common practice” within a sector in the applicable geographical area if both the following conditions are fulfilled;

- (a) The factor F is greater than 0.2; and
- (b) $N_{all}-N_{diff}$ is greater than 3.

Since F is “0” (smaller than 0.2) and $N_{all}-N_{diff}$ is “0” (smaller than 3), the proposed project activity cannot be regarded as “common practice” within the sector in the applicable geographical area.

Step 4b. The proposed project activity(s) does not apply any of the measures that are listed in the definitions section under the “Combined tool to identify the baseline scenario and demonstrate additionality” version 05.0.0.

This step is not applicable since the proposed project activity applies methane destruction.

Outcome of Step 4:

The outcome of Step 4 clearly demonstrates that the proposed project activity is not regarded as “common practice” and therefore the proposed project activity is additional.

B.6. Emission reductions

B.6.1. Explanation of methodological choices

The emission reductions resulting from the proposed project are calculated according to ACM0001 “Flaring or Use of Landfill Gas” version 13.0.0.

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

$$ER_y = BE_y - PE_y \quad (1)^{38}$$

Where:

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

Baseline emissions

In accordance with ACM0001 “Flaring or Use of Landfill Gas” version 13.0.0, baseline emissions should comprise the following sources:

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

Since there are no heat generations or natural gas usage in the baseline scenario, only baseline emissions from methane emissions from SWDS (A) and electricity generation (B) will be taken into account³⁹. The baseline emissions are calculated as follows:

³⁸ This equation is referred as (#22) under ACM0001

³⁹ This approach will be applied to each equation where applicable.

$$BE_y = BE_{CH_4,y} + BE_{EC,y} \quad (2)^{40}$$

Where:

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

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

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

$$BE_{CH_4,y} = (1 - OX_{top-layer}) * (F_{CH_4,PJ,y} - F_{CH_4,BL,y}) * GWP_{CH_4} \quad (3)^{41}$$

Where:

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

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

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

$$F_{CH_4,PJ,y} = F_{CH_4,flared,y} + F_{CH_4,EL,y} \quad (4)^{42}$$

Where:

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

$F_{CH_4,EL,y}$ is determined using the “Tool to determine the mass flow of a greenhouse gas in a gaseous stream” and monitoring the working hours of the power plant, so that no emission reduction are claimed for methane destruction during non-working hours. This is taken into account by monitoring the hours that the equipment utilizing the LFG is operating in year y ($Op_{j,h,y}$).

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

⁴⁰ This equation is referred as (#1) under ACM0001

⁴¹ This equation is referred as (#2) under ACM0001

⁴² This equation is referred as (#3) under ACM0001

$F_{CH_4,PJ,y}$ is determined using the “Tool to determine the mass flow of a greenhouse gas in a gaseous stream” version 02.0.0.

The tool provides procedures to determine the following parameter:

Parameter	SI Unit	Description
$F_{i,t}^{43}$	kg/h	Mass flow of greenhouse gas i (CO ₂ , CH ₄ , N ₂ O, SF ₆ or a PFC) in the gaseous stream in time interval t.

The mass flow of CH₄ in LFG is determined through measurement of the flow and volumetric fraction of the gaseous stream (LFG). The “Tool to determine the mass flow of a greenhouse gas in a gaseous stream” version 02.0.0 provides 6 different ways to make these measurements and the corresponding calculation option for $F_{i,t}$.

Table 16 Measurement options for $F_{i,t}$

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

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

Option A:

According to the “Tool to determine the mass flow of a greenhouse gas in a gaseous stream” version 02.0.0, flow measurement on a dry measurement is not doable for a wet gaseous stream. Therefore it will be demonstrated that the temperature of the gaseous stream (T_t) is less than 60°C (333.15 K) at the flow measurement point.

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

$$F_{CH_4,t} = V_{t,db} * v_{CH_4,t,db} * \rho_{CH_4,t} \quad (5)^{44}$$

With

$$\rho_{CH_4,t} = \frac{P_t * MM_{CH_4}}{R_u * T_t} \quad (6)^{45,46}$$

Where:

$F_{CH_4,t}$ Mass flow of CH₄ in the gaseous stream in time interval t (kg gas/h)

⁴³ The parameter ($F_{i,t}$) under the “Tool to determine the mass flow of a greenhouse gas in gaseous stream” corresponds to the parameter ($F_{CH_4,EL,y}$) under ACM0001.

⁴⁴ This equation is referred as (#5) under the “Tool to determine the mass flow of a greenhouse gas in a gaseous stream”

⁴⁵ This equation is referred as (#6) under the “Tool to determine the mass flow of a greenhouse gas in a gaseous stream”

⁴⁶ Since all the parameters are converted to normal conditions during the monitoring process, $p_{CH_4,n}$ which is equal to 0.716 kg/m³ will be used for equation (5) for ex-post calculation of mass flow of CH₄ in the gaseous stream.

$V_{t,db}$	Volumetric flow of the gaseous stream in time interval t on a dry basis (m^3 dry gas/h)
$V_{CH_4,t,db}$	Volumetric fraction of CH_4 in the gaseous stream in a time interval t on a dry basis (m^3 gas CH_4/m^3 dry gas)
$\rho_{CH_4,t}$	Density of CH_4 in the gaseous stream in time interval t (kg gas CH_4/ m^3 gas CH_4)
P_t	Absolute pressure of the gaseous stream in time interval t (Pa)
MM_{CH_4}	Molecular Mass of CH_4 (kg/kmol)
R_u	Universal ideal gases content (Pa.m ³ /kmol.K)
T_t	Temperature of gaseous stream in time interval t (K)

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

The project participant opts to exclude the flare system from the baseline calculations and will not claim any emission reductions from the flaring activities (if any) within the crediting period, since the flare system is observed/envisaged to work none or for insignificant durations throughout the operational lifetime.

The exclusion of the emission reductions from flaring activities is conservative since it will result in no change (if there is no flaring activity) or decrease in the total emission reductions (if flaring activity is observed).

In accordance to the above explanation, the “Project emissions from flaring” version 02, is not applied to the proposed project activity and no emission reductions will be claimed from the flaring activity, therefore the amount of methane destroyed by flaring $F_{CH_4,flared,y}$ is fixed to “0”.

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

An ex-ante estimate of $F_{CH_4,PJ,y}$ is required to estimate baseline emissions of methane from the SWDS (according to equation 3) in order to estimate the emission reductions of the proposed project activity. In accordance with ACM0001 “Flaring or Use of Landfill Gas” version 13.0.0, it is determined as follows:

$$F_{CH_4,PJ,y} = \eta_{PJ} * BE_{CH_4,SWDS,y} / GWP_{CH_4} \quad (11)^{47}$$

Where:

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

$BE_{CH_4,SWDS,y}$ is determined using the methodological tool “Emissions from solid disposal sites” version 06.0.1. The amount of methane generated from disposal of waste at the SWDS is calculated based on a first order decay (FOD) model. The amount of methane generated from disposal of waste at the SWDS is calculated for year y as follows⁴⁸:

⁴⁷ This equation is referred as (#5) under ACM0001

⁴⁸ The time period for the calculation starts from x=1997, when the SWDS starts receiving waste till 2019, which is the end of the first crediting period.

$$BE_{CH_4, SWDS, y} = \varphi \cdot (1 - f) \cdot GWP_{CH_4} \cdot (1 - OX) \cdot \frac{16}{12} \cdot F \cdot DOC_f \cdot MCF \cdot \sum_{x=1}^y \sum_j W_{j,x} \cdot DOC_j \cdot e^{-k_j \cdot (y-x)} \cdot (1 - e^{-k_j}) \quad (12)^{49}$$

Where:

$BE_{CH_4, SWDS, y}$	Baseline methane emissions occurring in year y generated from waste disposal at a SWDS during a time period ending in year y (tCO ₂ e/yr)
x	Years in time period in which waste is disposed at the SWDS, extending from the first year in time period (x=1) to year y (x=y)
y	Year of the crediting period for which methane emissions are calculated
$DOC_{f,y}$	Fraction of degradable organic carbon (DOC) that decomposes under the specific conditions occurring in the SWDS for year y (weight fraction)
$W_{j,x}$	Amount of solid waste type j disposed or prevented from disposal in the SWDS in the year x (t)
φ_y	Model correction factor to account for model uncertainties for year y
f_y	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
GWP_{CH_4}	Global Warming Potential of methane
OX	Oxidation factor (reflecting the amount of methane from SWDS that is oxidised in the soil or other material covering the waste)
F	Fraction of methane in the SWDS gas (volume fraction)
MCF_y	Methane correction factor for year y
DOC_j	Fraction of degradable organic carbon in the waste type j (weight fraction)
k_j	Decay rate for the waste type j (1/yr)
j	Type of residual waste or types of waste in the MSW

Parameters required applying the FOD model

The parameters required to apply the FOD model is listed under table 18 below. The parameters are selected according to Application A as defined under the tool “Emissions from solid disposal sites” version 06.0.1, and under section B.2 “Applicability of the tool” in the PDD.

Table 18 Parameters required to apply FOD model

Parameter	Value									
φ_v	A default value of 0.75									
OX	A default value of 0.1									
F	A default value of 0.5									
$DOC_{f,y}$	A default value of 0.5									
MCF_v	A default value of 0.8									
k_j	The following values for the different waste types have been applied as a default value:<table><thead><tr><th colspan="2" rowspan="2">Waste type j</th><th>Boreal and Temperate (MAT < 20°C)</th></tr><tr><th>WET(MAP/PET >1)</th></tr></thead><tbody><tr><td rowspan="2">Slowly degrad</td><td>Pulp, paper, cardboard</td><td>0.06</td></tr><tr><td>Wood, wood products and straw</td><td>0.03</td></tr></tbody></table>	Waste type j		Boreal and Temperate (MAT < 20°C)	WET(MAP/PET >1)	Slowly degrad	Pulp, paper, cardboard	0.06	Wood, wood products and straw	0.03
Waste type j				Boreal and Temperate (MAT < 20°C)						
		WET(MAP/PET >1)								
Slowly degrad	Pulp, paper, cardboard	0.06								
	Wood, wood products and straw	0.03								

⁴⁹ This equation is referred as (#1) under the methodological tool “Emissions from solid waste disposal sites”

	Moderately degrading	Other (non-food) organic putrescible garden and park waste	0.10	
	Rapidly degrading	Food, food waste, sewage sludge, beverages and tobacco	0.185	
$W_{i,x}$	Estimated once. Please refer to table 14			
DOC_j	The following values for the different waste types have been applied as a default value:			
	Waste type j		DOC_i (% wet waste)	
	Wood and wood products		43	
	Pulp, paper and cardboard		40	
	Food, food waste, beverages and tobacco		15	
	Textiles		24	
	Garden, yard and park waste		20	
	Glass, plastic, metal, other inert		0	
	f_v	A default value of 0		

Determining the model correction factor (φ_y)

In line with the requirements of the tool “Emissions from solid disposal sites” version 06.0.1, a default value: $\varphi_y = \varphi_{\text{default}}$ will be used. φ_{default} is set as 0.75.

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

In total approximately 8 million tons of MSW is estimated to accumulate between 1996 and 2011. The latest figure on the total amount of daily waste is 2000ton/day in year 2011 and it is increased by the population growing rate by 1.3%⁵⁰ each upcoming year for ex-ante purposes. waste input is expected throughout the crediting period.

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

In line with the requirements of the tool “Emissions from solid disposal sites” version 06.0.1, a default value: $DOC_{f,y} = DOC_{f,\text{default}}$ will be used. $DOC_{f,\text{default}}$ is set as 0.5.

Procedure to determine the methane correction factor (MCF_y)

In line with the requirements of the tool “Emissions from solid disposal sites” version 06.0.1, a default value: $MCF_y = MCF_{\text{default}}$ will be used. $DOC_{f,\text{default}}$ is set as 0.8, which corresponds to unmanaged solid waste disposal site – deep.

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

This step provides a procedure to determine the amount of methane that would have been captured and destroyed (by flaring) in the baseline due to regulatory requirements, or to address safety and odour concerns. ACM0001 “Flaring or Use of Landfill Gas” version 13.0.0 provides 4 cases and corresponding instructions.

⁵⁰ Reference: Turkish Statistics Institute <http://www.tuik.gov.tr/PreHaberBultenleri.do?id=13140>

Table 19 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 requirement to destroy methane exists and no existing LFG capture system	No	No
Case 2: Requirement to destroy methane exists and no existing LFG capture system	Yes	No
Case 3: No requirement to destroy methane exists and a LFG capture system exists	No	Yes
Case 4: Requirement to destroy methane exists and LFG capture system exists	Yes	Yes

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

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

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

The baseline emissions associated with electricity generation in year y ($BE_{EC,y}$) is calculated in accordance with the “Tool to calculate baseline, project and leakage emissions from electricity consumption” version 1. The electricity source k in the tool corresponds to the sources of electricity generated by the grid, which is identified as the most plausible baseline scenario. $EC_{BL,k,y}$ in the tool is equivalent to the net amount of electricity generated using LFG in year y ($EG_{PJ,y}$).

Generic approach

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

$$BE_{EC,y} = \sum_k EC_{BL,k,y} * EF_{EL,k,y} * (1 + TDL_{k,y}) \quad (13)^{51}$$

Where:

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

⁵¹ This equation is referred as (#2) under the “Tool to calculate baseline, project and leakage emissions from electricity consumption”

k the sources of electricity generated by the grid

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

The emission factor for the electricity generation $EF_{EL,k,y}$ will be determined in accordance with Scenario A (Electricity consumption from the grid) as defined under the “Tool to calculate baseline, project and leakage emissions from electricity consumption” version 1 and as described under section B.2 “Applicability of the tool” of the PDD.

According to the tool, the project participants can either calculate the combined margin emission factor of the applicable electricity system (Option A1), or could use conservative default values (Option A2). The project participant chooses Option A1, which the combined margin emission factor of the applicable electricity system will be calculated using the procedures in the “Tool to calculate the emission factor for an electricity system” version 3.0.0, ($EF_{EL,k,y}=EF_{grid,CM,y}$).

In accordance with the methodological “Tool to calculate the emission factor for an electricity system” version 03.0.0, the “combined margin” emission factor is calculated through the following six steps:

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

STEP 1: Identify the relevant electricity system

According to the applicable methodology, the relevant project electricity system has to be identified. A project electricity system is defined by the spatial extent of the power plants that are physically connected through transmission and distribution lines to the project activity and that can be dispatched without significant transmission constraints.

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

The transmission lines in Turkey are operated by TEİAŞ (Turkish Electricity Transmission CO), which is a state owned company. The grid is 48.871 km long and constitutes of 632 transformer stations with a total transformer capacity of 108,378 MVA and 10 interconnections to neighbour countries⁵². The interconnected grid system is operated continuously and there are no electricity price differences throughout the regions⁵³. Therefore the relevant electric power system is defined as the national grid system of Turkey.

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

According to the applicable tool, Project Participants may choose between the following two options to calculate the operating margin and build margin emission factor:

⁵² Reference: http://www.turek2012.info/pdf/sunumlar/ercument_ozdemirci.pdf

⁵³ Reference: TEİAŞ (Turkish Electricity Transmission Co) official webpage <http://www.teias.gov.tr/>

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

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

The Project Participant chooses Option I and therefore only grid power plants are included in the calculation.

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

According to the applicable methodological tool, 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 project participant has selected option (a) Simple OM method for calculation of the operating margin emission factor. This choice is applicable since low-cost/must-run resources constitute less than 50% of total grid generation in average of five most recent years. The low-cost/must-run resources include hydro, geothermal, wind, low-cost biomass, nuclear, and solar power generation.

The share of the installed capacity of renewable energy sources excluding hydro power is 1.2% of the total electricity generation and the electricity generation from hydro power is 20.3% of the total electricity generation in average of five most recent years. The total share of renewable energy resources add up to 21.5%, which is below the threshold for applicability of the simple OM method. There is no indication that coal is used as a must-run and no nuclear energy plants are located in Turkey. Therefore the requirements for the use of the Simple OM calculations are satisfied.

Table 20. Annual development of Turkey's electricity generation by share of Primary energy resources⁵⁴

Years	Total Thermal	Total Hydro	Geothermal and Wind
2007	81.0%	18.7%	0.3%
2008	82.8%	16.8%	0.5%
2009	80.6%	18.5%	1.0%
2010	73.8%	24.5%	1.7%
2011	74.8%	22.8%	2.4%
Average	78.6%	20.3%	1.2%

For the simple OM, the emission factor can be calculated using either of the two following data vintages:

- **Ex ante option:** If the *ex ante* option is chosen, the emission factor is determined once at the validation stage, thus no monitoring and recalculation of the emissions factor during the crediting period is required. For grid power plants a 3-year generation-weighted average, based on the most recent data available at the time of submission of the VER-PDD to the DOE for validation.
- **Ex post option:** If the *ex post* option is chosen, the emission factor is determined for the year in which the project activity displaces grid electricity, requiring the emissions factor to be updated annually during monitoring.

⁵⁴ Reference: [www.teias.gov.tr/T%C3%BCrkiyeElektrik%C4%B0statistikleri/istatistik2011/uretim%20tuketim\(22-45\)/36.xls](http://www.teias.gov.tr/T%C3%BCrkiyeElektrik%C4%B0statistikleri/istatistik2011/uretim%20tuketim(22-45)/36.xls)

For the proposed project activity the **ex-ante option** is selected. Data for calculating the three year average is obtained from the period 2009 – 2011 which are the most recent data available at the time of submission of the PDD to DOE.⁵⁵

STEP 4: Calculating the operating margin emission factor according to the selected method

The simple OM emission factor is calculated as the generation-weighted average CO₂ emissions per unit net electricity generation (tCO₂e/MWh) of all generating power plants serving the system, not including low-cost / must-run power plants / units. It may be calculated:

Option A: Based on the net electricity generation and a CO₂ emission factor of each power unit; or
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.

As the fuel consumption and the average efficiency data for each power plant / unit is not available Option B is used for simple OM calculation.⁵⁶

Option B: Calculation based on total fuel consumption and electricity generation of the system

As Option B is used, the simple OM emission factor is calculated based on the net electricity supplied to the grid by all power plants serving the system, not including low-cost/must run power plants/units, and based on the fuel type(s) and total fuel consumption of the project electricity system as follows:

$$EF_{grid,OMsimple,y} = \frac{\sum_i FC_{i,y} \times NCV_{i,y} \times EF_{CO_2,i,y}}{EG_y} \quad (14)$$

Where:

$EF_{grid,OMsimple,y}$	Simple operating margin CO ₂ emission factor in year y (tCO ₂ /MWh)
$FC_{i,y}$	Amount of fossil fuel type i consumed in the project electricity system in year y (mass or volume unit)
$NCV_{i,y}$	Net calorific value (energy content) of fossil fuel type i in year y (GJ / mass or volume unit)
$EF_{CO_2,i,y}$	CO ₂ emission factor of fossil fuel type i in year y (tCO ₂ /GJ)
EG_y	Net electricity generated and delivered to the grid by all power sources serving the system, not including low-cost/must run power plants/units, in year y (MWh)
i	All fossil fuel types combusted in power sources in the project electricity system in year y
y	The three most recent years for which data is available at the time of submission of the PDD to the DOE for validation (ex-ante option)

For this approach (simple OM) to calculate the operating margin, subscript m refers to the power plants/units delivering electricity to the grid, not including low-cost/must run power plants/units, and including electricity imports to the grid.

STEP 5. Calculation of the build margin emission factor

⁵⁵ The index “y” in the equations refers to the years 2009-2011 to calculate the emission factor ex-ante.

⁵⁶ Only 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.

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

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

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

For the proposed project activity the Project Participant chooses **Option 1** in terms of vintage of data.

The sample group of power units m used to calculate the build margin should be determined as per the following procedure, consistent with the data vintage selected above:

- (a) Identify the set of five power units, excluding power units registered as VER project activities, that started to supply electricity to the grid most recently ($SET_{5-units}$) and determine their annual electricity generation ($AEG_{SET_{5-units}}$, in MWh).
- (b) Determine the annual electricity generation of the project electricity system, excluding power units registered as VER project activities (AEG_{total} , in MWh). Identify the set of power units, excluding power units registered as VER project activities, that started to supply electricity to the grid most recently and that comprise 20% of total AEG_{total} (if 20% falls on part of the generation of a unit, the generation of that unit is fully included in the calculation) ($SET_{>20\%}$) and determine their annual electricity generation ($AEG_{SET_{>20\%}}$, in MWh);
- (c) From $SET_{5-units}$ and $SET_{>20\%}$ select the set of power units that comprise the larger annual electricity generation (SET_{sample});

Identify the date when the power units in SET_{sample} started to supply electricity to the grid. If none of the power units in SET_{sample} started to supply electricity to the grid more than 10 years ago, then use the SET_{sample} to calculate the build margin.

The most recent information available belongs to 2011 and based on TEİAŞ statistics which is the official information source for the grid. According to TEİAŞ figure, the annual electricity generation of the project electricity system excluding power units registered as VER project activities (AEG_{total}) is 229,395,100 MWh⁵⁷. Based on the AEG_{total} , the set of power units, excluding power units registered as VER project activities, that started to supply electricity to the grid most recently and that comprise 20% of total AEG_{total} , have been defined and the $AEG_{SET_{>20\%}}$ is determined as 41,250,851 MWh and includes 309 units of power plants under $SET_{>20\%}$. Without the need of any further assessment it can be concluded that the $SET_{5-units} \ll SET_{>20\%}$ and therefore the $SET_{>20\%}$ is selected as SET_{sample} ⁵⁸ for the calculation of the build margin (BM).

⁵⁷ Reference: [www.teias.gov.tr/T%C3%BCrkiyeElektrik%C4%B0statistikleri/istatistik2011/uretim%20tuketim\(22-45\)/35\(75-11\).xls](http://www.teias.gov.tr/T%C3%BCrkiyeElektrik%C4%B0statistikleri/istatistik2011/uretim%20tuketim(22-45)/35(75-11).xls)

⁵⁸ None of the power units in SET_{sample} started to supply electricity to the grid more than 10 years ago.

The built margin (BM) emission factor is the generation-weighted average emission factor (tCO₂/MWh) of all power units m during the most recent year y for which power generation data is available⁵⁹, calculated as follows:

$$EF_{grid,BM,y} = \frac{\sum_m EG_{m,y} \times EF_{EL,m,y}}{\sum_m EG_{m,y}} \quad (15)$$

Where:

$EF_{grid,BM,y}$	Build margin CO ₂ emissions factor in year y (tCO ₂ /MWh)
$EG_{m,y}$	Net quantity of electricity generated and delivered to the grid by power unit m in year y (MWh)
$EF_{EL,m,y}$	CO ₂ emission factor of the power unit m in year y (tCO ₂ /MWh)
m	Power units included in the build margin
y	Most recent historical year for which power generation data is available

As per the “Tool to calculate the emission factor for an electricity system” version 03.0.0, the CO₂ emission factor of each power unit m ($EF_{EL,m,y}$) should be determined as per the guidance from the tool in step 4 for simple OM, using options A1, A2 or A3, using for y the most recent historical year for which power generation data is available, where m is the power units included in the build margin.

As plant specific fuel consumption data is not available for Turkey, option A2 has been selected for the calculation of the CO₂ emission factor of each power unit m ($EF_{EL,m,y}$) as follows:

$$EF_{EL,m,y} = \frac{EF_{CO_2,i,y} \cdot 3.6}{\eta_{m,y}} \quad (16)$$

Where:

$EF_{EL,m,y}$	CO ₂ emission factor of the power unit m in year y (tCO ₂ /MWh)
$EF_{CO_2,m,i,y}$	Average CO ₂ emission factor of fuel type i used in power unit m in year y (tCO ₂ /GJ)
$\eta_{m,y}$	Average net energy conversion efficiency of power unit m in year y (ratio)
m	All power units serving the grid in year y except low-cost/must-run power units
y	The most recent year for which power generation data is available at the time of submission of the VER-PDD to the DOE for validation (ex-ante option)

STEP 6: Calculation of the combined margin emission factor

According to the applicable methodological tool, the calculation of the combined margin (CM) emission factor ($EF_{grid,CM}$) is based on one of the following methods:

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

In line with the requirements of the applicable tool, the Project Participant chooses option (a), weighted average CM.

⁵⁹ The most recent year for which power generation data is available is 2011.

The combined margin emissions factor is calculated as follows:

$$EF_{grid,CM,y} = EF_{grid,OM,y} \cdot w_{OM} + EF_{grid,BM,y} \cdot w_{BM} \quad (17)$$

Where:

$EF_{grid,CM,y}$	Combined Margin emission factor (tCO ₂ /MWh)
$EF_{grid,OM,y}$	Operating margin emission factor (tCO ₂ /MWh)
$EF_{grid,BM,y}$	Build margin emission factor (tCO ₂ /MWh)
w_{OM}	Weight of the operating margin emission factor
w_{BM}	Weight of the build margin emission factor

As stated in the “Tool to calculate the emission factor for an electricity system” version 03.0.0, the default weights for the operating margin and build margin emission factors for the proposed project type is defined as:

$$w_{OM}=0.50$$

$$w_{BM}=0.50$$

for the first crediting period⁶⁰.

Changes required for the methodology implementation in 2nd and 3rd crediting periods

At the start of the second and third crediting period the Project Proponents will address two issues as required by the applicable methodology:

- Assess the continued validity of the baseline; and
- Update the baseline as defined above

Project Emissions

In accordance with ACM0001 “Flaring or Use of Landfill Gas” version 13.0.0, the project emissions are calculated as follows:

$$PE_y = PE_{EC,y} \quad (18)^{61}$$

Where:

$PE_{EC,y}$	Emission from consumption of electricity due to the project activity in year y (tCO ₂ e/yr).
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Since there are no consumption of fossil fuels due to the project activity, for the purpose other than electricity generation, there are no emissions from fossil fuel consumption and therefore $PE_{FC,y}$ is equal to “0” and has not been included in equation (17).

The project emissions from consumption of electricity by the project activity $PE_{EC,y}$ shall be calculated using the “Tool to calculate baseline, project and/or leakage emissions from electricity consumption” version 1. When applying the tool, electricity sources j in the tool corresponds to the sources of electricity consumed due to the project activity.

⁶⁰ For the second and third crediting period, $w_{OM}=0.25$ and $w_{BM}=0.75$ will be used unless otherwise specified in the methodology. Project participant may submit alternative weights if the weightage does not reflect their situation.

⁶¹ This equation is referred as (#22) under ACM0001

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

$$PE_{EC,y} = \sum_j EC_{PJ,y} * EF_{EL,j,y} * (1 + TDL_{j,y}) \quad (19)^{62}$$

Where:

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

The combined margin emission factor of the applicable electricity system, has been determined as emission factor for the electricity system ($EF_{EL,j,y}$), in line with Option A1 of scenario A (Electricity consumption from grid) under the “Tool to calculate baseline, project and/or leakage emissions from electricity consumption” version 1.

Leakage

In accordance with ACM0001 “Flaring or Use of Landfill Gas” version 13.0.0, no leakage effects are accounted.

B.6.2. Data and parameters fixed ex ante

Data and parameters under ACM0001 “Flaring or Use of Landfill Gas” version 13.0.0, that are available at validation and not monitored:

Data / Parameter	ID.1 / OX _{top_layer}
Unit	Dimensionless
Description	Fraction of methane that would be oxidized in the top layer of the SWDS in the baseline
Source of data	Consistent with how oxidation is accounted for in the methodological tool “Emissions from solid waste disposal sites”
Value(s) applied	0.1
Choice of data or Measurement methods and procedures	As referred under ACM0001
Purpose of data	Calculation of baseline emissions
Additional comment	Applicable to Step A defined under ACM0001

⁶² This equation is referred as (#1) under “Tool to calculate baseline, project and/or leakage emissions from electricity consumption”

Data / Parameter	ID.2 / GWP_{CH_4}
Unit	tCO ₂ e/tCH ₄
Description	Global Warming Potential of CH ₄
Source of data	IPCC
Value(s) applied	21 for the first commitment period and 25 for the second commitment period. Shall be updated accordingly to any future COP/MOP decision.
Choice of data or Measurement methods and procedures	As referred under ACM0001
Purpose of data	Calculation of baseline emissions
Additional comment	-

Data / Parameter	ID.3 / n_{PJ}
Unit	Dimensionless
Description	Efficiency of the LFG capture system that will be installed in the project activity
Source of data	ACM0001
Value(s) applied	
Choice of data or Measurement methods and procedures	Default value under ACM0001
Purpose of data	Calculation of baseline emissions
Additional comment	Applicable to Step A.1.1 defined under ACM0001

Data and parameters under the “Tool to determine the mass flow of a greenhouse gas in a gaseous stream” version 02.0.0, that are available at validation and not monitored:

Data / Parameter	ID.4 / R_u
Unit	Pa.m ³ /kmol.K
Description	Universal ideal gases constant
Source of data	Tool to determine the mass flow of a greenhouse gas in a gaseous stream
Value(s) applied	8.314
Choice of data or Measurement methods and procedures	As referred under “Tool to determine the mass flow of a greenhouse gas in a gaseous stream”
Purpose of data	Calculation of baseline emissions
Additional comment	-

Data / Parameter	ID.5 / MM _{CH4}		
Unit	kg/kmol		
Description	Molecular mass of CH ₄		
Source of data	Tool to determine the mass flow of a greenhouse gas in a gaseous stream		
Value(s) applied			
	Compound	Structure	Molecular mass (kg/kmol(
	Methane	CH ₄	16.04
Choice of data or Measurement methods and procedures	As referred under “Tool to determine the mass flow of a greenhouse gas in a gaseous stream”		
Purpose of data	Calculation of baseline emissions		
Additional comment	-		

Data and parameters under the tool “Emissions from solid disposal sites” version 06.0.1, that are available at validation and not monitored:

Data / Parameter	ID.8 / φ_{default}
Unit	-
Description	Default value for the model correction factor to account for model uncertainties
Source of data	Emissions from solid disposal sites
Value(s) applied	0.75
Choice of data or Measurement methods and procedures	As referred under “Emissions from solid disposal sites”
Purpose of data	Calculation of baseline emissions
Additional comment	The proposed project activity falls under Application A

Data / Parameter	ID.9 / OX
Unit	-
Description	Oxidation factor (reflecting the amount of methane from SWDS that is oxidized in the soil or other material covering the waste)
Source of data	Emissions from solid disposal sites. Based on extensive review of published literature on this subject, including the IPCC 2006 Guidelines for National Greenhouse Gas Inventories
Value(s) applied	0.1
Choice of data or Measurement methods and procedures	As referred under “Emissions from solid disposal sites”
Purpose of data	Calculation of baseline emissions
Additional comment	-

Data / Parameter	ID.10 / F
Unit	-
Description	Fraction of methane in the SWDS gas (volume fraction)
Source of data	IPCC 2006 Guidelines for National Greenhouse Gas Inventories
Value(s) applied	0.5
Choice of data or Measurement methods and procedures	Emissions from solid disposal sites
Purpose of data	Calculation of baseline emissions
Additional comment	Upon biodegradation, organic material is converted to a mixture of methane and carbon dioxide

Data / Parameter	ID.11 / DOC_{f,default}
Unit	Weight fraction
Description	Default value for the fraction of degradable organic carbon (DOC) in MSW that can decompose in the SWDS
Source of data	IPCC 2006 Guidelines for National Greenhouse Gas Inventories
Value(s) applied	0.5
Choice of data or Measurement methods and procedures	Emissions from solid disposal sites
Purpose of data	Calculation of baseline emissions
Additional comment	The proposed project activity falls under Application A

Data / Parameter	ID.12 / MCF_{default}
Unit	-
Description	Methane correction factor
Source of data	IPCC 2006 Guidelines for National Greenhouse Gas Inventories
Value(s) applied	0.8
Choice of data or Measurement methods and procedures	Emissions from solid disposal sites
Purpose of data	Calculation of baseline emissions
Additional comment	The baseline falls under the definition “unmanaged solid waste disposal site-deep”

Data / Parameter	ID.13 / DOC_j														
Unit	-														
Description	Fraction of degradable organic carbon in waste type j (weight fraction)														
Source of data	IPCC 2006 Guidelines for National Greenhouse Gas Inventories (adapted from Volume 5, Table 2.4 and Table 2.5)														
Value(s) applied	The following values for the different waste types have been applied: <table border="1"> <thead> <tr> <th>Waste type j</th><th>DOC_j (% wet waste)</th></tr> </thead> <tbody> <tr> <td>Wood and wood products</td><td>43</td></tr> <tr> <td>Pulp, paper and cardboard</td><td>40</td></tr> <tr> <td>Food, food waste, beverages and tobacco</td><td>15</td></tr> <tr> <td>Textiles</td><td>24</td></tr> <tr> <td>Garden, yard and park waste</td><td>20</td></tr> <tr> <td>Glass, plastic, metal, other inert</td><td>0</td></tr> </tbody> </table>	Waste type j	DOC _j (% wet waste)	Wood and wood products	43	Pulp, paper and cardboard	40	Food, food waste, beverages and tobacco	15	Textiles	24	Garden, yard and park waste	20	Glass, plastic, metal, other inert	0
Waste type j	DOC _j (% wet waste)														
Wood and wood products	43														
Pulp, paper and cardboard	40														
Food, food waste, beverages and tobacco	15														
Textiles	24														
Garden, yard and park waste	20														
Glass, plastic, metal, other inert	0														
Choice of data or Measurement methods and procedures	Emissions from solid disposal sites														
Purpose of data	Calculation of baseline emissions														
Additional comment	-														

Data / Parameter	ID.14 / k _j																	
Unit	1/yr																	
Description	Decay rate for the waste type j																	
Source of data	IPCC 2006 Guidelines for National Greenhouse Gas Inventories (Volume 5, Table 3.3)																	
Value(s) applied	The following values for the different waste types have been applied: <table><tr><th colspan="2" rowspan="2">Waste type j</th><th>Boreal and Temperate (MAT < 20°C)</th></tr><tr><th>WET(MAP/PET >1)</th></tr><tr><td rowspan="2">Slowly degrading</td><td>Pulp, paper, cardboard</td><td>0.06</td></tr><tr><td>Wood, wood products and straw</td><td>0.03</td></tr><tr><td>Moderately degrading</td><td>Other (non-food) organic putrescible garden and park waste</td><td>0.10</td></tr><tr><td>Rapidly degrading</td><td>Food, food waste, sewage sludge, beverages and tobacco</td><td>0.185</td></tr></table>			Waste type j		Boreal and Temperate (MAT < 20°C)	WET(MAP/PET >1)	Slowly degrading	Pulp, paper, cardboard	0.06	Wood, wood products and straw	0.03	Moderately degrading	Other (non-food) organic putrescible garden and park waste	0.10	Rapidly degrading	Food, food waste, sewage sludge, beverages and tobacco	0.185
Waste type j		Boreal and Temperate (MAT < 20°C)																
		WET(MAP/PET >1)																
Slowly degrading	Pulp, paper, cardboard	0.06																
	Wood, wood products and straw	0.03																
Moderately degrading	Other (non-food) organic putrescible garden and park waste	0.10																
Rapidly degrading	Food, food waste, sewage sludge, beverages and tobacco	0.185																
Choice of data or Measurement methods and procedures	Emissions from solid disposal sites																	
Purpose of data	Calculation of baseline emissions																	
Additional comment	According to the latest available report on Bursa Provincial Environment Annual Report (2008) ⁶³ the Mean Annual Temperature (MAT) is 15.4 ⁰ C (p39 table C.5); Mean Annual Precipitation (MAP) is 639.1 mm (p40 table C.7) and Potential Evapotranspiration (PET) is 30.9 (p39 table C.6).																	

⁶³ Reference: <http://bursa.cevreorman.gov.tr/Bursa/Files/belgeler/2008cevdurap.pdf> (page 44-45)

Data and parameters under the “Tool to calculate the emission factor for an electricity system” version 03.0.0, that are available at validation and not monitored:

Data / Parameter	ID.15 / $EG_{m,y}$
Unit	MWh
Description	Net electricity generated by power plant/unit m
Source of data	TEIAS (Turkish Electricity Transmission Company) http://www.teias.gov.tr/istatistikler.aspx
Value(s) applied	Please refer to Table 32
Choice of data or Measurement methods and procedures	According to “Turkish Statistics Law and Official Statistics Program” ⁶⁴ TEIAS, the Turkish Electricity Transmission Company is the official source for the related data, hence providing the most up-to-date and accurate information available.
Purpose of data	Used to calculate the combined margin emission factor
Additional comment	-

Data / Parameter	ID.16 / $FC_{i,y}$
Unit	tonnes (m^3 for gaseous fuels)
Description	Amount of fossil fuel type i consumed in the project electricity system by generation sources in year y (2009-2011)
Source of data	TEIAS (Turkish Electricity Transmission Company) http://www.teias.gov.tr/istatistikler.aspx
Value(s) applied	Please refer to Table 30
Choice of data or Measurement methods and procedures	According to “Turkish Statistics Law and Official Statistics Program” TEIAS, the Turkish Electricity Transmission Company is the official source for the related data, hence providing the most up-to-date and accurate information available.
Purpose of data	Used to calculate the combined margin emission factor
Additional comment	-

⁶⁴ TEIAS 2005: <http://rega.basbakanlik.gov.tr/Eskiler/2005/11/20051118-1.htm>

Data / Parameter	ID.17 / $NCV_{i,y}$
Unit	GJ/tonnes (m^3 for gaseous fuels)
Description	Net calorific value (energy content) of fossil fuel type i in year y
Source of data	TEIAS (Turkish Electricity Transmission Company) http://www.teias.gov.tr/istatistikler.aspx
Value(s) applied	Please refer to Table 30
Choice of data or Measurement methods and procedures	According to “Turkish Statistics Law and Official Statistics Program” TEIAS, the Turkish Electricity Transmission Company is the official source for the related data, hence providing the most up-to-date and accurate information available.
Purpose of data	Used to calculate the combined margin emission factor
Additional comment	-

Data / Parameter	ID.18 / $EF_{CO_2,i,y}$
Unit	tCO ₂ /GJ
Description	CO ₂ emission factor of fossil fuel type i ” used in power unit min year y
Source of data	IPCC default values at the lower limit of the uncertainty at a 95% confidence interval as provided in table 1.4 of Chapter 1 of Volume 2 (Energy) of the 2006 IPCC Guidelines for National Greenhouse Gas Inventory http://www.ipcc-nggip.iges.or.jp/public/2006gl/index.htm
Value(s) applied	Please refer to Table 30
Choice of data or Measurement methods and procedures	There is no information on the fuel specific default emission factor in Turkey, hence, IPCC values has been used.
Purpose of data	Used to calculate the combined margin emission factor
Additional comment	-

Data / Parameter	ID.19 / $\eta_{m,y}$										
Unit	%										
Description	Average net energy conversion efficiency of power unit m in year y										
Source of data	“Tool to calculate the emission factor for an electricity system” version 03.0.0, Appendix 1										
Value(s) applied	<table border="1"> <thead> <tr> <th></th><th>Average conversion efficiency $\eta_{m,y}$</th></tr> </thead> <tbody> <tr> <td>Natural Gas</td><td>IPCC default value of 60% for combined cycle</td></tr> <tr> <td>Lignite</td><td>IPCC default value of 45% for Supercritical IPCC default value of 41.4% for PFBS</td></tr> <tr> <td>Coal</td><td>IPCC default value of 45% for Supercritical IPCC default value of 41.4% for PFBS</td></tr> <tr> <td>Fuel Oil</td><td>IPCC default value of 46% for combined cycle</td></tr> </tbody> </table>		Average conversion efficiency $\eta_{m,y}$	Natural Gas	IPCC default value of 60% for combined cycle	Lignite	IPCC default value of 45% for Supercritical IPCC default value of 41.4% for PFBS	Coal	IPCC default value of 45% for Supercritical IPCC default value of 41.4% for PFBS	Fuel Oil	IPCC default value of 46% for combined cycle
	Average conversion efficiency $\eta_{m,y}$										
Natural Gas	IPCC default value of 60% for combined cycle										
Lignite	IPCC default value of 45% for Supercritical IPCC default value of 41.4% for PFBS										
Coal	IPCC default value of 45% for Supercritical IPCC default value of 41.4% for PFBS										
Fuel Oil	IPCC default value of 46% for combined cycle										
Choice of data or Measurement methods and procedures	Default values have been used .										
Purpose of data	Used to calculate the combined margin emission factor										
Additional comment	Where available Plant specific efficiencies are used instead of default values where available. Please refer to emission reduction calculation sheet for more details.										

B.6.3. Ex ante calculation of emission reductions

Emission Reductions

Emission reductions are calculated through equation (1):

Table 21 Emission reductions of the proposed project activity

Year	Parameter		
	ER_v (tCO ₂ e/yr)	BE_v (tCO ₂ e/yr)	PE_v (tCO ₂ e/yr)
2012	134,758	135,685	927
2013	184,498	186,725	2,226
2014	196,159	198,758	2,598
2015	201,538	204,136	2,598
2016	206,606	209,205	2,598
2017	211,415	214,013	2,598
2018	216,005	218,603	2,598
2019	220,410	223,009	2,598

Baseline emissions

Baseline emissions are calculated through equation (2):

Table 22 Baseline emissions of the proposed project activity

Year	Parameter		
	BE _y (tCO ₂ e/yr)	BE _{CH₄,y} (tCO ₂ e/yr)	BE _{EC,y} (tCO ₂ e/yr)
2012	135,685	119,967	15,719
2013	186,725	149,000	37,725
2014	198,758	154,745	44,012
2015	204,136	160,123	44,012
2016	209,205	165,192	44,012
2017	214,013	170,001	44,012
2018	218,603	174,590	44,012
2019	223,009	178,996	44,012

Baseline emissions of methane from SWDS

Baseline emissions of methane from SWDS are calculated through equation (3). A default value of 0.1 has been applied for $OX_{top-layer}$ and 25 for GWP_{CH_4} within the calculation that fall under the second commitment period and 21 that fall under the first commitment period.

Table 23 Baseline emissions of methane from SWDS

Year	Parameter		
	BE _{CH₄} (tCO ₂ /yr)	FE _{CH₄,PJ,y} (tCH ₄ /yr)	FE _{CH₄,BL,y} (tCH ₄ /yr)
2012	119,967	6,347	0
2013	149,000	6,622	0
2014	154,745	6,878	0
2015	160,123	7,117	0
2016	165,192	7,342	0
2017	170,001	7,556	0
2018	174,590	7,760	0
2019	178,996	7,955	0

Amount of methane in the LFG which is flared and or used in the project activity

Amount of methane in the LFG which is flared and or used in the project activity in year y has been estimated ex-ante through FOD model and equation (14). The following default values have been applied to the FOD model:

Table 24 Default values for FOD

ϕ_y	0.75		
OX	0.1		
F	0.5		
DOC _{f,y}	0.5		
MCF _y	0.8		
k _j	Waste type j		Boreal and Temperate (MAT < 20°C)
			WET(MAP/PET >1)
	Slowly degrad	Pulp, paper, cardboard	0.06
		Wood, wood products and straw	0.03

	Moderately degrading	Other (non-food) organic putrescible garden and park waste	0.10															
	Rapidly degrading	Food, food waste, sewage sludge, beverages and tobacco	0.185															
DOC _j	<table><tr><th>Waste type j</th><th>DOC_i (% wet waste)</th></tr><tr><td>Wood and wood products</td><td>43</td></tr><tr><td>Pulp, paper and cardboard</td><td>40</td></tr><tr><td>Food, food waste, beverages and tobacco</td><td>15</td></tr><tr><td>Textiles</td><td>24</td></tr><tr><td>Garden, yard and park waste</td><td>20</td></tr><tr><td>Glass, plastic, metal, other inert</td><td>0</td></tr></table>				Waste type j	DOC _i (% wet waste)	Wood and wood products	43	Pulp, paper and cardboard	40	Food, food waste, beverages and tobacco	15	Textiles	24	Garden, yard and park waste	20	Glass, plastic, metal, other inert	0
Waste type j	DOC _i (% wet waste)																	
Wood and wood products	43																	
Pulp, paper and cardboard	40																	
Food, food waste, beverages and tobacco	15																	
Textiles	24																	
Garden, yard and park waste	20																	
Glass, plastic, metal, other inert	0																	
f _v	0																	
n _{PI}	50%																	

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

Table 25 Fraction of solid waste type j disposed or prevented from disposal in the SWDS

Waste Type	Fraction (%)
Wood and wood products	3%
Pulp, paper and cardboard	8%
Food, food waste, beverages and tobacco	53%
Glass, plastic, metal, other inert	30%

The total amount of waste disposed to the SWDS between 1996 - 2019 has been estimated as follows:

Table 26 Total amount of waste disposed to the SWDS 1996-2019

Year	W _x (tons)
1996	614
1997	846
1998	951
1999	1,006
2000	1,100
2001	1,062
2002	1,133
2003	1,204
2004	1,388
2005	1,582
2006	1,691
2007	2,120
2008	1,895
2009	1,812
2010	1,907
2011	2,000
2012	2,026

2013	2,052
2014	2,079
2015	2,106
2016	2,133
2017	2,161
2018	2,189
2019	2,218

Based on the above parameters the amount of methane in the LFG which is flared and or used in the project activity in year y has been estimated ex-ante as follows:

Table 27 The amount of methane in the LFG which is flared and or used

Year	FE_{CH₄,PJ,y} (tCH₄/yr)
2012	6,347
2013	6,622
2014	6,878
2015	7,117
2016	7,342
2017	7,556
2018	7,760
2019	7,955

Baseline emissions associated with electricity generation

Baseline emissions associated with electricity generation are calculated through equation (16). The amount of estimated electricity generation has been based on an assumption of 7000h estimated operational hours for the power generation.

Table 28 Baseline emissions associated with electricity generation

Year	Parameter			
	BE_{EL,PJ,y}(tCO₂/yr)	EC_{BL,y} (MWh)	EF_{EL,y} (tCO₂e/MWh)	TDL_y (%)
2012	15,719	24,500	0.535	20%
2013	37,725	58,800	0.535	20%
2014	44,012	68,600	0.535	20%
2015	44,012	68,600	0.535	20%
2016	44,012	68,600	0.535	20%
2017	44,012	68,600	0.535	20%
2018	44,012	68,600	0.535	20%
2019	44,012	68,600	0.535	20%

Calculating the CO₂ emission factor of the grid

The CO₂ emission factor of the grid (EF_{CO₂,grid,y}) is calculated as the combined margin emission factor (EF_{grid,CM,y}) through equation (17) as followed:

Table 29. Combined margin emission factor

Combined Margin Emission Factor ($EF_{grid,CM,y}$)	Operating Margin Emission Factor ($EF_{grid,OM,y}$)	Build Margin Emission Factor ($EF_{grid,BM,y}$)	Weight of operating margin emission factor (w_{OM})	Weight of build margin emission factor (w_{BM})
tCO ₂ e/MWh	tCO ₂ e/MWh	tCO ₂ e/MWh	%	%
0.535	0.658	0.412	50	50

The operating margin emission factor ($EF_{grid,OM,y}$) is calculated as the simple operating margin through equation (14) as followed:

Table 30. Simple operating emission factor

Simple Operating Margin Emission Factor ($EF_{grid,OM,y}$)		0.658 tCO ₂ /MWh			
Fuel Type		Amount of Fossil Fuel ($FC_{i,y}$)	Net Calorific Value ($NCV_{i,y}$)	CO ₂ Emission Factor of Fossil Fuel ($EF_{CO_2,i,y}$)	Electricity Generated and Delivered to the Grid (EG_y)
		Tons ⁶⁵	GJ/tons ⁶⁶	tCO ₂ /GJ	MWh
Natural Gas	2009	20,978,040	37,177	0.0540	91,975,170
	2010	21,783,414	37,382		93,936,330
	2011	22,804,587	37,100		99,587,133
Lignite	2009	63,620,177	6,427	0.0909	37,413,753
	2010	56,689,392	7,131		34,401,281
	2011	61,507,310	7,298		37,204,046
Coal	2009	6,621,177	22,215	0.0946	15,884,155
	2010	7,419,703	22,316		18,285,308
	2011	10,574,434	22,794		26,175,127
Fuel Oil	2009	1,783,366	40,091	0.0726	4,597,576
	2010	925,276	40,201		2,086,545
	2011	546,655	41,628		864,863

Imports to the grid are also taken into account calculating the electricity generated and delivered to the grid (EG_y). CO₂ emission factor of the net electricity imports from a connected electricity system is determined as 0 tCO₂/MWh.

Table 31. Electricity imports from a connected electricity system

	Year		
	2009	2010	2011
Electricity Imports (MWh/y)	812,000	1,143,800	4,555,800

The build margin emission factor ($EF_{grid,BM,y}$) is calculated through equation (15) as followed:

⁶⁵ 1000 m³ in case for natural gas.

⁶⁶ GJ/1000m³ in case for natural gas.

Table32. Build margin emission factor

Build Margin Emission Factor ($EF_{grid,BM,y}$)		0.412 tCO ₂ /MWh		
Fuel Type		Electricity Generated and delivered to the Grid ($EG_{m,y}$)	Average CO ₂ Emission Factor of Fuel ($EF_{CO_2,m,i,y}$)	Average Net Energy Conversion Efficiency ($\eta_{m,y}$)
		MWh	tCO ₂ /GJ	%
Natural Gas	2010	12,787,008	0.0543	Combined Cycle
	2011	12,316,264		60
Lignite	2010	155,593	0.0909	Super Critical
	2011	0		45
Coal	2010	9,080,000	0.0946	Super Critical
	2011	4,320,000		45
Fuel Oil	2010	258,824	0.0726	Combined Cycle
	2011	1,026,593		46
Hydro	2010	2,523,322	0	n.a.
	2011	2,879,579		n.a.
Other Renewable	2010	551,785	0	n.a.
	2011	715,474		n.a.

Power plants under SET_{20%} are listed under Appendix 4 of this PDD.

Project Emissions

The project emissions of the proposed project activity are calculated through equation 18 and 19. For ex-ante purposes the electricity consumption of the proposed project activity is estimated to be approximately 4,050 MWh/yr after reaching full capacity.

Table 33 Project emissions from electricity consumption

Year	Parameter			
	PE _{EC,y} (tCO ₂ /yr)	EC _{PJ,y} (MWh)	EF _{EL,y} (tCO ₂ e/MWh)	TDL _y (%)
2012	927	1,445	0.535	20%
2013	2,226	3,470	0.535	20%
2014	2,598	4,050	0.535	20%
2015	2,598	4,050	0.535	20%
2016	2,598	4,050	0.535	20%
2017	2,598	4,050	0.535	20%
2018	2,598	4,050	0.535	20%
2019	2,598	4,050	0.535	20%

B.6.4. Summary of ex ante estimates of emission reductions

Year	Baseline emissions (t CO ₂ e)	Project emissions (t CO ₂ e)	Leakage (t CO ₂ e)	Emission reductions (t CO ₂ e)
2012 ⁶⁷	45,228	309	0	44,919
2013	186,725	2,226	0	184,498
2014	198,758	2,598	0	196,159
2015	204,136	2,598	0	201,538
2016	209,205	2,598	0	206,606
2017	214,013	2,598	0	211,415
2018	218,603	2,598	0	216,005
2019 ⁶⁸	148,673	1,732	0	146,940
Total	1,425,340	17,260	0	1,408,081
Total number of crediting years	7			
Annual average over the crediting period	203,620	2,466		201,154

B.7. Monitoring plan

B.7.1. Data and parameters to be monitored

Data and parameters under ACM0001 “Flaring or Use of Landfill Gas” version 13.0.0, that are monitored:

Data / Parameter	ID.20 / Op _{i,h}
Unit	-
Description	Operation of the equipment that consumes the LFG
Source of data	Project participant
Value(s) applied	n.a.
Measurement methods and procedures	For each equipment unit j using the LFG, the operation of the plant in hour h is monitored by: - Products generated (such as electricity generation) Op _{j,h} =0 when: - No products are generated in hour h Otherwise Op _{j,h} =1
Monitoring frequency	Hourly
QA/QC procedures	-
Purpose of data	Calculation of baseline emissions
Additional comment	-

⁶⁷ The values for 2012 have been adjusted to take into account the starting date of the crediting period (01.09.2012).

⁶⁸ The values for 2019 have been adjusted to take into account the ending date of the first crediting period (30.08.2019).

Data / Parameter	ID.21 / Management of SWDS
Unit	-
Description	Management of SWDS
Source of data	One of the following sources could be used: - Original design of the landfill - Technical specifications for the management of the SWDS Local or national regulations
Value(s) applied	n.a.
Measurement methods and procedures	Project participants will refer to the original design of the landfill to ensure that any practice to increase methane generation have been occurring prior to the implementation of the project activity. Any change in the management of the SEDS after the implementation of the project activity should be justified by referring to technical or regulatory specifications.
Monitoring frequency	Annually
QA/QC procedures	-
Purpose of data	Calculation of baseline emissions
Additional comment	-

Data and parameters under the “Tool to determine the mass flow of a greenhouse gas in a gaseous stream” version 02.0.0, that are monitored:

Data / Parameter	ID.22 / $V_{t,db}$
Unit	m ³ dry gas/h
Description	Volumetric flow of the gaseous stream in time interval t on a dry basis
Source of data	Volumetric flow meter
Value(s) applied	n.a.
Measurement methods and procedures	Volumetric flow will be monitored with a volumetric flow meter. $V_{t,db}$ will be converted to normal conditions.
Monitoring frequency	Continuous
QA/QC procedures	Periodic calibration against a primary device provided by an independent accredited laboratory. Calibration and frequency of calibration is according to manufacturer’s specifications.
Purpose of data	Calculation of baseline emissions
Additional comment	-

Data / Parameter	ID.23 / $v_{CH_4,t,db}$
Unit	m^3 gas CH_4 / m^3 dry gas
Description	Volumetric fraction of CH_4 in a time interval t on a dry basis
Source of data	The volumetric fraction of CH_4 will be monitored with a gas analyzer
Value(s) applied	n.a.
Measurement methods and procedures	Continuous gas analyzer operating in dry-basis.
Monitoring frequency	Continuous
QA/QC procedures	Calibration should include zero verification with an inert gas (e.g. N_2) and at least one reading verification with a standard gas (single calibration gas or mixture calibration gas). Calibration and frequency of calibration is according to manufacturer's specifications.
Purpose of data	Calculation of baseline emissions
Additional comment	-

Data / Parameter	ID.24 / T_t
Unit	K
Description	Temperature of the gaseous stream in time interval t
Source of data	Temperature reading instruments
Value(s) applied	n.a.
Measurement methods and procedures	Instruments with recordable electronic signal (analog or digital).
Monitoring frequency	Continuous
QA/QC procedures	Periodic calibration against a primary device provided by an independent accredited laboratory. Calibration and frequency of calibration is according to manufacturer's specifications.
Purpose of data	Calculation of baseline emissions
Additional comment	Since all parameters are converted to normal conditions during the monitoring process, this parameter is only monitored to verify the applicability condition is met related gaseous stream flow temperature being $60^{\circ}C$.

Data and parameters under the “Tool to calculate baseline, project and/or leakage emissions from electricity consumption” version 01, that are monitored:

Data / Parameter	ID.25 / EC_{BL,y}
Unit	MWh
Description	Net amount of electricity generated using LFG by the project activity in year y
Source of data	Electricity meters
Value(s) applied	Estimated as 68,600 MWh/year for ex-ante calculations. The estimation is based on an estimate of 7000h load of 9.8 MW installed capacity.
Measurement methods and procedures	The quantity of net electricity generation supplied to the grid by the project plant will be monitored based on the main meter (also referred as TEİAŞ meters) readings.
Monitoring frequency	Continuous monitoring and monthly recording.
QA/QC procedures	Maintenance and calibration of equipment will be carried out according to the instructions of the manufacturer. The electricity meters are used to measure the net electricity exported to the grid and used for billing purposes. Therefore the meters are sealed by TEİAŞ (Turkish Electricity Transmission CO).
Purpose of data	Calculation of baseline emissions
Additional comment	-

Data / Parameter	ID.26 / EC_{PJ,y}
Unit	MWh
Description	Quantity of electricity consumed by the project activity.
Source of data	Electricity meters
Value(s) applied	Estimated as 4050 MWh/year for ex-ante calculations.
Measurement methods and procedures	The quantity of electricity consumed by the project plant will be monitored based on the main meter (also referred as TEİAŞ meters) readings.
Monitoring frequency	Continuous monitoring and monthly recording.
QA/QC procedures	Maintenance and calibration of equipment will be carried out according to the instructions of the manufacturer. The electricity meters are used to measure the net electricity exported to the grid and used for billing purposes. Therefore the meters are sealed by TEİAŞ (Turkish Electricity Transmission CO).
Purpose of data	Calculation of project emissions
Additional comment	The quantity of electricity consumed is monitored by the same equipment, which monitors the net amount of electricity generated by the project activity.

Data / Parameter	ID.27 / TDL_y
Unit	%
Description	Average technical transmission and distribution losses
Source of data	Recent, accurate and reliable data available within the host country
Value(s) applied	Estimated as 20% for ex-ante calculations.
Measurement methods and procedures	Will be estimated for the distribution and transmission networks of the electricity grid of the same voltage as the connection where the project activity is connected. The distribution losses can either be calculated by the project participant or be based on references from utilities, network operators or other official documentation (such as protocols for electricity meter readings)
Monitoring frequency	Annually. In the absence of data from the relevant year, most recent figures should be used, but not older than 5 years.
QA/QC procedures	-
Purpose of data	Calculation of baseline and project emissions
Additional comment	-

B.7.2. Sampling plan

There are no data or parameters monitored to be determined by a sampling approach.

B.7.3. Other elements of monitoring plan

Monitoring Plan

Monitoring will be carried out following the procedures set by the consolidated baseline methodology ACM0001 version 13 and all applicable tools of the above explained parameters. The monitoring consists of:

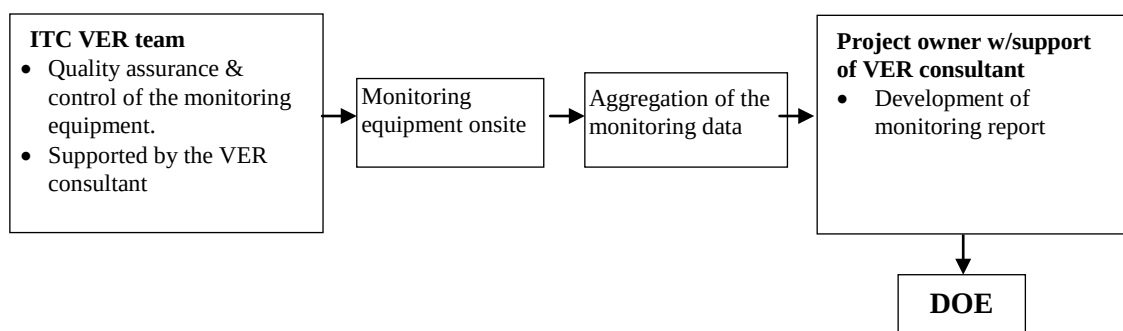
- Amount of landfill gas combusted in power generation units
- Temperature of the landfill gas sent to power generation to ensure compliance regarding dry basis for measurement
- Concentration of methane of the landfill gas
- Total amount of electricity exported to the grid
- Operating hours of power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

Responsibilities for monitoring

The project owner is responsible for the operation and maintenance of the landfill and the installed equipment⁶⁹. The project owner is also responsible for the administration of the data, setting up a VER team who will be responsible for monitoring all data required to estimate emission reductions.

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

⁶⁹ Except for the electricity meter that monitors both electricity imports and exports, since the monitoring device is sealed by TEİAŞ (Turkish Electricity Transmission Company) and the Project Participant cannot interfere with the device.



Registration of the monitored data

ITC VER-Team will be responsible for quality assurance and quality control of the monitoring equipment. The data measured by the monitoring equipment will be stored and will be processed into a monitoring report, which will be submitted by the project owner. All the monitored data will be stored during the crediting period and for at least two years after the end of the crediting period, whichever occurs later.

Corrective actions and emergency preparedness

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

QA/QC procedure

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

Measuring of exported and imported electricity

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

SECTION C. Duration and crediting period

C.1. Duration of project activity

C.1.1. Start date of project activity

20.06.2011⁷⁰

C.1.2. Expected operational lifetime of project activity

29 years

⁷⁰ The start date of project activity marks the agreement date between the PP and the sub-contractor for construction.

C.2. Crediting period of project activity**C.2.1. Type of crediting period**

Renewable (This PDD covers the first crediting period)

C.2.2. Start date of crediting period

01.09.2012

C.2.3. Length of crediting period

7 years

SECTION D. Environmental impacts**D.1. Analysis of environmental impacts**

According to Regulation on Environmental Impact Assessment” Article 35, electricity generation units aiming to provide electricity with an installed capacity under 20 MW is exempted from an Environmental Impact Assessment. In line with the requirements of “Regulation on Environmental Impact Assessment”, the proposed project has been exempted from performing an Environmental Impact Assessment.

D.2. Environmental impact assessment

n.a.

SECTION E. Local stakeholder consultation**E.1. Solicitation of comments from local stakeholders**

As required by the Gold Standard a Local Stakeholders Consultation and a Feedback Round has to be undertaken by the project participant in order to encourage the stakeholders to express their opinion and incorporate it in the project. In this way, the project developer, together with the public, ensures a project going along the main principles of sustainability. For more details on both the Local Stakeholder Consultation (LSC) and the Stakeholder Feedback Round see the LSC report and the GS Passport.

Local Stakeholder Consultation (LSC)

The proposed project activity is exempted from conducting an Environmental Impact Assessment (EIA) according to Turkish Law and Regulation however the project participant has organized a Local Stakeholders Meeting on 21 April 2011 in accordance with the latest requirements of Gold Standard. The LSC meeting was held in Osmangazi Belediye Spor Kulübü Akpınar Kültür Sanat ve Spor Merkezi Akpınar Mahallesi 1050 Konutlar Havuz Sokak Osmangazi Bursa, 2 km away from the project site. The meeting has started at 13:00 and the participation level was high with more than 103 people including locals, muchtars, students, teachers, (68 Students and Teachers). 62% of the stakeholders participated to the meeting was females.

The meeting has started with an introduction session where ITC representatives introduced themselves and the company and provided explanation on the purpose of the meeting. The non-technical project description, meeting evaluation forms along with the sustainable indicators explanation note and questionnaires were printed and already been provided to the stakeholders before the start of the meeting. ITC representatives have also explained and gave information on these documents in the opening session. After the opening session, presentation on the project activity was given using a projection. As ITC is

also involved in another similar project in Ankara Mamak, references and examples were mostly given from Mamak Project for a better understanding of the project activity. After the presentation a question and answer section took place allowing the stakeholders to understand the project in more detail as well as to clarify any questions from the stakeholders.

A detailed report on the LSC meeting and its outcomes could be found under the Local Stakeholders Consultation Report.

Stakeholder Feedback Round (SFR)

The Gold Standard stakeholders' consultation process has two main events: a "live" stakeholders consultation meeting and the stakeholders feedback round. The first consultation meeting includes a discussion of the design and consequent impacts of the project while the feedback round provides ground for stakeholders to provide feedback on how their comments have been taken into account.

The documents including the LSC report, the GS Passport and the PDD has been delivered to the stakeholders who have been selected as stakeholders to the project activity. The main communication method has been through e-mails and delivery of hard copies of the mentioned documents for those who don't have an email address (specifically the locals through the muchtar).

The feedback round has started on 18.05.2012 with sending out the documents to the stakeholders and no feedback has been received till 18.07.2012.

E.2. Summary of comments received

Local Stakeholder Consultation:

The general outcome of the first public consultation was positive. There was a widespread opinion that the project is favourable and a major improvement to the prevailing conditions of the local area. There were two main topics discussed:

- the creation of local employment is beneficial
- it is an important environmental improvement from the prevailing conditions, in which foul odours, leachate pollution of groundwater and smoke from fires were a part of the locals' life

Stakeholder Feedback Round:

The feedback round has started on 18.05.2012 with sending out the documents to the stakeholders and no feedback has been received till 18.07.2012.

The details of the Stakeholders Consultation Process could be found under the GS LSC Report and the GS Passport.

E.3. Report on consideration of comments received

Local Stakeholder Consultation:

Stakeholder comment	Was comment taken into account (Yes/ No)?	Explanation (Why? How?)
There is a significant odour problem in the area	Yes	The project will have a significant impact on the odour problem in the region. The odour from the landfill is caused by a gas (hydrogen sulphide) in the LFG itself. It



		can cause unpleasant odours even at very low concentrations. The landfill area will be first covered with a layer to prevent LFG leakage and the trapped LFG will be sent to gas engines where it is burned. This will also eliminate the effect of the gas (hydrogen sulphide) significantly.
Will the project create employment opportunities in the area?	Yes	As a general principle of ITC, employment recruitments will be made mostly from the nearby regions and villages especially for the unqualified jobs.
Can we benefit from the electricity generated for free?	No	According to the current practices and legislations, ITC can only export the electricity generated to the national grid.

Stakeholder Feedback Round:

The feedback round has started on 18.05.2012 with sending out the documents to the stakeholders and no feedback has been received till 18.07.2012.

The details of the Stakeholders Consultation Process could be found under the GS LSC Report and the GS Passport.

SECTION F. Approval and authorization

This section is not applicable since the proposed project activity is under the Voluntary Scheme.

**Appendix 1: Contact information of project participants**

Organization name	ITC Bursa Enerji Üretim San. Ve Tic. A.Ş.
Street/P.O. Box	Nato Yolu Ege Mah. / Mamak
Building	Mamak Katı Atık Alanı
City	Ankara
State/Region	-
Postcode	-
Country	Turkey
Telephone	+90 312 390 87 01
Fax	+90 312 390 96 73
E-mail	gogen@gpg.com.tr
Website	
Contact person	Mr. Erdoğan Göğen
Title	General Manager
Salutation	
Last name	
Middle name	
First name	
Department	
Mobile	
Direct fax	
Direct tel.	
Personal e-mail	

Appendix 2: Affirmation regarding public funding**Appendix 3: Applicability of selected methodology****Appendix 4: Further background information on ex ante calculation of emission reductions****List of SET_{20%} Power Units**

2011					
Plant Name	Fuel Type	Added Installed Capacity	Generation	Total Installed Capacity	Total Generation
		MW	MWh	MW	MWh
Akım Enerji Başpınar (Süper Film)	Natural Gas	25,32	177.000	25,32	177.000
Aksa Akrilik	Natural Gas	25,00	189.076	59,50	450.000
Aksa Enerji (Antalya)	Natural Gas	300,00	1.800.000	1.450,00	8.700.000



Aksa Enerji (Antalya) İlave	Natural Gas	300,00	1.800.000	1.450,00	8.700.000
Aldaş Altyapı Yönetim Danışmanlık	Natural Gas	1,95	15.000	1,95	15.000
Aliağa Çakmaktepe Enerji (İlave)	Natural Gas	130,95	985.876	244,40	1.840.000
Aliağa Çakmaktepe Enerji (İlave)	Natural Gas	8,73	65.725	244,40	1.840.000
Bosen Enerji Elektrik Üretim A.Ş.	Natural Gas	93,00	698.092	235,80	1.770.000
Boyteks Tekstil San ve Tic. A.Ş.	Natural Gas	8,60	67.000	8,60	67.000
Cengiz Çift Yakıtlı K.Ç.E.S.	Natural Gas	131,34	985.000	131,34	985.000
Cengiz Enerji San ve Tic A.Ş.	Natural Gas	35,00	281.289	238,90	1.920.000
Fraport IC İçtaş Antalya Havalimanı	Natural Gas	8,00	64.000	8,00	64.000
Global Enerji (Çorlu) (İlave)	Natural Gas	4,00	29.909	24,30	181.700
Gordion AVM (Redevco Üç Emlak)	Natural Gas	2,01	15.030	2,01	15.000
Goren-1 (Gaziantep Organize San)	Natural Gas	48,65	277.000	48,65	277.000
Gülle Enerji (Çorlu) (İlave)	Natural Gas	3,90	17.989	10,20	47.000
Hamitabat (Lisans Tadili)	Natural Gas	36,00	211.889	1.156,00	6.804.000
Hasırcı Tekstil Tic ve San Ltd Şti	Natural Gas	2,00	15.000	2,00	15.000
HG Enerji Elektrik Üret. San. Tic. A.Ş.	Natural Gas	52,38	366.000	52,38	366.000
Isparta Mensucat (Isparta)	Natural Gas	4,30	33.000	4,30	33.000
Istanbul Sabiha Gökçen Ul. Ar. Hav.	Natural Gas	4,00	32.000	4,00	32.000
Knauf İnş. Ve Yapı Elemanlar Sn.	Natural Gas	1,56	12.000	1,56	12.000
Lokman Hekim Engürü Sağ. (Sincan)	Natural Gas	0,51	4.031	0,51	4.000
MOSB Enerji Elektrik Üretim Ltd. Şti (İlave)	Natural Gas	43,50	347.864	128,30	1.026.000
Nuh Enerji El. Ürt. A.Ş. (İlave)	Natural Gas	119,98	900.000	119,98	900.000
ODAŞ Doğalgaz KÇS (Odaş Elektrik)	Natural Gas	54,96	415.000	54,96	415.000
Polyplex Europa Polyester Film	Natural Gas	3,90	30.698	11,70	92.000
Samsun Tekeköy En. San. (Aksa En.)	Natural Gas	131,34	979.963	131,34	980.000
Samur Halı A.Ş.	Natural Gas	4,30	33.000	4,30	33.000
Sarah Halı A.Ş.	Natural Gas	4,29	33.000	4,29	33.000
Şanlıurfa OSB (Rasa Enerji Ür. A.Ş.)	Natural Gas	116,76	800.000	116,76	800.000
Tekirdağ - Çorlu Teks. Tes (Nil Örne)	Natural Gas	2,68	20.976	2,68	21.000
Tirenda Tire Enerji Üretim A.Ş.	Natural Gas	58,38	410.000	58,38	410.000
Tüpraş O.A. Rafineri (Kırıkkale) (İlave)	Natural Gas	12,00	84.783	46,00	325.000
Yeni uşak Enerji Elektrik Santrali	Natural Gas	8,73	65.000	8,73	65.000
Zorlu Enerji (B. Karıştırın)	Natural Gas	7,20	54.073	122,50	920.000
Natural Gas 2011		1.795,22	12.316.263,8		



Total	7
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Eti Bor (Borik Asit) (Emet)(Düzeltilme)	Fuel Oil	0,60	4.473	11,00	82.000
Karkey (Silopi 1)	Fuel Oil	100,44	701.152	171,90	1.200.000
Mardin-Kızıltepe (Aksa Enerji)	Fuel Oil	32,10	225.000	32,10	225.000
Toros Tarım (Mersin) (Nafta+Doğalgaz)	Fuel Oil	12,14	95.968	12,14	96.000
Fuel Oil 2011 Total		145,28	1.026.592,93		

Bekirli TES (İçdaş Elektrik En.)	Coal	600,00	4.320.000	600,00	4.320.000
Coal 2011 Total		600,00	4.320.000,00		

Çeşmebaşı REG ve HES (Gimak En.)	Hydro	8,20	17.000	8,20	17.000
Çukurçayı HES (Aydemir Elektrik Ür.)	Hydro	1,80	4.000	1,80	4.000
Darca HES (Bükör Elektrik Üretim)	Hydro	8,91	35.000	8,91	35.000
Değirmendere (Kadirli) (KA-FNİH Elek.)	Hydro	0,50	800	0,50	800
Derme (Kayseri ve Civarı Enerji)	Hydro	4,50	7.000	4,50	7.000
Duru 2 REG ve HES (Durucasu Elektrik)	Hydro	4,49	13.000	4,49	13.000
Erenköy REG ve HES (Nehir Enerji)	Hydro	21,46	48.991	21,46	49.000
Erkenek (Kayseri ve Civarı Enerji)	Hydro	0,32	500	0,32	500
Eşen 1 HES (Göлтаş Enerji Elektrik)	Hydro	30,00	65.000	60,00	130.000
Eşen 1 HES (Göлтаş Enerji Elektrik)	Hydro	30,00	65.000	60,00	130.000
Girlevik (Boydak Enerji)	Hydro	3,04	19.000	3,04	19.000
Gökmen REG ve HES (Su-Gücü Elektrik)	Hydro	2,87	7.997	2,87	8.000
Hacınınoğlu HES (Enerji SA Enerji)	Hydro	71,14	101.986	142,30	204.000
Hacınınoğlu HES (Enerji SA Enerji)	Hydro	71,14	101.986	142,30	204.000
Hakkari (Otluca) (NAS Enerji A.Ş.)	Hydro	1,28	8.107	3,00	19.000
Hasanlar	Hydro	9,35	29.600	9,35	29.600
Hasanlar HES (Düzce Enerji Birliği)	Hydro	4,68	12.000	4,68	12.000
İncirli REG ve HES (Laskar Enerji)	Hydro	25,20	71.000	25,20	71.000
İnegöl (Cerrah) (Kent Solar Elektrik)	Hydro	0,27	806	0,27	800
İznik (Dereköy) (Kent Solar Elektrik)	Hydro	0,24	900	0,24	900



Kalkandere REG ve Yokuşlu HES	Hydro	23,36	61.636	37,90	100.000
Karaçay (Osmaniye)(KA-FNİH) Elektrik	Hydro	0,40	2.000	0,40	2.000
Karasu 4-2 HES (İdeal Enerji Üretim)	Hydro	10,35	33.000	10,35	33.000
Karasu 4-3 HES (İdeal Enerji Üretim)	Hydro	4,60	12.000	4,60	12.000
Karasu 5 HES (İdeal Enerji Üretim)	Hydro	4,10	14.000	4,10	14.000
Karasu I HES (İdeal Enerji Üretim)	Hydro	3,84	11.000	3,84	11.000
Karasu II HES (İdeal Enerji Üretim)	Hydro	3,08	8.000	3,08	8.000
Kayadibi (Bartın) (İvme Elektromek.)	Hydro	0,46	2.017	0,46	2.000
Kazankaya REG ve İncesuyu HES (Aksa)	Hydro	15,00	27.000	15,00	27.000
Kernek (Kayseri ve Civarı Enerji)	Hydro	0,83	6.014	0,83	6.000
Kesme REG ve HES (Kıvanç Enerji)	Hydro	2,31	4.510	4,60	9.000
Kesme REG ve HES (Kıvanç Enerji)	Hydro	2,31	4.510	4,60	9.000
Kıran HES (Arsan Enerji A.Ş.)	Hydro	9,74	23.000	9,74	23.000
Koruköy HES (Akar Enerji San ve Tic)	Hydro	3,03	13.000	3,03	13.000
Kovada I (Batıçim Enerji Elektrik)	Hydro	8,25	1.600	8,25	1.600
Kovada II (Batıçim Enerji Elektrik)	Hydro	51,20	24.400	51,20	24.400
Kozdere HES (Ado Madencilik Elekt.)	Hydro	3,15	7.987	3,15	8.000
Köyobaş HES (Şirikoğlu Elektrik)	Hydro	1,07	3.000	1,07	3.000
Kulp I HES (Yıldızlar Enerji Elk. Ür.)	Hydro	22,92	44.000	22,92	44.000
Kumköy HES (AES-IC İçtaş Enerji)	Hydro	17,49	55.000	17,49	55.000
Kuzuculu (Dörtöl) (Ka-FNİH Elektrik)	Hydro	0,27	1.007	0,27	1.000
M. Kemalpaşa (Suutçu) (Kent Solar)	Hydro	0,47	1.306	0,47	1.300
Malazgirt (Mostar Enerji Elektrik)	Hydro	1,22	2.990	1,22	3.000
Adilcevaz(Mostar Enerji Elektrik)	Hydro	0,39	505	0,39	500
Ahlat (Mostar Enerji Elektrik)	Hydro	0,20	503	0,20	500
Aksu REG. Ve HES (Kalen Enerji)	Hydro	5,20	12.000	5,20	12.000
Alkumru Barajı ve HES (Limak Hid.)	Hydro	174,18	311.368	261,80	468.000
Alkumru Barajı ve HES (Limak Hid.)	Hydro	87,09	155.684	261,80	468.000
Ayrancılar HES (Muradiye Elektrik)	Hydro	18,72	43.734	32,10	75.000



Ayrancılar HES (Muradiye Elektrik)	Hydro	13,38	31.255	32,10	75.000
Balkondu I HES (BTA Elektrik Enerji)	Hydro	9,19	20.002	9,19	20.000
Batman	Hydro	0,48	1.077	198,50	450.000
Bayburt (Boydak Enerji)	Hydro	0,40	1.683	0,40	1.700
Bayramhacılı Barajı ve HES	Hydro	47,00	95.000	47,00	95.000
Berdan	Hydro	10,20	15.000	10,20	15.000
Besni (Kayseri ve Civarı Enerji)	Hydro	0,27	201	0,27	200
Boğuntu HES (Beyobası Enerji)	Hydro	3,80	10.003	3,80	10.000
Bünyan (Kayseri ve Civarı El. Taş.)	Hydro	1,16	3.200	1,16	3.200
Cevheri I II REG ve HES (Özcehver En.)	Hydro	16,36	32.000	16,36	32.000
Çağ Çağ (NAAS Enerji A.Ş.)	Hydro	14,40	22.000	14,40	22.000
Çakırman REG ve HES (Yusaka En.)	Hydro	6,98	15.000	6,98	15.000
Çamardı (Kayseri ve Civarı Elek. Taş.)	Hydro	0,07	100	0,07	100
Çamlıca III HES (Çamlıca Elektrik)	Hydro	27,62	24.998	27,62	25.000
Çamlıkaya REG ve HES (Çamlıkaya En)	Hydro	2,82	3.655	8,50	11.000
Çanakçı HES (Can Enerji Entegre)	Hydro	4,63	10.960	9,30	22.000
Çanakçı HES (Can Enerji Entegre)	Hydro	4,63	10.960	9,30	22.000
Çemişkezek (Boydak Enerji)	Hydro	0,12	500	0,12	500
Menge Barajı ve HES (EnerjiSA Enerji)	Hydro	44,71	58.000	44,71	58.000
Molu Enerji (Zamantı Bahçelik HES)	Hydro	4,17	30.000	4,17	30.000
Muratlı REG ve HES (Armahes El.)	Hydro	26,70	55.000	26,70	55.000
Narinkale REG ve HES (EBD Enerji)	Hydro	30,40	55.355	33,50	61.000
Otluca I HES (Beyobası Enerji Ür)	Hydro	37,54	99.997	37,54	100.000
Otluca II HES (Beyobası Enerji Ür)	Hydro	6,36	15.000	6,36	15.000
Ören REG ve HES (Çelikler Elektrik)	Hydro	6,64	16.000	6,64	16.000
Pınarbaşı (Kayseri ve Civarı El. Taş)	Hydro	0,10	297	0,10	300
Poyraz HES (Yeşil Enerji Elektrik)	Hydro	2,66	6.000	2,66	6.000
Saraçbendi HES (Çamlıca Elektrik)	Hydro	25,48	57.000	25,48	57.000
Sarıkavak HES (Eser Enerji Yat. A.Ş.)	Hydro	8,06	24.000	8,06	24.000
Sayan HES (Karel Elektrik Üretim)	Hydro	14,90	26.993	14,90	27.000
Sefaköy HES (Püre Enerji Üretim A.Ş.)	Hydro	33,11	68.000	33,11	68.000

Daren HES Elektrik (Seyrantepe)	Hydro	49,70	140.875	56,80	161.000
Seyrantepe HES (Düzeltilme)	Hydro	7,14	20.238	56,80	161.000
Sızır (Kayseri ve Cıvırı Elek. Taş.)	Hydro	5,76	35.000	5,76	35.000
Söğütükaya (Posof III) HES	Hydro	6,13	18.000	6,13	18.000
Tefen HES (Aksu Madencilik San.)	Hydro	22,00	53.333	33,00	80.000
Tefen HES (Aksu Madencilik San.)	Hydro	11,00	26.667	33,00	80.000
Tektuğ (Erkenek)	Hydro	0,51	1.186	13,00	30.000
Turunçova (Finike) (Turunçova En.)	Hydro	0,55	80	55,00	8.000
Tuztaş HES (Gürüz Elek. Üretim)	Hydro	1,61	5.981	1,61	6.000
Uluabat Kuv. Tün. Ve HES (Düzeltilme)	Hydro	2,98	6.854	100,00	230.000
Uludure (Nas Enerji A.Ş.)	Hydro	0,64	2.600	0,64	2.600
Üzümlü HES (Akgün Enerji Üretim)	Hydro	11,36	22.996	11,36	23.000
Varto (Mostar Enerji Elektrik)	Hydro	0,29	604	0,29	600
Yamaç HES (Yamaç Enerji Üretim A.Ş.)	Hydro	5,46	10.000	5,46	10.000
Yapısan (Karıca REG ve Darıca I HES)	Hydro	13,32	24.515	110,30	203.000
Yaprak II HES (Nisan Elektromek)	Hydro	5,40	10.500	10,80	21.000
Yaprak II HES (Nisan Elektromek)	Hydro	5,40	10.500	10,80	21.000
Yaşıl HES (Yaşıl Enerji Elektrik)	Hydro	1,52	3.196	3,80	8.000
Yaşıl HES (Yaşıl Enerji Elektrik)	Hydro	2,28	4.792	3,80	8.000
Yedigöl REG. Ve HES (Yedigöl Hidir.)	Hydro	21,90	42.000	21,90	42.000
Yedigöze HES (Yedigöze Elek.) (İlave)	Hydro	155,33	133.983	310,70	268.000
Hydro 2011 Total		1.509,22	2.879.578,98		

Bolu Belediyesi Çöp Top. Tes. Biyogaz	Biogas	1,13	7.500	1,13	7.500
CEV Enerji Üretim (Gaziantep Çöp Biogaz)	Biogas	4,52	29.366	5,70	37.000
ITC Adana Enerji Üretim (İlave)	Biogas	1,42	83.000	1,42	83.000
ITC-Ka En (Aslım Biyokütle) Konya	Biogas	4,25	33.141	5,70	44.500
ITC-Ka En (Aslım Biyokütle) Konya	Biogas	1,42	11.047	5,70	44.500
ITC-Ka Enerji (Sincan) (İlave)	Biogas	1,42	11.055	5,70	44.500
ITC-Ka Enerji Mamak Katı Atık Top.	Biogas	2,83	18.914	25,40	170.000
Kayseri Katı Atık Deponi Sahası	Biogas	1,56	12.000	1,56	12.000



Aydın/Germencik Jeotermal	Geothermal	20,00	150.000	20,00	150.000
Akres (Akhisar Rüzgar En. Elekt.)	Wind	20,00	64.384	43,80	141.000
Akres (Akhisar Rüzgar En. Elekt.)	Wind	20,00	64.384	43,80	141.000
Akres (Akhisar Rüzgar En. Elekt.)	Wind	3,75	12.072	43,80	141.000
Ayvacic RES (Ayres Ayvacık Rüzgar)	Wind	5,00	15.000	5,00	15.000
Baki Elektrik Şamlı Rüzgar (İlave)	Wind	24,00	78.947	114,00	375.000
Bandırma Enerji (Bandırma RES)	Wind	3,00	5.625	24,00	45.000
Çanakkale RES (Enerji-SA Enerji)	Wind	25,30	66.000	29,90	78.000
Çanakkale RES (Enerji-SA Enerji)	Wind	4,60	12.000	29,90	78.000
Çataltepe RES (Alize Enerji Elektrik)	Wind	16,00	44.000	16,00	44.000
Innores Elektrik Yuntdağ Rüzgar	Wind	10,00	27.619	52,50	145.000
Killik RES (Pem Enerji A.Ş.)	Wind	20,00	36.500	40,00	73.000
Killik RES (Pem Enerji A.Ş.)	Wind	15,00	27.375	40,00	73.000
Killik RES (Pem Enerji A.Ş.)	Wind	5,00	9.125	40,00	73.000
Sares RES (Garet Enerji Üretim)	Wind	7,50	17.000	22,50	51.000
Seyitali RES (Doruk Enerji Elektrik)	Wind	30,00	94.000	30,00	94.000
Soma RES (Soma Enerji) (İlave)	Wind	20,00	55.642	116,10	323.000
Soma RES (Soma Enerji) (İlave)	Wind	16,90	47.017	116,10	323.000
Susurluk RES (Alantek Enerji Üret.)	Wind	12,50	26.667	45,00	96.000
Susurluk RES (Alantek Enerji Üret.)	Wind	10,00	21.333	45,00	96.000
Susurluk RES (Alantek Enerji Üret.)	Wind	12,50	26.667	45,00	96.000
Susurluk RES (Alantek Enerji Üret.)	Wind	10,00	21.333	45,00	96.000
Şah RES (Galata Wind Enerji Ltd. Şti)	Wind	63,00	231.000	93,00	341.000
Şah RES (Galata Wind Enerji Ltd. Şti)	Wind	27,00	99.000	93,00	341.000
Şah RES (Galata Wind Enerji Ltd. Şti)	Wind	3,00	11.000	93,00	341.000
Turguttepe RES (Sabaş Elektrik)	Wind	3,00	6.875	24,00	55.000
Ziyaret RES (Ziyaret RES Elektrik)	Wind	2,00	6.330	57,50	182.000
Renewable 2011 Total		213,37	715.474,13		

2011 TOTAL		4.263	21.257.910
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	Plant Name	Fuel Type	Added Installed Capacity MW	Generation MWh	Total Installed Capacity MW	Total Generation MWh
28.01.2010	Can Tekstil (Çorlu/Tekirdağ)	Natural Gas	7,832	60.246	13	100.000
28.01.2010	Altınmarka	Natural Gas	4,6	37.024	8,2	66.000
18.02.2010	Akbaşlar (İlave)	Natural Gas	1,54	12.078	10,2	80.000
26.02.2010	Global Enerji (Pelitlik)	Natural Gas	3,544	27.057	23,8	181.700
03.03.2010	Rasa Enerji (Van)	Natural Gas	26,19	166.622	114,9	731.000
20.03.2010	Aksa Enerji (Antalya)	Natural Gas	25	192.500	850	6.545.000
22.04.2010	Yıldız Entegre Ağaç (Kocaeli)	Natural Gas	12,368	79.794	18,6	120.000
05.05.2010	Ataer Enerji Elektrik Üretim A.Ş.	Natural Gas	49	277.886	119,2	676.000
22.05.2010	Cengiz Enerji San ve Tic A.Ş. (Tekkeköy)	Natural Gas	101,95	802.000	203,9	1.604.000
21.06.2010	Uğur Enerji Üretim San ve Tic A.Ş.	Natural Gas	48,2	405.136	60,2	506.000
01.07.2010	Aksa Enerji (Antalya)	Natural Gas	25	192.500	850	6.545.000
10.07.2010	Altek Alarko Elektrik Santralleri	Natural Gas	60,1	415.570	164	1.134.000
17.07.2010	Flokser Tekstil (Çerkezköy/Tekirdağ)	Natural Gas	5,2	42.000	5,2	42.000
23.07.2010	RB Karesi İthalat İhracat Tekstil	Natural Gas	8,6	65.000	8,6	65.000
31.07.2010	Cengiz Enerji San ve Tic A.Ş. (Tekkeköy)	Natural Gas	101,95	802.000	203,9	1.604.000
11.08.2010	Keskinioğlu Tavukçuluk ve Dam. İşl.	Natural Gas	3,5	25.000	3,5	25.000
17.08.2010	Binatom Elektrik Üretim A.Ş.	Natural Gas	2	13.000	2	13.000
19.08.2010	Can Enerji Elektrik Üretim A.Ş. (Tekirdağ)	Natural Gas	29,1	203.000	29,1	203.000
19.08.2010	Kurtoğlu Bakır Kurşun San ve A.Ş.	Natural Gas	1,6	12.000	1,6	12.000
26.08.2010	Sönmez Enerji Üretim (Uşak)	Natural Gas	33,242	256.297	70,7	545.100
29.09.2010	Kırka Boraks (Kırka) (Eti Maden İşl) (İlave)	Natural Gas	10	65.934	18,2	120.000
07.10.2010	Enerji SA (Bandırma)	Natural Gas	930,8	7.540.000	930,8	7.540.000
07.10.2010	Uğur Enerji Üretim San ve Tic A.Ş. (İlave)	Natural Gas	12	100.864	60,2	506.000
25.11.2010	Marmara Pamuklu Mensucat (İlave)	Natural Gas	26,19	203.450	69,9	543.000
26.11.2010	Aliğa Çakmaktepe Enerji (İlave)	Natural Gas	69,84	557.920	104,7	836.400
07.12.2010	Sönmez Enerji Üretim (Uşak) (İlave)	Natural Gas	2,564	19.769	70,7	545.100
16.12.2010	Polyplex Europa Polyester Film	Natural Gas	7,8	61.000	7,8	61.000
18.12.2010	Altek Alarko Elektrik Santralleri	Natural Gas	21,89	151.361	164	1.134.000
29.12.2010	Rasa Enerji (Van) (İlave)	Natural Gas	10,124	64.409	114,9	731.000
31.12.2010	International Hospital İstanbul A.Ş.	Natural Gas	0,8	6.000	0,8	6.000
		Natural Gas 2010 Total	1.632	12.787.008		



15.12.2010	Tüpraş Rafineri (İzmit) (İlave)	Fuel Oil	40	258.824	85	550.000
		Fuel Oil 2010 Total	40	258.824		

22.01.2010	Eti Soda Üre. Paz. Nak. Ve Elek. Üre. San.	Lignite	24	144.000	24	144.000
26.02.2010	Konya Şeker San. Ve Tic. A.Ş.	Lignite	6	11.593	147,5	285.000
		Lignite 2010 Total	30	155.593		

15.07.2010	Eren Enerji Elektrik Üretim A.Ş.	Coal	160	1.068.235	1360	9.080.000
01.11.2010	Eren Enerji Elektrik Üretim A.Ş. (İlave)	Coal	600	4.005.882	1360	9.080.000
29.12.2010	Eren Enerji Elektrik Üretim A.Ş. (İlave)	Coal	600	4.005.882	1360	9.080.000
		Coal 2010 Total	1360	9.080.000		

13.01.2010	Kulp IV HES (Yıldızlar En. Elk. Ür. A.Ş.)	Hydro	12,3	23.000	12,3	23.000
21.01.2010	Cindere Hes (İlave)	Hydro	9,065	16.073	28,2	50.000
28.01.2010	Bayburt HES (Bayburt Enerji Üret.)	Hydro	14,6	24.000	14,6	24.000
28.01.2010	Uzunçayır HES (Tunceli) (İlave)	Hydro	27,33	60.659	82	182.000
29.01.2010	Alakır HES (Yurt Enerji Üretim)	Hydro	2,1	4.000	2,1	4.000
19.02.2010	Peta Mühendislik En. (Mursal II Hes)	Hydro	4,5	11.000	4,5	11.000
19.02.2010	Asa Enerji (Kale Reg ve HES)	Hydro	9,6	18.000	9,6	18.000
23.02.2010	Hetaş Hacısalıhoğlu (Yıldızlı HES)	Hydro	1,2	3.000	1,2	3.000
11.03.2010	Doğubey Elektrik (Sarımehmet Hes)	Hydro	3,1	6.000	3,1	6.000
26.03.2010	Nuryol Enerji (Defne Reg ve Hes)	Hydro	7,2	13.000	7,2	13.000
01.04.2010	Özgür Elektrik (Azmak I Reg. Ve Hes)	Hydro	5,913	12.026	11,8	24.000
03.04.2010	Birim Hidr. Üretim. A.Ş. (Erfelek Hes)	Hydro	3,225	5.458	6,5	11.000
07.04.2010	Beytel Elek. Ür. A.Ş. (Çataloluk Hes)	Hydro	9,5	17.000	9,5	17.000
09.04.2010	Nisan E. Mekanik. En. (Başak Reg. HES)	Hydro	6,9	12.000	6,9	12.000
11.04.2010	Uzunçayır HES (Tunceli) (İlave)	Hydro	27,33	60.659	82	182.000
16.04.2010	Fırtına Elektrik Ür. A.Ş. (Sümer HES)	Hydro	21,6	39.000	21,6	39.000
30.04.2010	Karen Karadeniz El. A.Ş. Aralık Hes	Hydro	12,4	32.000	12,4	32.000
14.05.2010	Birim Hidr. Üretim. A.Ş. (Erfelek Hes)	Hydro	3,225	3.006	11,8	11.000
27.05.2010	Karadeniz El. Üretim (Uzundere 1 Hes)	Hydro	31	46.350	62,2	93.000



28.05.2010	Akım Enerji (Cevizlik Reg. Ve Hes)	Hydro	91,4	187.000	91,4	187.000
01.06.2010	Çakıt HES (Çakıt Enerji A.Ş.)	Hydro	20,2	54.000	20,2	54.000
04.06.2010	Erenler Reg ve Hes (BME Bir Müt. En)	Hydro	45	48.000	45	48.000
11.06.2010	Paşa Reg ve Hes (Özgür Elektrik)	Hydro	8,7	19.000	8,7	19.000
15.06.2010	Güzel Çay I HES (İlk Elektrik Enerji)	Hydro	3,14	9.304	8,1	24.000
16.06.2010	Kale Reg ve Hes (Kale Enerji Üretim A.Ş.)	Hydro	34,1	66.000	34,1	66.000
30.06.2010	Erikli Akocak Reg ve Akocak Hes	Hydro	41,25	73.000	82,5	146.000
30.06.2010	Çamlıkaya Reg ve Hes	Hydro	5,6	11.000	5,6	11.000
03.07.2010	Dinar Hes (Elda Elektrik Üretim)	Hydro	4,4	9.000	4,4	9.000
08.07.2010	Damlapınar Hes (Cenay Elektrik Üretim)	Hydro	16,4	52.000	16,4	52.000
08.07.2010	Dim Hes (Diler Elektrik Üretim)	Hydro	38,3	70.000	38,3	70.000
11.07.2010	Kirpilik Reg. Ve Hes (Özgür Elektrik)	Hydro	6,2	13.000	6,2	13.000
10.07.2010	Özgür Elektrik (Azmak I Reg. Ve Hes)	Hydro	5,913	12.026	11,8	24.000
14.07.2010	Yavuz Reg. Ve Hes (Masat Enerji)	Hydro	22,5	47.000	22,5	47.000
21.07.2010	Kayabükü Reg. Ve Hes (Elite Elek.)	Hydro	14,6	28.000	14,6	28.000
29.07.2010	Erikli Akocak Reg ve Akocak Hes	Hydro	41,25	73.000	82,5	146.000
06.08.2010	Gök Reg. Ve Hes (Gök Enerji El. San.)	Hydro	10	24.000	10	24.000
10.08.2010	Bulam Reg ve Hes (Mem Enerji Elk)	Hydro	7	19.000	7	19.000
28.08.2010	Karşıyaka Hes (Akua Enerji Üret)	Hydro	1,6	5.000	1,6	5.000
20.08.2010	Ceyhan Hes (Berkman Hes) (Enova En)	Hydro	12,6	29.000	25,2	58.000
25.08.2010	Güdül 1 Reg ve Hes (Yaşam Enerji)	Hydro	2,4	8.000	2,4	8.000
28.08.2010	Ceyhan Hes (Berkman Hes) (Enova En)	Hydro	12,6	29.000	25,2	58.000
03.09.2010	Tektuğ Elektrik (Andırın Hes)	Hydro	40,5	60.000	40,5	60.000
06.09.2010	Selen Elektrik (Kepezkaya Hes)	Hydro	28	70.000	28	70.000
17.09.2010	Reşadiye 2 Hes (Turkon Mng Elekt)	Hydro	26,1	119.000	26,1	119.000
21.09.2010	Kozan Hes (SerEr Enerji)	Hydro	4	5.000	4	5.000
30.09.2010	Kahraman Reg ve Hes (Katırcıoğlu)	Hydro	1,4	3.000	1,4	3.000
30.09.2010	Narinkale Reg ve HES (EBD Enerji)	Hydro	3,1	6.000	3,1	6.000
07.10.2010	Erenköy Reg ve Hes (Türkerler)	Hydro	21,5	49.000	21,5	49.000
14.10.2010	Kahta I Hes (Erdemiyıldız Elek. Ürt)	Hydro	7,1	20.000	7,1	20.000
27.10.2010	Uluabat Kuvvet Tüneli ve Hes	Hydro	48,5	105.000	97	210.000



28.10.2010	Sabunsuyu II Hes (Ang Enerji Elk)	Hydro	7,4	12.000	7,4	12.000
04.11.2010	Burç Bendi ve Hes (Akkur Enerji)	Hydro	27,3	64.000	27,3	64.000
07.11.2010	Karadeniz El. Üretim (Uzundere 1 Hes) (İlave)	Hydro	31	46.350	62,2	93.000
11.11.2010	Murgul Bakı (Ç. Kaya) (İlave)	Hydro	19,6	31.587	24,2	39.000
11.11.2010	Güzel Çay II HES (İlk Elektrik Enerji)	Hydro	4,96	14.696	8,1	24.000
25.11.2010	Uluabat Kuvvet Tüneli ve Hes (İlave)	Hydro	48,5	105.000	97	210.000
26.11.2010	Reşadiye 1 Hes (Turkon Mng Elekt)	Hydro	15,6	71.126	26,1	119.000
26.11.2010	Egemen 1 Hes (Enersis Elektrik)	Hydro	8,8	18.131	19,9	41.000
02.12.2010	Yedigöze Hes (Yedigöze Elektrik)	Hydro	155,3	268.000	155,3	268.000
13.12.2010	Umut III Reg ve Hes (Nisan Elek)	Hydro	12	15.000	12	15.000
24.12.2010	Feke 2 Barajı (Akkur Enerji)	Hydro	69,3	126.000	69,3	126.000
28.12.2010	Egemen 1B Hes (Enersis Elektrik)	Hydro	11,1	22.869	19,9	41.000
30.12.2010	Kalkandere Reg ve Yokuşlu Hes	Hydro	14,5	36.000	14,5	36.000
Hydro 2010 Total			1.248	2.523.322		

01.02.2010	CEV Enerji Üretim (Gaziantep Çöp Biyogazı)	Biogas	1,1	8.600	1,1	8.600
24.02.2010	Ortadoğu Enerji (Odayeri) (Eyüp İst)	Biogas	4,245	33.357	16,9	132.800
30.04.2010	ITC KA Enerji Sincan	Biogas	1,416	11.126	4,2	33.000
02.09.2010	ITC Adana Biokütle Sant	Biogas	11,32	91.475	9,9	80.000
13.01.2010	Tuzla Jeotermal	Geothermal	7,5	55.000	7,5	55.000
26.03.2010	Menderes Geotermal Dora - 2	Geothermal	9,5	73.000	9,5	73.000
14.01.2010	Rotor Elektrik (Osmaniye RES)	Wind	20	64.444	135	435.000
26.02.2010	Asmakinsan (Bandırma 3 RES)	Wind	20	37.500	24	45.000
10.03.2010	Soma Enerji Üretim (Soma RES)	Wind	4,5	11.364	79,2	200.000
10.03.2010	Rotor Elektrik (Osmaniye RES)	Wind	17,5	56.389	135	435.000
12.03.2010	Deniz Elektrik (Sebanoba RES)	Wind	10	32.000	30	96.000
19.03.2010	Akdeniz Elektrik (Mersin RES)	Wind	33	50.000	33	50.000
26.03.2010	Asmakinsan (Bandırma 3 RES)	Wind	4	7.500	24	45.000
09.03.2010	Boreas Enerji (Bores I Enez RES)	Wind	15	42.000	15	42.000
09.04.2010	Rotor Elektrik (Osmaniye RES)	Wind	17,5	56.389	135	435.000
09.04.2010	Bergama RES En. Ür. A.Ş. Aliğa RES	Wind	52,5	176.167	90	302.000
22.04.2010	Bakras En. Elkt. Ür. A.Ş. Şenbük RES	Wind	15	40.000	15	40.000



28.04.2010	Alize Enerji (Keltepe RES)	Wind	1,8	5.391	20,7	62.000
05.06.2010	Rotor Elektrik (Gökçedağ RES)	Wind	20	64.444	135	435.000
10.06.2010	Soma Enerji Üretim (Soma RES)	Wind	7,2	18.182	79,2	200.000
16.06.2010	Bergama RES En. Ür. A.Ş. Aliğa RES	Wind	37	124.156	90	302.000
18.06.2010	Mazı 3 RES Elektrik (Mazı 3 RES)	Wind	7,5	20.000	30	80.000
30.06.2010	Borasko Enerji (Bandırma RES)	Wind	12	30.105	57	143.000
15.07.2010	Ziyaret RES (Ziyaret RES Elektrik)	Wind	12,5	42.500	35	119.000
28.07.2010	Soma Enerji Üretim (Soma RES)	Wind	7,2	18.182	79,2	200.000
13.08.2010	Soma RES (Bilgin Rüzgar San. En. Ür)	Wind	32	92.800	90	261.000
20.08.2010	Soma Enerji Üretim (Soma RES)	Wind	6,3	15.909	79,2	200.000
02.09.2010	Belen Elektrik (Belen RES) (İlave)	Wind	6	11.667	36	70.000
03.09.2010	Ütopya Elektrik (Düzova RES) (İlave)	Wind	15	30.000	30	60.000
23.09.2010	Soma RES (Bilgin Rüzgar San. En. Ür) (İlave)	Wind	27,5	79.750	90	261.000
01.10.2010	Soma Enerji Üretim (Soma RES) (İlave)	Wind	9	22.727	79,2	200.000
13.10.2010	Ziyaret RES (Ziyaret RES Elektrik) (İlave)	Wind	22,5	76.500	35	119.000
15.10.2010	Rotor Elektrik (Gökçedağ RES) (İlave)	Wind	2,5	8.056	135	435.000
11.11.2010	Soma RES (Bilgin Rüzgar San) (İlave)	Wind	30	87.000	90	261.000
11.11.2010	Kuyucak RES (Alize Enerji Üret)	Wind	8	29.375	25,6	94.000
09.12.2010	Kuyucak RES (Alize Enerji Üret) (İlave)	Wind	17,6	64.625	25,6	94.000
22.12.2010	Sares RES (Garet Enerji Üretim)	Wind	15	51.000	15	51.000
30.12.2010	Turguttepe RES (Sabaş Elektrik Ür)	Wind	22	55.000	22	55.000
Renewable 2010 Total			193	551.785		

2010 TOTAL		4.503	25.356.531
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Appendix 5: Further background information on monitoring plan

Appendix 6: Summary of post registration changes



History of the document

Version	Date	Nature of revision
04.1	11 April 2012	Editorial revision to change version 02 line in history box from Annex 06 to Annex 06b.
04.0	EB 66 13 March 2012	Revision required to ensure consistency with the “Guidelines for completing the project design document form for CDM project activities” (EB 66, Annex 8).
03	EB 25, Annex 15 26 July 2006	
02	EB 14, Annex 06b 14 June 2004	
01	EB 05, Paragraph 12 03 August 2002	Initial adoption.
Decision Class: Regulatory Document Type: Form Business Function: Registration		