



**CLEAN DEVELOPMENT MECHANISM
PROJECT DESIGN DOCUMENT FORM (CDM-PDD)
Version 03 - in effect as of: 28 July 2006**

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**SECTION A. General description of project activity****A.1. Title of the project activity:**

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Adana Landfill Waste Management Project – Turkey

Version Number of the Document: ~~09~~10Date: ~~27~~20/~~11~~12/2012**A.2. Description of the project activity:**

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Adana Landfill Waste Management Project (hereafter referred as “the Proposed Project”) is being developed by Ankara Branch of “ITC Invest Trading & Consulting A.G.” (hereafter referred to as the “project participant”)¹.

The proposed project includes two activities one being the LFG extraction and utilization project and the other one is the anaerobic digesters biogas generation and utilization. The landfill, known as the Adana-Sofulu Landfill has been established as a landfill area in 1990 and currently receives the waste of approximately 1,5 million people living in the municipalities of the Adana Greater Municipality. The daily average amount of waste landfilled is approximately 1,500 – 1,700 tonnes consisting of municipal waste.

The proposed project activity involves the covering of the landfill and the installation of a gas extraction system, capturing the landfill gas and feeding it to gas engines for electricity generation. Furthermore, the incoming municipality waste is sorted and the organic waste fed to anaerobic digesters generating biogas, which is further utilised for electricity production. Total capacity of the proposed project is projected to reach 16 MW. The generated electricity will be delivered to the national grid.

The proposed VER project is a part of a larger landfill and waste management project (hereafter referred to as the “Generic Project”). The other component of the Generic Project is a gasification system, in which carbon-rich material is fed to a gasifier producing syngas. The syngas is also utilized to generate electricity.

The important milestones to the project activity is as follows:

Date	Event
19.05.2008	Board decision on to continue the project development taking into account the CO ₂ certificates.
24.11.2008	Adana Sofular Landfill Area has been handed over to the Project Participant by the Adana Greater Municipality
30.05.2009	Local Stakeholders Consultation Meeting
24.08.2009	Start of construction
01.09.2010	First start of energy generation

¹ <http://www.itcturkiye.com/>



A board decision demonstrating that the investment decision is based on the carbon credits has been taken on 19.05.2008, which is also before the start date of project activity. These documents provide solid and transparent evidence that the PP was aware of the CDM/VER prior to the project activity. The PP has contracted a consultant company in 2008 to develop the project activity as a GS VER project activity. Furthermore, the LSC report has been uploaded to the GS registry on 20 August 2009. All of these documents provide evidence on the awareness of the PP on the GS VERs and real and continuous actions were taken to secure the carbon status of the project activity.

In the baseline situation, the municipal waste was deposited and left for decay at the – uncovered – landfill site, leading to the generation and release of large amounts of landfill gas. Landfill gas is one of the largest sources of methane emissions to the atmosphere and typically contains approximately 50% methane,² which is a potent greenhouse gas.

The proposed project will reduce GHG emissions in several ways:

- by collecting methane from the landfill and utilizing it for electricity generation;
- by treating organic waste in anaerobic digesters and thereby avoiding future methane emissions;
- by displacing electricity which otherwise would have been generated by power plants connected to the Turkish grid.

The proposed project contributes significantly to the region's sustainable development:

- The project implements a modern type of waste management to Turkey; it is one of the first of its kind to be implemented in Turkey.
- Being relatively close to the city centre as well as to Çukurova University and to Balcalı Hospital, the un-managed landfill area had become a real health concern to the public. The project activity will considerably have a positive impact on mitigating the threat to public health.
- The project will result in the creation of local employment both during the construction and operational phase.
- The project results in the transfer of knowledge on waste management principles.
- Uncontrolled landfill areas cause odour nuisance and have a high risk of explosion and fire. By covering the landfill and extracting the landfill gas the odour nuisance and risk of explosion and fire will be significantly reduced.
- Landfill gas is a waste product, the utilisation of it results not only in the destruction of methane, a potent greenhouse gas, but utilisation for the production of electricity also results in less emission of the power generation sector in Turkey and reduces the dependency of Turkey on imported electricity.

A.3. Project participants:

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Name of Party involved (host) indicates a host Party)	Private and/or public entity(ies) project participants (as applicable)	Kindly indicate if the Party involved wishes to be considered as project participant (Yes/No)
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² US Environmental Protection Agency 2000: Facts About Landfill Gas
<http://www.dem.ri.gov/programs/benviron/waste/central/lfgfact.pdf> (Accessed 08/12/2009)



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Turkey (host country)	ITC Invest Trading & Consulting A.G. Turkish Ankara Branch	No
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Turkish Ankara Branch of ITC Invest Trading & Consulting A.G. is the operating company of the project activity.

OakDanışmanlık is the carbon consultant for this project.

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

A.4. Technical description of the project activity:**A.4.1. Location of the project activity:**

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A.4.1.1. Host Party(ies):

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Host Country: Turkey

A.4.1.2. Region/State/Province etc.:

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East of Mediterranean Region, Ankara Province, Sofulu District

A.4.1.3. City/Town/Community etc.:

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The project location is the Sofulu district of Adana province. Adana landfill receives fresh waste from the municipalities of Adana Greater Municipality.



A.4.1.4. Details of physical location, including information allowing the unique identification of this project activity (maximum one page):

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Figure 1 Location of the Adana Landfill Waste Management Project



Coordinates of the project: Latitude: 37°3'1.93"N, Longitude: 35°23'44.22" E

A.4.2. Category(ies) of project activity:

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Table 1. Categories of the project activity

Applicable rules and definitions	Category	Justification
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UNFCCC	Sectoral scope 13, Waste Handling and Disposal ³ .	The project involves waste management and treatment through LFG extraction and Anaerobic Digestion.
Gold Standard	Large scale Renewable Energy Supply ⁴ .	The project exceeds the small scale project threshold of 15 MW installed capacity and involves generation and delivery of energy services from non-fossil and non-depletable energy sources ⁵ .

A.4.3. Technology to be employed by the project activity:

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The project participant's overall aim is to limit, or even neutralise, the impact of waste. The generic project therefore involves (1) Land Fill Gas (LFG) extraction and utilisation system for management of the waste in the landfill area and (2) bio-digester and (3) gasification system for the incoming waste (fresh waste). The successful implementation of these technologies is considered only viable with the income from carbon revenues. However, due to the fact that the waste gasification is not eligible under Gold Standard rules⁶, no emission reduction credits are claimed from the gasification system. Therefore a distinction is made between the "GS VER project activities" and the "Other Activities". Both activity types are part of the "Generic Project Activity". ~~Table 2~~ **Table 2** below depicts this sub-division.

³ Sectoral scopes related approved methodologies and DOEs: <http://cdm.unfccc.int/DOE/scopes.html>

⁴ Gold Standard Toolkit, Chapter 1.2, p 20:
http://www.cdmgoldstandard.org/fileadmin/editors/files/6_GS_technical_docs/GSv2/GSV2_Toolkit.pdf

⁵ Although making use of depletable source, landfill gas projects are eligible under the Gold Standard according to Gold Standard Requirements.

⁶ Gold Standard v2.1 Annex C, Guidance on Project Eligibility:
http://www.cdmgoldstandard.org/fileadmin/editors/files/6_GS_technical_docs/GSv2.1/GSv2.1_Annexes_A-N.pdf

**Table 2** Activities under the scope of the generic and GS VER project activities.

Activity			Impacts on:		
			Environment	Safety	Electricity Production
Generic Project Activity	GS VER Project activity (Project Boundary)	Covering of the landfill	Reduction of odour nuisance and prevent LFG to be emitted to the atmosphere	Reduce health hazards	Increase the efficiency of the landfill gas collection system
		Landfill gas collection system	Prevent LFG to be emitted to the atmosphere	Controlled capture of LFG reduced the risk on explosion and fires	Provides the fuel for the gas engines, methane.
		Anaerobic digester system	Reduce environmental effects of the methane and reduce the amount of land filled material	Controlled capture of biogas reducing the risk on explosion and fires	Provides fuel for the gas engines, methane
		Energy generation units	Displace electricity otherwise produced by the grid	Combustion of methane reduces the risk on explosion and fires.	Renewable energy production from a waste stream
		Landfill leachate drainage system	Controls the leachate, this is directed to a waste water treatment system	Prevents the leachate to enter the environment, reduce health hazards.	Enables to manage the humidity level of the land filled waste, therefore enhances the LFG recovery.
		Gas flaring system	Reduce environmental effects of Methane	Combustion of methane reduces the risk on explosion and fires.	Required as safety device.
		Connection to the grid via transmission line			Delivery of the generated electricity to the national grid
	Other Activities (Outside the Project Boundary)	Sorting Facility & Recycling Centre	Saves natural resources		
		Gasification System	Utilisation of inorganic materials otherwise landfilled	Controlled capture of syngas reducing the risk on explosion and fires	Increases the amount of electricity produced

*Covering of the landfill:*

In order to reduce the odour and increase the efficiency of the gas collection system, the landfill will be covered.

Landfill gas collection system:

The LFG collection system consists of vertical gas wells and horizontal collectors. The collected LFG will be sent to 5 gas engines to support 7 MW of total installed capacity for LFG utilization.

Anaerobic digester system:

Fresh waste entering the landfill area will be sorted in the recycling centre; the organic waste will be transferred to anaerobic digestion units, where the organic waste will be digested and the methane recovered. The biogas from anaerobic digester will be fed to biogas engines. The amount of waste treated in the anaerobic digester system is expected to increase gradually, starting from approximately 310 tonnes of daily organic waste input reaching to approximately 630 tonnes through out the crediting period. The anaerobic digester system is envisaged to reach 8.4 MW installed capacity for electricity generation with 6 units of gas engines. The residues from the anaerobic digestion system will be landfilled.

Energy generation units:

The captured LFG and biogas from the anaerobic digesters will be utilised in gas engines for electricity generation⁷. As of February 2011, 7 units of 1.4 MW gas fuel burning engine generators have been installed and three of them are operational. The total energy generation capacity is expected to gradually increase, reaching an estimated capacity of 15.4 MW for the GS VER project through the crediting period. The capacity might be increased dependent on the success of possible innovative landfill cover, extraction and waste disposal technologies. The following table outlines the planned installed capacity implementation for the GS VER Project during the first crediting period.

Table 3 Timeline of projected capacity development of the proposed GS VER Adana Landfill Waste Management Project

Years	2010	2011	2012	2013	2014	2015	2016	2017
Landfill (MW)	4.2	7	7	7	7	7	7	7
Anaerobic Digester (MW)	0	4.2	8.4	8.4	8.4	8.4	8.4	8.4
Total (MW)	4.2	11.2	15.4	15.4	15.4	15.4	15.4	15.4

Landfill leachate drainage system:

The proposed project includes the installation of a leachate collection system in which the leachate is collected through undergrounds canals and transported through pipes to the municipalities water treatment centre, where the wastewater is treated through several steps including aerobic treatment.

Gas flaring system:

The enclosed flaring system will only be used if the captured amount of gas exceeds the amount that can be burned in the gas engines. Besides the flaring equipment a gas booster is installed to provide the required discharge pressure. The purpose of the enclosed flaring system is to ensure safety of the project.

⁷ GE Jenbacher Gas Engines are selected for the project activity. http://www.ge-energy.com/products_and_services/products/gas_engines_power_generation/ge_jenbacher_type_4_gas_engines.jsp

*Grid connection:*

The project activity further involves the connection to the national grid. The grid connection is 2.2 km long and at 31.5 kV level. The facility is connected to the grid at the 154/31.5 kV Cihadiye feeder transformer station.

ITC is continuously seeking to introduce innovative waste management technologies as to improve the efficiency of the gas collection and extraction systems in the future.

*Activities outside project boundary**Sorting facility & Recycling Centre:*

In the sorting facility, incoming municipal waste is sorted into various categories of organic and inorganic waste, enabling a high degree of recycling of the waste. The sorting facility and recycling centre is not part of the VER project activity. The facility aims to have a capture rate of 50% of all non-organic materials delivered, resulting in an expected recycle rate of approximately 4% - 6% of the total waste delivered to the landfill.

Gasification system:

The gasification process converts any carbon-containing material into a synthesis gas composed primarily of carbon monoxide and hydrogen, which can be used as a fuel to generate electricity. A mix of non-organic and organic waste will be fed into the gasification system; this will reduce the amount of waste delivered to the landfill. With the expected start up in 2015 the gasification system is estimated to support 10 MW installed capacity. This system is not part of the VER project activity and no emission reduction credits are claimed from the gasification system.

The following table present the timeline of the projected waste input to the Adana - Sofulu Landfill and the projected amounts of waste utilised by the various components of the generic project.

Table 4 Timeline of projected waste input

Years	2010	2011	2012	2013	2014	2015	2016	2017
Landfill (tonnes)	1,500	1,130	1,130	900	900	950	950	950
Anaerobic Digester (tonnes)	0	310	630	630	630	630	630	630
Gasification (tonnes)	0	0	0	0	0	50	50	50
Recycled (tonnes)	0	60	60	80	80	80	80	80
Total (tonnes)	1,500	1,500	1,500	1,610	1,610	1,710	1,710	1,710

**A.4.4. Estimated amount of emission reductions over the chosen crediting period:**

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Table 5 Estimated amount of emission reductions over the first crediting period

Years	Annual estimation of emission reductions (tCO ₂ e)
2010	~~154,129~~ 153,262
2011	~~299,547~~ 295,620
2012	~~325,190~~ 319,790
2013	~~328,920~~ 323,519
2014	~~332,492~~ 327,092
2015	~~336,544~~ 331,144
2016	~~340,420~~ 335,019
2017	~~443,386~~ 441,136
Total emission reductions (tCO₂e)	~~2,260,629~~ 2,226,583
Total number of crediting years	7
Annual average over the crediting period of estimated reductions (tCO₂e)	~~322,947~~ 318,083

A.4.5. Public funding of the project activity:

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No public funding is obtained for the project.⁸⁸ The ODA declaration form is available to the DOE.

**SECTION B. Application of a baseline and monitoring methodology****B.1. Title and reference of the approved baseline and monitoring methodology applied to the project activity:**

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Applied approved baseline and monitoring methodologies:

- Approved consolidated baseline methodology ACM0001 “Consolidated methodology for landfill gas project activities” Version 11;
- Approved baseline and monitoring methodology AM0025 “Avoided emissions from organic waste through alternative waste treatment process” Version 12.

Used tools:

- “Tool for the demonstration and assessment of additionality” Version 05.2;
- “Tool to determine project emissions from flaring gases containing methane” Version 01;
- “Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site” Version 05;
- “Tool to calculate the emission factor for an electricity system” Version 02, EB50;
- “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. Justification of the choice of the methodology and why it is applicable to the project activity:

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The project activity involves several waste management technologies including LFG extraction, Anaerobic Digester system and utilization of the produced LFG and biogas for electricity generation. This requires the use of two different methodologies and referred tools. The applicability of the methodologies and tools have been discussed below.

Applicability of ACM0001 v.11

For the landfill gas recovery component of the proposed VER project, the emission reductions resulting from the capture and utilisation of landfill gas are calculated using ACM0001 “Consolidated baseline methodology for landfill gas project activities” (version 11). This methodology is applicable to landfill gas capture project activities, where the baseline scenario is the partial or total atmospheric release of the gas and the project activities include activities such as:

Ref.	Applicability Criteria	Justification
a	The captured gas is flared; and/or	In the proposed project activity the captured LFG is only flared in case of emergency or unavailability of the project equipment for electricity production.
b	The captured gas is used to produce energy (e.g. electricity/thermal energy). Emission reductions can be claimed for thermal energy	In the proposed project activity the captured gas is used to produce electricity. There will be no thermal energy generation and no emission



	generation, only if the LFG displaces use of fossil fuel either in a boiler or in an air heater. For claiming emission reductions for other thermal energy equipment (e.g. kiln), project proponents may submit a revision to this methodology;	reductions are claimed for thermal energy generation or other thermal energy equipment.
c	The captured gas is used to supply consumers through natural gas distribution network. If emissions reductions are claimed for displacing natural gas, project activities may use approved methodology AM0053.	The project activity does not involve in supply of captured gas to consumers through natural gas distribution network.

The baseline scenario of the proposed project is total atmospheric release of the gas (see section B.4) and the captured gas is used to produce energy. Thus the VER project activity corresponds to a) and b) above and therefore ACM0001 “Consolidated baseline methodology for landfill gas project activities” (version 11) is applicable to the project activity.

Applicability of AM0025 v12:

For the anaerobic digester component of the proposed VER project activity, the emission reductions resulting from the recovery and utilisation of the biogas are calculated using AM0025 “Avoided emissions from organic waste through alternative waste treatment process” (version 12). Applicability of AM0025 is discussed below:

Ref	Applicability Criteria	Justification
a	The project activity involves one or a combination of the following waste treatment options for the fresh waste that in a given year would have otherwise been disposed of in a landfill: 1) A composting process in aerobic conditions; 2) Gasification to produce syngas and its use; 3) Anaerobic digestion with biogas collection and flaring and/or its use. The anaerobic digester processes only the waste for which emission reductions are claimed. In this methodology. If the biogas is processed and upgraded to the quality of natural gas distribution grid, project activities may use approved methodology AM0053 in conjunction with this methodology. In such cases the baseline scenario	The proposed VER project activity involves anaerobic digestion with biogas collection and flaring (the excess gas) for fresh waste that would have otherwise been disposed of in the landfill. The anaerobic digester processes only the waste for which emission reductions are claimed. The biogas is not upgraded to the quality of natural gas distribution grid. The project activity does not involve in mechanical / thermal treatment to produce RDF or incineration of fresh waste for energy generation. Although the generic project activity involves gasification to produce syngas, the gasifier has been excluded from the VER project activity. No emission reductions will claim from the gasification process.



	identification procedure and additionality assessment shall be undertaken for the combination of the two components for the project activity i.e. biomethane emission avoidance and displacement of natural gas; 4) Mechanical / Thermal treatment process to produce refuse-derived fuel (RDF) / stabilized biomass (SB) and its use. The thermal treatment process (dehydration) occurs under controlled conditions (up to 300 degrees Celcius). In case of thermal treatment process, the process shall generate a stabilized biomass that will be used as fuel or raw material in other industrial process. The physical and chemical properties of the RDF / SB shall be homogenous and constant over time; 5) Incineration of fresh waste for energy generation, electricity and/or heat. The thermal energy generated is either consumed on site and/or exported to a nearby facility. Electricity generated is either consumed on-site, exported to the grid or exported to a nearby facility. The incinerator is rotating fluidized bed or circulating fluidized bed or hearth or grate type.	
b	In case of anaerobic digestion, gasification or RDF processing of waste, the residual waste from these processes is aerobically composted and/or delivered to a landfill;	The residual waste from the anaerobic digestion process is delivered to a landfill.
c	In case of composting, the produced compost is either used as soil conditioner or disposed of in landfills;	Not relevant to the project activity since the proposed project activity does not involve in composting.
d	In case of RDF / stabilized biomass processing, the produced RDF / stabilized biomass should not be stored in a manner that may result in anaerobic conditions before its use;	Not relevant to the project activity since the proposed project activity does not involve in RDF / stabilized biomass processing.
e	If RDF / SB is disposed of in a landfill, project proponent shall provide degradability analysis on an annual basis to demonstrate	Not relevant to the project activity since the proposed project activity does not involve in RDF / stabilized biomass processing.



	that the methane generation, in life-cycle of the SB is below 1% of related emissions. It has to demonstrate regularly that the characteristics of the produced RDF/SB should not allow for re-absorption of moisture of more than 3%. Otherwise, monitoring the fate of the produced RDF/SB is necessary to ensure that it is not subject to anaerobic conditions in its lifetime.	
f	In case of incineration of the waste, the waste should not be stored more than 10 days. The waste should not be stored in conditions that would lead to anaerobic decomposition and, hence, generation of CH ₄ ;	Not relevant to the project activity since the proposed project activity does not involve in incineration of waste.
g	The proportions and different characteristics of different types of organic waste processed in project activity can be determined, in order to apply a multiphase landfill gas generation model to estimate the quantity of landfill gas that would have been generated in the absence of the project activity.	The proportion and characteristics of different types of organic waste processed in the project activity can be determined.
h	The project activity may include electricity generation and/or thermal generation from the biogas, syngas captured, RDF/stabilized biomass produced, combustion heat generated in the incineration process, respectively, from the anaerobic digester, the gasifier, RDF/stabilized biomass combustor, and waste incinerator. The electricity can be exported to the grid and/or used internally at the project site. In the case of RDF/SB used for electricity and/or thermal energy generation can be monitored.	The proposed VER project activity includes electricity generation from the biogas captured from the anaerobic digester. The electricity will be exported to the national grid.
i	Waste handling in the baseline scenario shows a continuation of current practice of disposing the waste in the landfill despite environmental regulation that mandates the treatment of waste, if any, using any of the project activity treatment options mentioned above.	There are no environmental regulations that mandate the treatment of waste using any of the project activity treatment options mentioned under methodology AM0025 in Turkey. The waste handling in the baseline scenario shows a continuation of current practice of disposing the waste in the landfill.
j	The compliance rate of environmental regulations during (part of) the crediting period is below 50%; if monitored compliance with MSW rules exceeds 50%, the project activity shall receive no further credit, since the assumption that the policy is	The compliance rate of the environmental regulations during the crediting period is below 50%.



	not enforced is no longer tenable.	
k	Local regulations do not constrain the establishment of RDF production plants/thermal treatment plants nor the use of RDF /SB as fuel or raw material.	Not relevant to the project activity since the proposed project activity does not involve in RDF / stabilized biomass processing.
l	In case of RDF/SB production, project proponent shall provide evidences that no GHG occur, other than biogenic CO ₂ , due to chemical reactions during the thermal treatment process (such as chimney gas analysis report)	Not relevant to the project activity since the proposed project activity does not involve in RDF / stabilized biomass processing.
m	The project activity does not involve thermal treatment process of neither industrial nor hospital waste	The project activity does not involve thermal treatment process of neither industrial nor hospital waste.
n	In case of waste incineration, if auxiliary fossil fuel is added into the incinerator, the fraction of the energy generated by auxiliary fossil fuel is no more than 50% of the total energy generated in the incinerator.	Not relevant to the project activity since the proposed project activity does not involve in incineration of waste.

The anaerobic digester of the VER project activity does not involve capture and flaring of methane from existing waste in the landfill⁹.

As a summary to the above the VER project activity corresponds to every related applicability criteria under AM0025 “Avoided emissions from organic waste through alternative waste treatment process” version 12 and is applicable to the project activity.

In addition, the methodologies also refer to several tools described under section B.1 “Title and reference of the approved baseline and monitoring methodology applied to the project activity”. The applicability of these tools have been discussed below:

Applicability of “Tool for the demonstration and assessment of additionality” v 05.2:

The tool for demonstration and assessment of additionality provides a general framework demonstrating and assessing additionality and is applicable to a wide range of project types. As referred in both methodologies ACM0001 and AM0025, the additionality tool is applicable for the proposed project activity.

⁹ Two separate activities are included in the proposed project one being the LFG extraction and utilization and the other one is the anaerobic digesters biogas generation and utilization. Therefore ACM0001 “Consolidated methodology for landfill gas project activities” v11 has been used for the capture and flaring of methane from existing waste in the landfill.

**Applicability of “Tool to determine project emissions from flaring gases containing methane” v 01:**

The tool provides procedures to calculate project emissions from flaring of a residual gas stream containing methane. Applicability of “Tool to determine project emissions from flaring gases containing methane” is discussed below:

Ref	Applicability Criteria	Justification
a	The residual gas stream to be flared contains no other combustible gases than methane, carbon dioxide and hydrogen.	In the proposed project activity only the captured LFG, which contains no other combustible gases than methane is flared in case of emergency or unavailability of the project equipment for electricity production.
b	The residual gas stream to be flared shall be obtained from decomposition of organic material (through landfills, biodigesters or anaerobic lagoons, among others) or from gases vented in coal mines (coal mine methane and coal bed methane).	In the proposed project activity, the residual gas stream to be flared is obtained from decomposition of organic material through a landfill.

Based on the above arguments it can be concluded that the Tool to determine project emissions from flaring gases containing methane” v01 is applicable to the project activity.

Applicability of “Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site” v 05:

The tool calculates baseline emissions of methane from waste that would in the absence of the project activity be disposed at solid waste disposal sites (SWDS). The tool is applicable as the solid waste disposal site where the waste would be dumped can be clearly identified and the proposed project is not a stockpile and no hazardous waste is processed.

Applicability of “Tool to calculate the emission factor for an electricity system” v 02:

This methodological tool determines the CO₂ emission factor for displacement of electricity generated by power plants in an electricity system, by calculating the “combined margin” emission factor (CM) of the electricity system. This tool may be applied to estimate the OM, BM and/or CM when calculating baseline emissions for a project activity that substitutes grid electricity. As the proposed project activity supplies electricity to the national grid, the “Tool to calculate the emission factor for an electricity system” v 02 is applicable to the project activity.

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
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.

B.3. Description of the sources and gases included in the project boundary:

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Project boundary:

According to AM0025 “Avoided emissions from organic waste through alternative waste treatment process” (version 12) the spatial extent of the project boundary is the site of the project activity where the waste is treated. This is consistent with ACM0001 ‘Consolidated baseline methodology for landfill gas project activities’ (version 11), which defines the project boundary as the site of the project activity where the gas is captured and destroyed/used.

The spatial extent of the project boundary also includes the power generation sources utilizing LFG and biogas from anaerobic digestion and connected to the national grid, as the proposed VER project provides electricity to the national grid as required by ACM0001 “Consolidated baseline methodology for landfill gas project activities” (version 11) and AM0025 “Avoided emissions from organic waste through alternative waste treatment process” (version 12).

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 02). The electricity produced on-site will be delivered to the Turkish national grid.

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

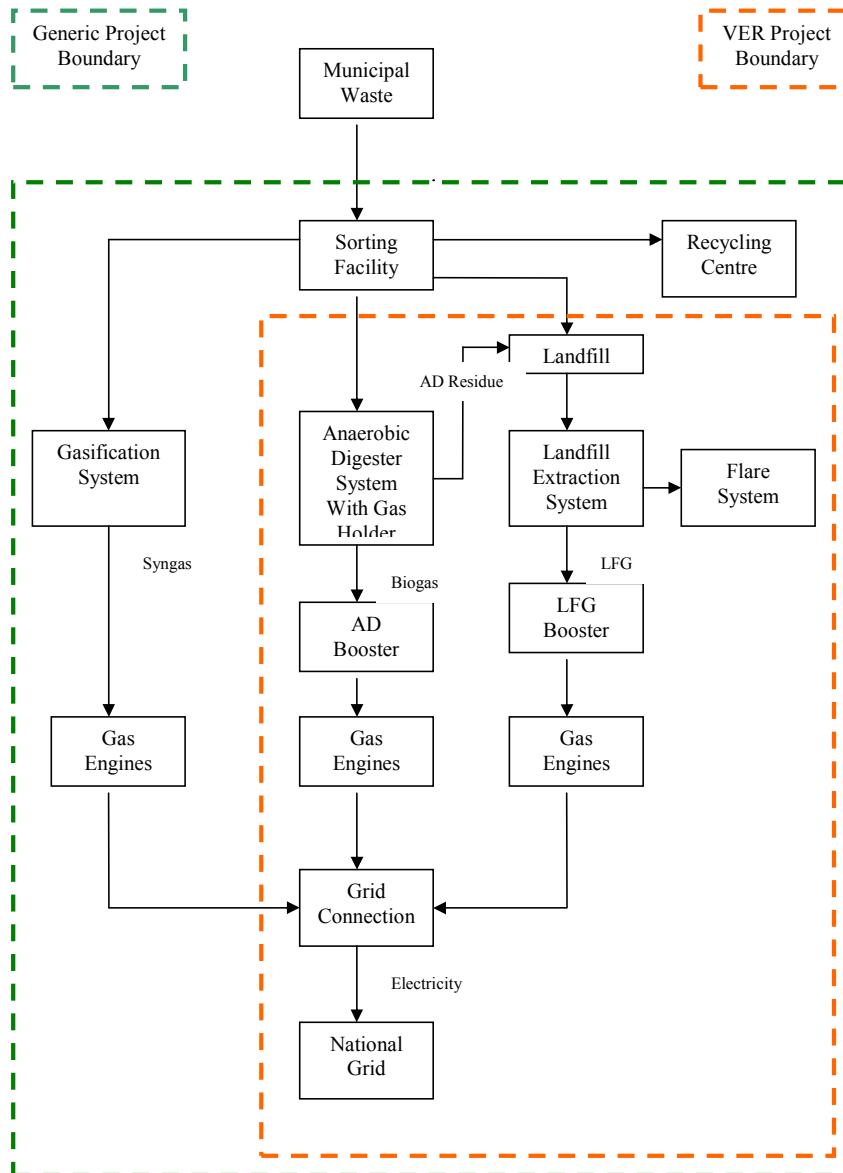
Table 6 Sources and GHG included in the project boundary

	Source	Gas	Included?	Justification / Explanation
Baseline	Emissions from decomposition of waste at the landfill site	CH ₄	Yes	The major source of emissions in the baseline
		N ₂ O	No	N ₂ O emissions are small compared to CH ₄ emissions from landfills. Exclusion of this gas is conservative.
		CO ₂	No	CO ₂ emissions from the decomposition of organic waste are not accounted.
	Emissions from electricity consumption	CO ₂	Yes	Main emission source
		CH ₄	No	Minor emission source
		N ₂ O	No	Minor emission source
VER Project Activity	Emissions from on-site electricity use	CO ₂	Yes	This is an important source of emissions in the project activity
		CH ₄	No	Excluded for simplification. This emission source is assumed to be very small
		N ₂ O	No	Excluded for simplification. This emission source is assumed to be very small
	Direct emissions from the waste treatment process	N ₂ O	Yes	Emissions from anaerobic digestion of the waste
		CO ₂	No	CO ₂ emissions from the decomposition of organic waste are not accounted.
		CH ₄	Yes	CH ₄ leakage from the anaerobic digester

As presented by the below figure, the physical boundary of the proposed project are the components of the VER 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.



Figure 2 Project boundary



**B.4. Description of how the baseline scenario is identified and description of the identified baseline scenario:**

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Both methodologies use a stepwise approach to select the most plausible baseline scenario also taking into account the procedures of ‘Tool for demonstration and assessment of additionality’ (Version 05.2), as agreed in the Executive Board’s 39th meeting.

As per the methodologies and the “Tool for demonstration and assessment of additionality”, the steps for identification of alternatives are as followed:

Table 7 Steps defined to identify the most plausible baseline scenario under the related methodologies and tools

Steps defined under AM0025	Steps defined under ACM0001	Steps defined under the additionality tool
Step1: Identification of alternative scenarios	Step1: Identification of alternative scenarios	Step1: Identification of alternatives to the project activity consistent with current laws and regulations.
Step 2: Identify the fuel for the baseline choice of energy source taking into account the national and/or sectoral policies as applicable	Step 2: Identify the fuel for the baseline choice of energy source taking into account the national and/or sectoral policies as applicable	Sub-step 1a: Define alternatives to the project activity
Step 3: Step 2 and/or Step 3 of the latest approved version of the tool for demonstration and assessment of additionality shall be used to assess which of these alternatives should be excluded from further consideration (e.g. alternatives facing prohibitive barriers or those clearly economically unattractive).	Step 3: Step 2 and/or Step 3 of the latest approved version of the tool for demonstration and assessment of additionality shall be used to assess which of these alternatives should be excluded from further consideration (e.g. alternatives facing prohibitive barriers or those clearly economically unattractive).	Sub-step 1b: Consistency with the mandatory laws and regulations
Step 4: Where more than one credible and plausible alternative remains, project participants shall, as a conservative assumption, use the alternative baseline scenario that results in the lowest baseline emissions as the most likely baseline scenario. The least emission alternative will be identified for each component of the baseline scenario. In assessing these scenarios, any regulatory or	Step 4: Where more than one credible and plausible alternative remains, project participants shall, as a conservative assumption, use the alternative baseline scenario that results in the lowest baseline emissions as the most likely baseline scenario. The least emission alternative will be identified for each component of the baseline scenario. In assessing these scenarios, any regulatory or	



contractual requirements should be taken into consideration.	contractual requirements should be taken into consideration.	
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To avoid complexity, steps under the methodologies and the Tool have been incorporated as followed:

Table 8 Consolidated steps to identify the most plausible baseline scenario under the related methodologies and tools

Steps ¹⁰	Description	Reference
Step A	Identification of alternative scenarios	Step 1 defined under AM0025 & ACM0001 and sub-step 1a & under the Tool.
Step B	Identify the fuel for the baseline choice of energy source taking into account the national and/or sectoral policies as applicable	Step 2 defined under AM0025 & ACM0001
Step C	Assessment of which of these alternatives should be excluded from further consideration	Step 3 defined under AM0025 & ACM0001
Step D	Selection of the lowest baseline emissions as the most likely baseline scenario.	Step 4 defined under AM0025 & ACM0001. This step will be applicable only if more than one credible and plausible alternative remains.
Step E	Consistency with mandatory laws and regulations	Sub step 1b defined under the Tool.

Step A. Identification of alternative scenarios

Assessed alternatives to the proposed project activities are defined according to ACM0001 v11 and AM0025 v12 as followed:

Table 9 Alternatives to LFG project (ACM0001)

LFG 1	The project activity (landfill gas extraction) undertaken without being registered as a VER project
LFG 2	Atmospheric release of the landfill gas or partial capture of landfill gas and destruction to comply with regulations or contractual requirements or to address safety and odour concerns.

Table 10 Alternatives to AD project (AM0025)

M 1	The project activity (anaerobic digestion) not implemented as VER project
M 2	Disposal of the waste at a landfill where landfill gas captured is flared
M 3	Disposal of the waste on a landfill without the capture of landfill gas

The project also involves electricity generation. Alternatives for electricity generation are shown in table 11 below.

¹⁰ In order to avoid confusion, the consolidated steps are named alphabetically.

**Table 11** Alternatives to baseline electricity production

P1	Electricity generated from landfill gas undertaken without being registered as VER project activity
P2	Existing or Construction of a new on-site or off-site fossil fuel fired cogeneration plant
P3	Existing or Construction of a new on-site or off-site renewable based cogeneration plant
P4	Existing or Construction of a new on-site or off-site fossil fuel fired captive power plant
P5	Existing or Construction of a new on-site or off-site renewable based captive power plant
P6	Existing and/or new grid-connected power plants

As the proposed project does not involve thermal energy generation, all the alternatives of heat generation are not considered.

Based on the combination of the above alternatives, the following baseline scenarios have been identified for further evaluation.

Table 12 Alternative baseline scenarios

Scenario	Baseline			Description of the baseline scenario
	LFG	Waste	Electricity	
1	LFG 1	M1	P1	The project activity undertaken without being registered as a VER project
2	LFG 2	M2	P6 (*)	Disposal of the waste at a landfill where landfill gas is captured and flared. The electricity is generated by existing grid connected power plants.
3	LFG 2	M3	P6 (*)	Disposal of the waste at a landfill without the capture and/or flaring of landfill gas. The electricity is generated by existing grid connected power plants.

(*) The proposed project activity is located in an area allocated for land filling and therefore there is no possibility to develop a cogeneration plant either based on fossil or renewable energy resources (other than waste originating gas). Therefore alternatives P2, P3, P4 and P5 have been excluded from further evaluation as they are not realistic and credible alternatives to the project activity.

Step B. Identify the fuel for the baseline choice of energy source taking into account the national and/or sectoral policies as applicable

The electricity generation in Turkey is mainly based on fossil fuel fired power plants and there is no supply constraint and the baseline fuel is available in abundance.

Step C. Assessment of which of these alternatives should be excluded from further consideration

Scenario 1: This scenario refers to the project activity undertaken without being registered as a VER project. The project activities face certain barriers and are not considered as financially attractive without the revenues from VER credits and therefore excluded as a realistic and credible baseline scenario. A detailed analysis is presented under section B.5 of this document.



Scenario 2: This scenario refers to the disposal of the waste at a landfill where landfill gas is captured and flared. Adana Landfill Area is established as a landfill in 1990 and is operational since. No waste management measures (e.g. LFG capture, flaring) have been taken before the start of the Project Activity. The common practice in Turkey shows that land filling would have continued without any capture and/or flaring in the absence of the proposed Project Activity as only flaring doesn't generate any income, hence would not have been viable from a commercial point of view, and therefore the alternative baseline scenario 2 is excluded as a realistic and credible baseline scenario.

Scenario 3, which is defined as “disposal of the waste at a landfill without the capture and/or flaring of landfill gas. The electricity is generated by existing grid connected power plants” is the most credible and realistic alternative to the proposed Project Activity and defined as the baseline scenario.

Step D. Selection of the lowest baseline emissions as the most likely baseline scenario

According to the applicable methodologies, where more than one credible and plausible alternative remains, project participants shall, as a conservative assumption, use the alternative baseline scenario that results in the lowest baseline emissions as the most likely baseline scenario.

As there is only one credible and plausible alternative remained, this step is not applicable to the project activity.

Step E. Consistency with mandatory laws and regulations

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

- Electricity Market Law¹¹ [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 Energy¹² [Law Number: 5346 Ratification Date: 10.05.2005 Enactment Date: 18.05.2005]
- Environmental Law¹³ [Law Number: 2827 Ratification Date: 09.08.1983 Enactment Date: 11.08.1983]
 - Regulation on Solid Waste Control¹⁴ [Last updated on 05.04.2005]
 - Regulation on Managed Waste Land Filling¹⁵ [Regulation number 27533 Enactment Date: 26.03.2010]

¹¹ Reference: The official web page of EMRA; <http://www.epdk.gov.tr/documents/10157/351a7a0c-52a9-40d5-8e12-f8e61afe7247>

¹² Reference: The official web page of EMRA;
http://www.epdk.gov.tr/documents/elektrik/mevzuat/kanun/Elk_Kanun_Yek_Kanun.doc

¹³ Reference: The official web page of the Ministry of Environment and Forestry;
<http://www2.cevreorman.gov.tr/yasa/k/2872.doc>

¹⁴ Reference: The official web page of the Ministry of Environment and Forestry;
<http://www.cygm.gov.tr/CYGM/Files/mevzuat/yonetmelik/kaky.doc>

¹⁵ Reference: The official web page of the Ministry of Environment and Forestry;
http://www.cygm.gov.tr/CYGM/Files/mevzuat/yonetmelik/Duzenli_Depolama.doc

**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 price range of 5-5.5 ¢cent/kWh of electricity generation. 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 activity¹⁶.

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 does not mandate the destruction of methane.

- **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.

¹⁶ On 29/12/2010, the Renewable Energy Law has been amended in order to provide technology based incentives, increasing the price to UScents 13.3 per kWh.



The regulation also states that newly established landfill areas (established after the enactment of the regulation) have to cover the waste and LFG drainage wells have to be constructed in order to reduce possible risks such as explosion and fire in the landfill (article 17).

Regarding already existing landfill areas (e.g. Adana Landfill Area), the regulation stipulates that legislation on improvements for landfills will have to be established by the Ministry in the future. However no indication or reference is provided on when these regulations will be established.

In summary: although solid waste management regulation is being implemented in Turkey, it is complied to nor enforced. The regulation doesn't define sanctions or penalties. In practice none of the landfill areas comply with these regulations, as indicated in statistics on landfill areas¹⁷. The majority of landfill areas in Turkey are actually 'waste dumps' where no waste management (including covering of the landfill) is implemented.

Based on the above arguments it can be concluded that the baseline scenario is the disposal of the waste at a landfill without the capture and/or flaring of landfill gas. The baseline scenario constitutes continuation of current practice, which is uncontrolled and unmanaged landfill. The electricity is generated by existing grid-connected power plants (see below table 13).

Table 13 Identified baseline scenario for the project activity

Scenario	Baseline			Description of the baseline scenario
	LFG	Waste	Electricity	
Scenario 3	LFG 2	M3	P6	Disposal of the waste at a landfill without the capture and/or flaring of landfill gas. The electricity is generated by existing grid-connected power plants.

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):

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Assessment and demonstration for the project activity is identified using the 'Tool for demonstration and assessment of additionality' (Version 05.2). Step 1 of this tool has already been applied in the above section B4 for baseline determination. We now proceed to a detailed analysis of the barriers facing the proposed project activity.

Step 2. Investment Analysis

Not applicable

¹⁷ Please refer to section B.5 Step 4, Common Practice for further details.

**Step 3. Barrier Analysis****Substep 3a. Identify barriers that would prevent the implementation of the proposed VER activity:**

Without being registered as a VER project, the proposed project activity faces barriers that would prevent its implementation. The main barrier towards the implementation of the project activity could be characterized as “limited access to financing” due to unfavourable investment and financial structure which results in high risks and limited access to project financing.

Limited access to project financing:

Waste management projects need a high level of financing and long repayment periods. In the proposed project activity, 75% of the investment is realised with debt funding with a repayment period of 5 years and 25% from equity. However the project developers face certain barriers to secure loan from finance institutions / creditor banks. The project participant was only able to obtain debt funding by demonstrating the additional revenues from VERs¹⁸. 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 14 Identified barrier(s) for the implementation of the project activity

Type of barrier	Identified barrier	Unfavourable conditions leading to limited access to finance
Financial Barrier	Limited Access to Finance	Impact of feed-in tariff on investment
		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:

Impact of feed-in tariff on investment:

“The Law on Utilization of Renewable Energy Resources for the Purpose of Generating Electrical Energy”¹⁹ (shortly referred as Renewable Energy Law) was enacted on 18.10.2005, with the purpose to expand the utilization of renewable energy resources for electricity generation in Turkey. The enactment of this law has basically introduced a guaranteed purchase of the electricity generated from renewable energy sources. On 18.04.2007 the Renewable Energy Law was amended and a limitation was introduced to the guaranteed purchase of the electricity from renewable energy resources. As applicable at the time of the investment decision, the guaranteed price cannot be less than the Turkish Lira equivalent of 5

¹⁸ Reference: Written statement from the creditor bank for the proposed project activity. The letter is available for the DOE.

¹⁹ Reference: <http://www.epdk.gov.tr/mevzuat/diger/yenilenebilir/yenilenebilir.doc> (Accessed 17/02/2010)



cent/kWh and may not exceed the Turkish Lira equivalent of 5.5 cent/kWh²⁰. Although the Law seems to intend to provide a sales guarantee for renewable energy, in reality it limits the feed in tariff to a lower price compared to the actual market price²¹, developing unfavourable sales conditions compared to other conventional alternatives, and creating a risk perception for creditors²².

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.²³ 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.²⁴

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 potential²⁵.

The amount of electricity generated and sold to the grid is a major source of company income and a central part of the project's cash flow. As discussed above, a high level of uncertainty is connected to the prediction of landfill gas generation. Adding to that is the unpredictability of the electricity generated from the gas yields of the anaerobic digester, technologies still requiring development. 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.

²⁰ Article 6, paragraph (c) of "The Law on Utilization of Renewable Energy Resources for the Purpose of Generating Electrical Energy"

²¹ The wholesale electricity tariff announced in 2009 by EMRA (Electricity Market Regulatory Authority) is 15.28 YKr/kWh, which corresponds to 6.97 cent/kWh (1cent=2.19 YKr) which is significantly higher than the upper cap of the guaranteed price in the Renewable Energy Law. Reference:
<http://www.epdk.gov.tr/documents/10157/91a20b38-01c5-462a-b74d-e7854b0fb2c0>

²² Reference: Article "The Guaranteed Electricity Price on Renewable Energy Law is Insufficient" published under the official webpage of Electricity Generators Association
<http://www.eud.org.tr/TR/Genel/BelgeGoster.aspx?F6E10F8892433CFFAAF6AA849816B2EF6883A22BF87BFC23>

²³ 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>
(Accessed 15/02/2010)

²⁴ 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> (Accessed 17/02/2010)

²⁵ idem; page 17 "Water and leachate management (Accessed 02/02/2011)

**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 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.”*²⁶

Although there is one GS VER project registered in Turkey²⁷ with the same layout, 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.

As a conclusive note, modern waste management technologies such as LFG utilization and Anaerobic Digestion are perceived 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.²⁸ 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.

Impact of Gasification System on Additionality of the Project Activity:

Although the gasification system is not eligible under the Gold Standard applicable rules, the Project Participant envisages putting a gasification system into operation within the first crediting period. Taking into account that there are no operational gasification systems in Turkey, this technology shares similar barriers. According to US Department of Energy / Gasification 2010 Worldwide Database 2010²⁹, there are only 144 gasification projects (mostly coal gasification) worldwide with a total capacity of 70,817 MW_{th}, which only 9 projects use waste with a total capacity of 373 MW_{th}. Gasification technology in waste management is a very new technology and unproven technology not only in Turkey but worldwide with only 9 operational projects worldwide. Therefore the financial institutions consider the gasification technology to be *“a new and unproven technology”*³⁰.

²⁶ Köse, Ayaz, Köruglu 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 (Accessed 17/02/2010)

²⁷ Mamak Waste Management Project in Ankara also developed by ITC.

²⁸ Statements from bank, provided to validating DOE

²⁹ Reference: http://www.netl.doe.gov/technologies/coalpower/gasification/worlddatabase/2010_Worldwide_Gasification_Database.pdf

³⁰ Reference: Bank Statement available to the DOE.



Sub-step 3 b: Show that the identified barriers would not prevent the implementation of at least one of the alternatives (except the proposed project activity):

The identified barriers would not prevent the implementation of alternatives: the disposal of the waste at a landfill without the capture of landfill gas and electricity generated by existing grid connected power plants as this scenario requires no major investments.

Step 4: Common practice analysis

Sub-step 4 a: Analyse other activities similar to the proposed project activity:

General information on waste indicators of Municipalities in Turkey:

There are 3,213 municipalities in Turkey, out of which 3,129 have a municipal waste service, covering 82% of the total population of Turkey. The amount of waste collected in 2008 was 24,361,000 tonnes. Out of 3,129 municipalities providing landfill services, only 37 of these landfills are classified as “controlled landfills”. From these controlled landfills only 4 have a composting plant and 2 of them have an incineration plant.

**Table 15** Main Waste Indicators of Municipalities 1996-2008³¹

	1996	1997	1998	2001	2002	2003	2004	2006	2008
# of municipalities receiving solid waste services	2,172	2,275	2,579	2,915	2,984	3,018	3,028	3,115	3,129
Rate of population receiving solid waste services in total population (%)	71	71	72	75	76	76	77	81	82
Solid waste collected (1000 t/year)	22,483	24,180	24,945	25,134	25,373	26,118	25,014	25,280	24,361
Solid waste per capita (kg/capita-day)	1.37	1.48	1.51	1.35	1.34	1.38	1.31	1.21	1.15
Solid waste disposal plants									
Controlled Landfill	Number	6	8	8	12	12	15	16	22
	Capacity	206,690	206,690	261,282	277,195	278,015	278,060	376,974	390,478
	Solid waste disposed of (1000 t/year)	2,847	4,364	5,258	8,304	7,047	7,432	9,942	10,037
Composting plant	Number	2	2	2	3	4	5	5	4
	Capacity	245	245	245	299	664	667	667	605
	Waste received by composting plant (1000 t/year)	179	180	166	218	383	326	351	268
Incineration plant	Number	1	2	2	3	3	3	3	2
	Capacity	9	44	44	44	44	44	44	44
	Medical waste incinerated (1000 t/year)	3	9	15	7	7	9	8	6
Rate of population served by solid waste disposal plants in total population	10	15	16	26	25	25	26	34	39

Of the total disposal of 24 million tonnes in year 2008 in Turkey, 13 million tonnes of solid waste per year is dumped at wild landfills, in nature and in streams.³² Moreover, nearly 20% of the population does not receive solid waste services at all, meaning that around 7 million tonnes are not officially registered and most likely are dumped or buried in illegal waste dumps.

From the above it can be concluded that treatment of waste in controlled landfills is not common practice. Furthermore, none of the existing landfills have a waste management model or similar treatment technologies in place that are comparable to the proposed project.

³¹ Turkish Statistics Institute official website / Main solid waste indicators of municipalities
http://www.turkstat.gov.tr/PrelstatistikTablo.do?istab_id=496 (Accessed 06/05/2010)

³² Turkish Statistics Institute official website / Main solid waste indicators of municipalities / Amount of Waste by Destination 2008 / Population Registration 2007. http://www.turkstat.gov.tr/PrelstatistikTablo.do?istab_id=498 (Accessed 17/02/2010) http://www.turkstat.gov.tr/PrelstatistikTablo.do?istab_id=498 (Accessed 06/05/2010)

Specific information on project activities involved in LFG extraction and utilization:

According to the “Tool for demonstration and assessment of additionality” v5.2, an analysis of any other activities that are operational and that are similar to the proposed project activity should be provided. Projects are considered similar if they are in the same country/region and/or rely on a broadly similar technology, are of similar scale, and take place in a comparable environment with respect to regulatory framework, investment climate, access to technology access to finance etc. Other VER Projects are excluded from this analysis in line with the requirements of the “Tool for demonstration and assessment of additionality” v5.2.

The following scopes have been applied in determining the “similar project activities”;

- In the same country (Turkey). This is the most conservative approach provided under the applicable rule.
- Project activities rely on LFG extraction and utilization as well as AD biogas utilization in a landfill area. Biogas production from waste water treatment centres has been excluded (if any) from the analysis since the environment, technology, input and process is significantly different from the technologies/process within the scope of the proposed project activity.
- With similar scale. The proposed project activity is planned to reach 15.4 MW and is considered as a large scale project activity. A conservative range of $\pm 50\%$ capacity have been considered in defining the “similar scale” and any project outside the range 30-7 MW have been excluded from the analysis.
- Projects those are operational. In line with the requirements, only project activities that are operational have been included in the analysis.
- In a comparable environment. Project activities built and/or operated by state owned companies/organizations (such as municipalities) have been excluded since the neither the investment climate nor access to finance shows similarities to the proposed project activity.

To identify any similar type of activity to the proposed project, a survey of existing generation licenses listed in the EMRA (Energy Market Regulatory Authority) database has been conducted.

Based on the survey of generation licenses, the following project activities, which are involved in landfill gas extraction and utilization, have been identified³³.

Table 16 Operational project activities involved in electricity generation from biogas or LFG

Company	Location	Installed Capacity (MW _e)	Brief notes on the project
Cargill Tarım ve Gıda Sanayi Ticaret A.Ş.	Bursa	0.12	Autoproducer license. Not based on municipality waste. Small scale
Yeni Adana İmar İnşaat Ticaret A.Ş.	Adana	0.8	Municipality owned autoproducer facility for biogas utilization from waste water treatment.

³³ Reference: Official webpage of EMRA, Licenses
<http://www2.epdk.org.tr/lisans/elektrik/lisansdatabase/verilentesistipi.asp>



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			Small scale
BEL-KA Ankara Katı Atıkları Ayıklama Değerlendirme, Bilgisayar, İnşaat Sanayi ve Ticaret A.Ş.	Ankara	3.2	Municipality owned autoproducer facility for biogas utilization from waste water treatment. Small scale
Gaski Enerji Yatırım Hizmetleri İnş. Ve Tic. A.Ş.	Gaziantep	1.66	Municipality owned, biogas utilization from waste water treatment. Small scale
Ekolojik Enerji Ltd. Şti.	İstanbul	0.98	Private owned gasification facility for hazardous wastes. Small scale
İstanbul Çevre Koruma ve Atık Maddeleri Değerlendirme San. Ve Tic. A.Ş. (İSTAÇ A.Ş.)	Istanbul	4.02	Autoproducer license. Municipality owned facility for LFG utilization. Small scale.
ITC KA Enerji Üretim San. Ve Tic. A.Ş.	Ankara (Sincan)	1.416	VER project activity.
Ortadoğu Enerji San. Ve Tic. A.Ş.	Istanbul	13.86	VER project activity.
Ortadoğu Enerji San ve Tic. A.Ş.	Istanbul	5.804	VER project activity
CEV Enerji Üretim San. Tic. Ltd. Şti	Gaziantep	1.03	VER project activity
ITC KA Enerji Üretim San. Ve Tic. A.Ş.	Ankara (Mamak)	11.3	VER project activity

Among the above mentioned projects, only İSTAÇ project activity involves LFG utilization, however the project is developed by a municipal company and neither the investment climate nor access to finance shows similarities to the proposed project activity.

Based on the above information it is clear that similar project activities are not a common practice in Turkey. There are no other project activities in Turkey that includes LFG extraction and Anaerobic, digestion except for “Mamak Waste Management Project”, which is also registered as a GS VER project activity.

Substep 4 b: Discuss any similar options that are occurring:

There are no similar options occurring which are not reliant on VER revenues for their implementation.

The proposed project activity is therefore not common practice and has hereby been proven to be additional.

**B.6. Emission reductions:****B.6.1. Explanation of methodological choices:**

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The emission reductions are calculated as the following equation:

$$ER_y = BE_y - PE_y - L_y$$

Equation 1

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)
L_y	The leakage in year y (tCO ₂ e/year)

B.6.1.a Baseline Emissions

The baseline emissions are:

- Emissions from decomposition of waste at the landfill site
- Emissions resulting from electricity consumption

The calculation of the baseline emissions for the waste management activities are based on two methodologies:

- For the fresh waste: Avoided methane emissions due to the installation of the anaerobic digester. This is calculated using approved methodology AM0025 “Avoided emissions from organic waste through alternative waste treatment process” (version 12).
- For the existing waste: avoided methane emissions due to the landfill gas capture and utilisation. This is calculated using approved consolidated methodology ACM0001 “Consolidated methodology for landfill gas project activities” (version 11).

The baseline emissions resulting from electricity consumption are calculated based on the amount of electricity generated and delivered to the grid by the project activity and the corresponding emissions resulting from the production of this amount of electricity by the Turkish grid. The grid emission factor is calculated using the “Tool for calculation of emission factor for electricity systems” version 02.

Baseline emissions (BE_y) from fresh waste

According to AM0025 “Avoided emissions from organic waste through alternative waste treatment process” (version 12) the baseline emissions are calculated as:

$$BE_y = (MB_y - MD_{reg,y}) + BE_{EN,y}$$

Equation 2

Where:

BE_y	is the baseline emissions in year y (tCO ₂ e)
MB_y	is the methane produced in the landfill in the absence of the project activity in year y (tCO ₂ e)



$MD_{reg,y}$ is the methane that would be destroyed in the absence of the project activity in year y (tCO₂e)
 $BE_{EN,y}$ baseline emissions from generation of energy displaced by the project activity in year y (tCO₂e)

The amount of methane that would have been destroyed in the absence of the project activity is calculated as:

$$MD_{reg,y} = MB_y * AF$$

Equation 3

Where:

$MD_{reg,y}$ is the methane that would be destroyed in the absence of the project activity in year y (tCO₂e)
 MB_y is the methane produced in the landfill in the absence of the project activity in year y (tCO₂e)
 AF Adjustment factor for MB_y (%)

There is no applicable legislation, contractual requirement or safety/odour requirement that enforces the proposed project activity the destruction of methane, consequently baseline methane destruction ($MD_{reg,y}$) is “zero”. The “Adjustment Factor” shall be revised at the start of each new crediting period taking into account the amount of GHG flaring that occurs as part of common industry practice and/or regulation at that point in the future.

Baseline emissions (BE_y) from existing waste

According to ACM0001 “Consolidated methodology for landfill gas project activities” (version 11), the baseline emission reductions (BE_y) are calculated by the following equation:

$$BE_y = (MD_{project,y} - MD_{BL,y}) * GWP_{CH_4} + EL_{LFG,y} * CEF_{elec,BL,y}$$

Equation 4

Where:

BE_y Baseline emissions in year y (tCO₂e)
 $MD_{project,y}$ The amount of methane that would have been destroyed/combusted during year y, in tonnes of methane (tCH₄) in project scenario
 $MD_{BL,y}$ The amount of methane that would have been destroyed/combusted during the year y, in absence of the project due to regulatory and/or contractual requirement, in tonnes of methane (tCH₄)
 GWP_{CH_4} Global Warming Potential value of methane for the first commitment period is 21 tCO₂e/tCH₄
 $EL_{LFG,y}$ Net quantity of electricity produced using LFG, which in the absence of the project activity would have been produced by power plants connected to the grid during year y, in megawatt hours (MWh)
 $CEF_{elec,BL,y}$ CO₂ emissions intensity of the baseline source of electricity displaced, in tCO₂e/MWh



The amount of methane that would have been destroyed in the absence of the project activity is calculated as:

$$MD_{BL,y} = MD_{project,y} * AF$$

Equation 5

Where:

$MD_{BL,y}$	The amount of methane that would have been destroyed/combusted during the year y, in absence of the project due to regulatory and/or contractual requirement, in tonnes of methane (tCH ₄)
$MD_{project,y}$	The amount of methane that would have been destroyed/combusted during year y, in tonnes of methane (tCH ₄) in project scenario
AF	Adjustment factor for $MD_{project,y}$ (%)

There is no applicable legislation, contractual requirement or safety/odour requirement that enforces the proposed project activity the destruction of methane, consequently baseline methane destruction ($MD_{reg,y}$) is “zero”.

Baseline emissions from generation of electricity ($BE_{elec,y}$)

According to AM0025 “Avoided emissions from organic waste through alternative waste treatment process” (version 12)”, the baseline emissions from electricity generated from the fresh waste are resulting from the utilisation of biogas. These baseline emissions are calculated by multiplying the amount of electricity generated utilising biogas with the carbon emission factor the displaced electricity source in the project scenario, which is the Turkish national grid.

According to ACM0001 “Consolidated methodology for landfill gas project activities” version 11, the baseline emissions from electricity generated from the existing waste are resulting from the net quantity of electricity produced using LFG. These baseline emissions are calculated by multiplying the amount of electricity generated utilising LFG with the carbon emission factor the displaced electricity source in the project scenario, which is the Turkish national grid.

Therefore it can be concluded that baseline emissions from electricity can be calculated as the total amount of electricity produced by utilisation of LFG and biogas multiplied by the emission factor for the Turkish grid.

$$BE_{elec,y} = EG_{d,y} * CEF_d$$

Equation 6

Where:

$BE_{elec,y}$	Is the baseline emissions from the electricity generated utilising the LFG and biogas in the project activity and exported to the grid (tCO ₂ /year)
$EG_{d,y}$	is the amount of electricity generated utilising the LFG and biogas collected in the project activity and exported to the grid during year y (MWh)
CEF_d	is the carbon emission factor for the displaced electricity source in the project scenario (tCO ₂ e/MWh)

**Total baseline emissions (BE_y)**

The baseline emissions include the emissions generated in the absence of the project activity (AM0025), the methane from the existing waste destroyed by the project activity (ACM0001) and the baseline emissions from electricity generated utilising the LFG and biogas (equation (2) (3) (4) and (5)) are as follows:

$$BE_y = MB_y + (MD_{project,y} * GWP_{CH_4}) + BE_{elec,y}$$

Equation 7

Where:

BE_y	Baseline emissions in year y (tCO ₂ e)
MB_y	The methane produced in the landfill from the fresh waste in the absence of the project activity in year y, calculated as per AM0025 (tCO ₂ e)
$MD_{project,y}$	The amount of methane destroyed/combusted during year y, in tonnes of methane in project scenario calculated as per ACM0001 (tCH ₄)
$BE_{elec,y}$	Is the baseline emissions from the electricity generated utilizing the LFG and biogas in the project activity and exported to the grid (tCO ₂ e/year)
GWP_{CH_4}	Global Warming Potential value of methane for the first commitment period is 21 tCO ₂ e/tCH ₄

Baseline Emissions due to methane generation from the landfill in the absence of the anaerobic digestion system with biogas

According to AM0025, the amount of methane that is generated each year (MB_y) is calculated as per the latest version of the approved “Tool to determine methane emissions avoided from dumping waste at a solid waste disposal site” by the following equation:

$$MB_y = BE_{CH_4,SWDS,y}$$

Equation 8

Where:

MB_y	The methane produced in the landfill from the fresh waste in the absence of the project activity in year y (tCO ₂ e)
$BE_{CH_4,SWDS,y}$	Is the methane generation from the landfill in the absence of the project activity at year y, calculated using the “Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site” version 05.

The amount of methane produced in year y ($BE_{CH_4,SWDS,y}$) is calculated as follows:

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

Equation 9

Where:



$BE_{CH_4, SWDS, y}$	Methane emissions avoided during the year y from preventing waste disposal at the solid waste disposal site (SWDS) during the period from the start of the project activity to the end of the year y (tCO ₂ e)
φ	Model correction factor to account for model uncertainties (0.9)
f	Fraction of methane captured at the SWDS and flared, combusted or used in another manner
GWP_{CH_4}	Global Warming Potential of methane valid for the commitment period (tCO ₂ e/tCH ₄)
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) (0.5)
DOC _f	Fraction of degradable organic carbon (DOC) that can decompose
MCF	Methane correction factor
$W_{j,x}$	Amount of organic waste type j prevented from disposal in the SWDS in the year x (tonnes)
DOC _j	Fraction of degradable organic carbon (by weight) in the waste type j
k_j	Decay rate for the waste type j
j	Waste type category (index)
x	Year during the crediting period: x runs from the first year of the first crediting period (x=1) to the year y for which avoided emissions are calculated (x=y)
y	Year for which methane emissions are calculated

Where different types of j are prevented from disposal, the amount of different waste types ($W_{j,x}$) will be determined through sampling and calculation of the mean from the samples, as follows:

$$W_{j,x} = W_x \cdot \frac{\sum_{n=1}^z p_{n,j,x}}{z}$$

Equation 10

Where:

$W_{j,x}$	Amount of organic waste type j prevented from disposal in the SWDS in year x (tonnes)
W_x	Total amount of organic waste prevented from disposal in year x (tonnes)
$p_{n,j,x}$	Weight fraction of the waste type j in the sample n collected during the year x
z	Number of samples collected during the year x

The methane destroyed by the project activity ($MD_{project,y}$)

The methane destroyed by the project activity during a year is determined *ex-post* by monitoring the quantity of methane actually flared and gas used to generate electricity and the total quantity of methane captured. According to ACM 0001 it is calculated as:

$$MD_{project,y} = MD_{flared,y} + MD_{electricity,y}$$

Equation 11



Where:

$MD_{project,y}$	The amount of methane destroyed/combusted during year y, in project scenario (tCH ₄)
$MD_{flared,y}$	Quantity of methane destroyed by flaring (tCH ₄), in year y
$MD_{electricity,y}$	Quantity of methane destroyed by generation of electricity (tCH ₄), in year y

The quantity of methane destroyed by the flare ($MD_{flared,y}$)

The quantity of methane destroyed by the flare $MD_{flared,y}$ is calculated as follows:

$$MD_{flared,y} = (LFG_{flare,y} * w_{CH_4,y} * D_{CH_4}) - (PE_{flare,y} / GWP_{CH_4})$$

Equation 12

Where:

$MD_{flared,y}$	Quantity of methane destroyed by flaring (tCH ₄), in year y
$LFG_{flare,y}$	Quantity of the landfill gas fed to the flare(s) during the year measured in cubic meters (m ³),
$w_{CH_4,y}$	Average methane fraction of the landfill gas as measured during the year and expressed as a fraction (in m ³ CH ₄ /m ³ LFG)
D_{CH_4}	Methane density expressed in tonnes of methane per cubic meter of methane (tCH ₄ /m ³ CH ₄)
$PE_{flare,y}$	Project emissions from flaring residual gas stream in year y (tCO ₂ e) determined following the procedure described in the “Tool to determine project emissions from flaring gases containing methane”
GWP_{CH_4}	Global Warming Potential methane (tCO ₂ /tCH ₄)

The emissions resulting from the flaring of the LFG are calculated with the “Tool to determine project emissions from flaring gases containing methane” version 01. This tool is applicable since:

- The residual gas stream to be flared contains no other combustible gases than methane, carbon monoxide and hydrogen;
- The residual gas stream to be flared is recovered from decomposition of organic materials through a landfill.

Emissions from flaring of the residual gas stream are calculated based on the flare efficiency and the flow rate of methane in the residual gas stream that is flared. The flare efficiency depends on both the actual efficiency of combustion in the flare and the time that the flare is operating.

An enclosed flaring system will be used at the proposed project activity. A default value as described under the “Tool to determine project emissions from flaring gases containing methane” Version 01, EB 28 Annex 13, shall be used for ex-post calculations.

Project emissions from flaring ($PE_{flare,y}$) are calculated according to:



$$PE_{flare,y} = \sum_{h=1}^{8760} TM_{RG,h} \times (1 - \eta_{flare,h}) \times \frac{GWP_{CH_4}}{1000}$$

Equation 13

Where:

$PE_{flare,y}$	Project emissions from flaring of the residual gas stream in year y (tCO ₂ e)
$TM_{RG,h}$	Mass flow rate of methane in the residual gas in the hour h (kg/h)
$\eta_{flare,h}$	Flare efficiency in hour h
GWP_{CH_4}	Global Warming Potential of methane valid for the commitment period (tCO ₂ e/tCH ₄)

Quantity of methane destroyed by generation of electricity ($MD_{electricity,y}$)

The quantity of methane destroyed by the generation of electricity, $MD_{electricity,y}$ is calculated as followed:

$$MD_{electricity,y} = LFG_{electricity,y} * w_{CH_4,y} * D_{CH_4}$$

Equation 14

Where:

$MD_{electricity,y}$	Is the quantity of methane destroyed by generation of electricity (tCH ₄ /year)
$LFG_{electricity,y}$	Is the quantity of landfill gas fed into electricity generator (m ³ /yr)
$w_{CH_4,y}$	Is the average fraction of methane in the landfill gas (fraction)
D_{CH_4}	Is the methane density expressed in tonnes of methane per cubic meter of methane (tCH ₄ / m ³ CH ₄)

Baseline emissions from generation of electricity that is displaced by the project activity

The baseline emissions for the proposed project activity involve emissions resulting from electricity generated by fossil fuel fired power plants connected to the Turkish National grid. The Baseline emissions from generation of electricity are calculated per formula (6). The amount of electricity generated will be monitored during the project activity. This includes electricity generated from

- the utilisation of LFG extracted from the landfill area,
- the biogas produced from the anaerobic digester,

The carbon emission factor for the displaced electricity source in the project scenario (CEF_d), i.e. the emission factor of the Turkish grid (EF_{grid,CM,y}), is calculated in the section below.

Calculation of EF_{grid,CM,y}

As referred in ACM0001 “Consolidated methodology for landfill gas project activities” Version 11 and AM0025 “Avoided emissions from organic waste through alternative waste treatment process” (version 12). EF_{grid,CM,y} is calculated according to the “Tool to calculate the emission factor for an electricity system” version 02. The application of the tool is described below.

Step 1. Identification of the relevant electrical power system

According to the “Tool to calculate the emission factor for an electricity system” version 2, a project electricity system has to be 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. Correspondingly, in this project activity the project electricity system include the project site and all power plants attached to the Interconnected Turkish National Grid.³⁴

Electricity transfers from connected electricity systems to the project electricity system are defined as electricity imports. For the purpose of determining the operating margin emission factor, 0 tCO₂/MWh emission factor has been determined for net electricity imports ($EF_{grid,import,y}$) from the connected electricity system.

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

Project participants may choose between two options to calculate the operating margin and build margin emission factor:

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

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

Option I is chosen for the ensuing operating and build margin emission factor calculation.

Step 3. Select a method to determine the operating margin (OM)

According to the “Tool to calculate the emission factor for an electricity system” (version 2), in calculating the operating margin ($EF_{grid,OM,y}$), project developers have the option to select from four potential methods:

- (a) Simple OM, or
- (b) Simple adjusted OM, or
- (c) Dispatch Data Analysis OM, or
- (d) Average OM.

Options (b) and (c) are not selected due to the limited availability of data for Turkey. Option (d) is not selected since low-cost/must run resources do not constitute more than 50% of total grid generation. As prescribed in the tool, the Simple OM (a) can only be used if low-cost/must run resources constitute less than 50% of total grid generation, where low-cost/must run resources include hydro, geothermal, wind, low-cost biomass, nuclear and solar generation. The share of the installed capacity of renewable energy sources excluding hydro power is 1.1% of the total electricity generation and is therefore not taken into consideration. There is no indication that coal is used as a must-run and no nuclear energy plants are located in Turkey. That leaves hydro power as the only relevant low-cost must run source for electricity. The electricity generation from hydro power is 18.5% of the total electricity generation. Therefore the requirements for the use of the Simple OM calculations are satisfied.

³⁴ TEIAS (Turkish Electricity Transmission Company): <http://www.teias.gov.tr>

**Table 17** Breakdown by sources of the electricity generation from the Turkish grid, 2009³⁵

Power plants by fuel type	2009 Generation	
	Generation (MWh)	Share (%)
Natural Gas	96,094,700	49.3
Coal	55,685,100	28.6
Hydro power	35,958,400	18.5
Fuel Oil	4,803,500	2.5
Geothermal + Wind	1,931,100	1
Other Renewable	340,100	0.1
Total	194,812,900	100

Since the Simple OM calculation is selected, the “Tool to calculate the emission factor for an electricity system” (version 2) provides two options for the calculation of the emission factor:

- Ex-ante option: 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, without the requirement to monitor and recalculate the emissions factor during the crediting period, or
- Ex-post option: The year, in which the project activity displaces grid electricity, requiring the emissions factor to be updated annually during the monitoring.

For this project the ex ante approach is selected. Data for calculating the three year average is obtained from the period 2007 – 2009 which are the most recent data available at the time of submission of the PDD to DOE.³⁶

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 (tCO₂/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.³⁷

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

³⁵ TEIAS (Turkish Electricity Transmission Company) 2009: [http://www.teias.gov.tr/istatistik2009/32\(75-09\).xls](http://www.teias.gov.tr/istatistik2009/32(75-09).xls)

³⁶ The index “y” in the equations refers to the years 2007-2009 to calculate the emission factor ex-ante.

³⁷ There are no nuclear power plants in Turkey and the share of the renewable energy is very small.



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:

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

Equation 15

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 the calculation of the Simple OM, the amount of fuel consumption ($FC_{i,y}$) is taken from website of TEIAS, which is the official source of related data. The fuel consumption values for relevant years are given in [Table 18](#) below.

Table 18 Fuel consumption of generation sources connected to the grid (2007-2009)

		$FC_{i,y}$			
	Units	2007	2008	2009	Total
Natural Gas	1000m ³	20,457,793	21,607,635	20,978,040	63,043,468
Lignite	tonnes	61,223,821	66,374,120	63,620,518	191,218,459
Coal	tonnes	6,029,143	6,270,008	6,621,177	18,920,328
Fuel Oil	tonnes	2,312,360	2,315,183	1,783,366	6,410,909

Turkish specific net calorific values ($NCV_{i,y}$) values for fossil fuel types have been calculated, however, data from the IPCC Guidelines for National Greenhouse Gas Inventory have been used as the source of data for the emission factor of the fossil fuel types ($EF_{CO_2,i,y}$).

The NCV and emission factors are presented in [Table 19](#) below.

**Table 19** NCV and emission factor of fossil fuel type

	NCV _i (GJ/tonnes)			EF _{CO₂, i} (tonnes/GJ)
	2007	2008	2009	
Natural Gas	36.765	36.634	37.177	0,054
Lignite	6.861	6.827	6.427	0,091
Coal	22.303	22.244	22.215	0,095
Fuel Oil	39.960	39.874	40.091	0,073

The electricity delivered to the grid by all power sources serving the system, not including low-cost/must-run power plants/units (EG_{gross,y}) is obtained from TEIAS (Turkish Electricity Transmission Company). [Table 20](#) shows the gross electricity production for 2007-2009 produced by fossil fuel power sources.

Table 20 Gross electricity generation by fossil fuel power sources 2007-2009³⁸

	EG _{gross,y} (MWh)			
	2007	2008	2009	Total
Natural Gas	95,024,800	98,685,300	96,094,700	289,804,800
Lignite	38,294,700	41,858,100	39,089,500	119,242,300
Coal	15,136,200	15,857,500	16,595,600	47,589,300
Fuel Oil	6,526,800	7,518,500	4,803,500	18,848,800

The gross electricity production includes the electricity consumption of the power plants. To be able to calculate the net electricity fed into the grid by specific fuel sources, an average correction factor had to be calculated from the overall gross/net electricity generation data. This relation is derived in [Table 21](#) below.

Table 21 Relation between net and gross electricity generation 2007-2009

	2007	2008	2009
Gross generation [MWh]	191,558,000	198,418,000	194,812,900
Net generation [MWh]	183,339,000	189,761,000	186,619,300
Relation	95.7%	95.6%	95.8%
Average correction factor	95.7%		

The net electricity delivered to the grid by the fossil fuel plants (EG_{net,y}) is calculated in

← Biçimlendirilmiş: Normal

[Table 22](#)

³⁸ For further information please see section B.6.2.



Table 22. The calculation of $EF_{grid,OM,y}$ requires the inclusion of electricity imports with an emission factor of 0 tCO₂/GWh. By including the imports in the electricity production this requirement is fulfilled.

Table 22 Net electricity generation by fossil fuel power plants and electricity imports 2007-2009³⁹

		2007	2008	2009	Total
Net electricity production $EG_{net,y}$ (MWh)	Natural Gas	90,951,136	94,454,712	91,975,170	277,381,017
	Lignite	36,653,026	40,063,665	37,413,753	114,130,444
	Coal	14,487,319	15,177,697	15,884,155	45,549,171
	Fuel Oil	6,246,999	7,196,186	4,597,576	18,040,762
Electricity imports		864,300	789,400	812,000	2,465,700
Electricity supplied to grid EG_y		149,202,780	157,681,659	150,682,654	457,567,094

Based on the above values, the simple operating margin CO₂ grid emission factor ($EF_{grid,OMsimple,y}$) calculated through Equation 15 is **0.657 tCO₂/MWh**.

For the calculation of the simple OM, the subscript *m* refers to the power plants delivering electricity to the grid, not including low-cost/must-run power plants, and including electricity imports to the grid.

Electricity imports are treated as one power plant *m*.

Step 5. Identifying the group of power units to be included in the build margin

The sample group of power units *m* used to calculate the build margin consists of either;

- (a) The set of five power units that have been built most recently, or
- (b) The set of power capacity additions in the electricity system that comprise 20% of the system generation (in MWh) and that have been built most recently⁴⁰.

Option (b) has been chosen to identify the cohort of power units to be included in the build margin as the set of power units comprise the larger annual generation.

The list of the power plants is defined under Annex 3, baseline information of this PDD.

³⁹ For further information please refer to section B.6.2.

⁴⁰ If 20% falls on part capacity of a unit, that unit is fully included in the calculation.

**Step 6. Calculation of the build margin emission factor**

The built margin emissions factor is the generation-weighted average emissions factor (tCO₂/MWh) of all power units m during the most recent year y ⁴¹ for which power generation data is available, calculated as follows:

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

Equation 16

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 02), 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:

$$EF_{EL,m,y} = \frac{EF_{CO_2,m,i,y} \times 3.6}{\eta_{m,y}}$$

Equation 17

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)

⁴¹ The index “ y ” refers to the year 2009, the most recent year.



Where several fuel types are used in the power unit, the lowest CO₂ emission factor for EF_{CO₂,m,i,y} has been used.

The average CO₂ emission factor of fuel types (EF_{CO₂,m}) and the average net energy conversion efficiency of the power plants (η_{m,y}) used for the calculation of emission factor of the power units (EF_{EL,m,y}) through Equation 17 are presented in the below table.

Table 23 Emission factor for fuel type and average conversion efficiencies of the power units⁴²

	Average emission factor EF _{CO₂,m,i,y} (tCO ₂ /GJ)	Average conversion efficiency η _{m,y}
Natural Gas	0,0543	IPCC default value of 60% for combined cycle
Lignite	0,0910,0909	IPCC default value of 45% for Supercritical IPCC default value of 41.4% for PFBS
Coal	0,095,0,0946	IPCC default value of 45% for Supercritical IPCC default value of 41.4% for PFBS
Fuel Oil	0,0730,0726	IPCC default value of 46% for combined cycle
Hydro	n.a.	n.a.
Wind	n.a.	n.a.

Biçimlendirilmiş Tablo

Biçimlendirilmiş: Ortadan

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The data on the electricity generated and delivered to the grid by power units (EG_{m,y}) are presented in the below table.

Table 24 Electricity generated by the power units included in the build margin calculation⁴³

	EG _{m,y} (MWh)					
	2005	2006	2007	2008	2009	Total
Natural Gas	415,000	3,102,795	3,343,903	765,780	13,602,509	21,229,986
Lignite	0	7,020,000	3,084	0	3,000	7,026,084
Coal	0	0	0	0	1,923,333	1,923,333
Fuel Oil	52,000	0	722,473	16,362	4,331,777	5,122,612
Hydro	0	212,339	717,432	128,145	1,402,961	2,460,877
Other renewable	0	69,448	0	0	1,189,986	1,259,434

⁴² For further information please refer to section B.6.2. Plant specific efficiencies are used instead of default values where available. Please refer to emission reduction calculation sheet for more details.

⁴³ For further information please refer to section B.6.2.



Total	467,000	10,404,583	4,786,892	910,286	22,453,566	39,022,327
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The build margin emission factor $EF_{grid,BM,y}$ calculated through Equation 16 is ~~0.561~~ 0.465 tCO₂/MWh.

Step 6. Calculation of the combined margin emission factor.

The combined margin emissions factor is calculated as follows:

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

Equation 18

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 2), the default weights for the operating margin and build margin emission factors of all other projects than wind and solar power generation by 0.5 and 0.5 respectively.

The combined margin emission factor $EF_{grid,CM,y}$ calculated through Equation 18 is ~~0.609~~ 0.561 tCO₂/MWh.

B.6.1.b Project Emissions

The project emissions are:

- Direct emissions from the waste treatment process. All the direct emissions from the waste treatment process can be calculated according to approved methodology AM0025 “Avoided emissions from organic waste through alternative waste treatment process” (version 12).
- ACM0001 “Consolidated methodology for landfill gas project activities” (version 11) requires the determination of the emissions from on-site electricity use. These emissions are calculated according to the tool ‘Tool to calculate baseline, project and/or leakage emissions from electricity consumption’ (version 02.2).

The project emissions are therefore described in AM0025 “Avoided emissions from organic waste through alternative waste treatment process” (version 12) as follows:

$$PE_y = PE_{elec,y} + PE_{fuel,on-site,y} + PE_{c,y} + PE_{a,y} + PE_{g,y} + PE_{r,y} + PE_{i,y} + PE_{w,y}$$

Equation 19

Where:

PE_y	is the project emissions during the year y (tCO ₂ e)
$PE_{elec,y}$	is the emissions from electricity consumption on-site due to the project activity in year y (tCO ₂ e)
$PE_{fuel,on-}$	is the emissions on-site due to fuel consumption in year y (tCO ₂ e)



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site,y	
PE _{c,y}	is the emissions during the composting process in year y (tCO ₂ e)
PE _{a,y}	is the emissions from the anaerobic digestion process in year y (tCO ₂ e)
PE _{g,y}	is the emissions from the gasification process in year y (tCO ₂ e)
PE _{r,y}	is the emissions from combustion of RDF/stabilized biomass in year y (tCO ₂ e)
PE _{i,y}	is the emissions from the waste incineration in year y (tCO ₂ e)
PE _{w,y}	is the emissions from waste water treatment in year y (tCO ₂ e)

From these identified potential emission sources the following sources are not applicable or considered zero.

Parameter	Description	Not applicable/considered zero
PE _{fuel,on-site,y}	is the emissions on-site due to fuel consumption in year y (tCO ₂ e)	Not applicable since no fuel will be consumed.
PE _{c,y}	is the emissions during the composting process in year y (tCO ₂ e)	Not applicable since the project activity does not involve composting.
PE _{r,y}	is the emissions from combustion of RDF/stabilized biomass in year y (tCO ₂ e)	Not applicable since the project activity does not combust RDF/stabilized biomass.
PE _{i,y}	is the emissions from the waste incineration in year y (tCO ₂ e)	Not applicable since the project activity does not involve waste incineration.
PE _{w,y}	is the emissions from waste water treatment in year y (tCO ₂ e)	Considered zero. The project involves waste water release. This is the leachate from the landfill, which is collected and transported to the waste water treatment centre of the Municipality. Here the wastewater is treated using aerobic treatment processed ⁴⁴ .
PE _{g,y}	is the emissions from the gasification process in year y (tCO ₂ e)	Not applicable since the VER project activity does not involve gasification.

Consequently equation (20) can be simplified as follows:

$$PE_y = PE_{elec,y} + PE_{a,y}$$

Equation 20

Where:

PE _y	is the project emissions during the year y (tCO ₂ e)
PE _{elec,y}	is the emissions from electricity consumption on-site due to the

⁴⁴ Official website of ASKI: <http://www.aski.gov.tr/m.asp?tid=15&pn=2>



$PE_{a,y}$ project activity in year y (tCO₂e)
is the emissions from the anaerobic digestion process in year y (tCO₂e)

Emissions from electricity use on-site ($PE_{elec,y}$)

The project emissions from electricity usage are calculated according to ACM0001, using the ‘Tool to calculate baseline, project and/or leakage emissions from electricity consumption’ version 02.2. This tool is applicable as the electricity is purchased from the grid only (scenario A, Option A1). The project emissions are calculated as:

$$PE_{elec,y} = EC_{PJ,j,y} * EF_{grid,CM,y} * (1 + TDL_{j,y})$$

Equation 21

Where:

$PE_{elec,y}$ is the emissions from electricity consumption on-site due to the project activity in year y (tCO₂e)
 $EC_{PJ,j,y}$ is the amount of electricity generated in an on-site fossil fuel fired power plant or consumed from the grid as a result of the project activity, measured using an electricity meter (MWh/year)
 $EF_{grid,CM,y}$ Combined Margin emission factor (tCO₂/MWh)
 $TDL_{j,y}$ Average technical transmission and distribution losses for providing electricity for source j, in year y.

Project emissions from anaerobic digestion ($PE_{a,y}$)

The project emissions from the anaerobic digestion are calculated as follows:

$$PE_{a,y} = PE_{a,l,y} + PE_{a,s,y}$$

Equation 22

Where:

$PE_{a,y}$ is the emissions from the anaerobic digestion process in year y (tCO₂e)
 $PE_{a,l,y}$ is the CH₄ leakage emissions from the anaerobic digester in year y (tCO₂e)
 $PE_{a,s,y}$ is the total emissions of N₂O and CH₄ from stacks of the anaerobic digestion process in year y (tCO₂e)

CH₄ emissions from leakage ($PE_{a,l,y}$)

Under AM0025 “Avoided emissions from organic waste through alternative waste treatment process” version 12, three options are provided for quantifying methane emissions from leakage: monitoring the actual quantity of the gas leakage, applying an appropriate IPCC physical leakage default factor, or applying a physical leakage factor of zero where advanced technology used by the project activity prevents any physical leakage. In the proposed project activity the last option, apply a physical leakage factor of zero, is selected.



The currently implemented technology for digester is dry digestion involving mesophilic/thermophilic bacteria at specific operating conditions and in absence of oxygen. The residence time is expected to be around 15 - 20 days. Digesters are designed to prevent physical leakage of biogas. To prevent leakage, advanced methods were implemented during the installation of the digesters. A proven and reliable technology developed by the project participant has been applied during construction of the digesters, enabling a gas leakage free operation. Special concrete walls and ground are thick enough and includes additives to prevent leakage. Inside of the digester is equipped with gas collection pipes in short distances. The connection points are more isolated to prevent leakage. Therefore emissions from the physical leakage from the anaerobic digester has been taken as “0” in line with the requirements of the methodology.

Emissions from anaerobic digestion stacks ($PE_{a,s,y}$)

The biogas produced from the anaerobic digestion process is used for energy generation. The final stack emissions are monitored from the final stack and estimated as follows:

$$PE_{a,s,y} = SG_{a,y} * MC_{N_2O,a,y} * GWP_{N_2O} + SG_{a,y} * MC_{CH_4,a,y} * GWP_{CH_4}$$

Equation 23

Where:

$PE_{a,s,y}$	is the total emissions of N_2O and CH_4 from stacks of anaerobic digestion process in year y (tCO_2e)
$SG_{a,y}$	is the total volume of stack gas from the anaerobic digestion in year y (m^3/y)
$MC_{N_2O,a,y}$	is the monitored content of nitrous oxide in the stack gas from anaerobic digestion in year y (tN_2O/m^3)
GWP_{N_2O}	is the Global Warming Potential of nitrous oxide (tCO_2e/tN_2O)
$MC_{CH_4,a,y}$	is the monitored content of methane in the stack gas from anaerobic digestion in year y (tCH_4/m^3)
GWP_{CH_4}	is the Global Warming Potential of methane (tCO_2e/tCH_4)

At the time of PDD development the anaerobic digester has not been implemented. Therefore values of $MC_{N_2O,a,y}$ and $MC_{CH_4,a,y}$ are not available. In the project activity the emissions from anaerobic digestion stacks will be determined based on ex-post monitoring of $MC_{N_2O,a,y}$ and $MC_{CH_4,a,y}$. For the ex-ante calculations these stack emissions from combustion of biogas ($PE_{a,s,y}$) are considered zero. This is based on the IPCC 2006 Guidelines for Natural Greenhouse Gas Inventory “The emissions combustion of the recovered gas are not significant, as the CO_2 emissions are of biogenic origin, and the CH_4 and N_2O emissions are very small so *good practice* in the Waste Sector does not require their estimation”⁴⁵.

B.6.1.c Leakage

According to AM0025 “Avoided emissions from organic wastes through alternative waste treatment process” (version 12), the sources of leakage are CO_2 emissions from off-site transportation of waste

⁴⁵ 2006 IPCC Guidelines for Natural Greenhouse Gas Inventory, Volume 5, Waste, page.4.5 / http://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/5_Volume5/V5_4_Ch4_Bio_Treat.pdf



materials in addition to CH₄ and N₂O emissions from the residual waste from anaerobic digestion, gasification process and processing/combustion of RDF.

The project activity does not include processing/combustion of RDF, composting nor off-site transportation of waste materials. In addition, gasification, though part of the generic project, is not part of the proposed VER project activity. Part of the operation of the landfill in the baseline situation is the transportation of waste to the landfill area. This will remain as such in the project situation; consequently no increase in transport emissions due to the project activity is expected.

Leakage emissions are calculated as follows:

$$LE_y = LE_{t,y} + LE_{r,y} + LE_{i,y} + LE_{s,y}$$

Equation 24

Where:

- LE_y is the leakage emissions in the year y (tCO₂e)
- LE_{t,y} is the leakage emissions from increased transport in the year y (tCO₂e)
- LE_{r,y} is the leakage emissions from the residual waste from the anaerobic digestion (tCO₂e)
- LE_{i,y} is the leakage emissions from the residual waste from MSW incinerator in year y (tCO₂e)
- LE_{s,y} is the leakage emissions from stabilised biomass in the year y (tCO₂e)

From these identified potential leakage sources the following sources are not applicable or considered zero.

Parameter	Description	Not applicable
LE _{t,y}	Is the leakage emissions from increased transport in the year y (tCO ₂ e)	The proposed project activity does not result in a change in transport in emissions, therefore LE _{t,y} is not applicable.
LE _{s,y}	Is the leakage emissions from stabilised biomass in the year y (tCO ₂ e)	The project activity does not involve RDF or stabilised biomass, therefore LE _{s,y} is not applicable.
LE _{i,y}	Is the leakage emission from the residual waste from MSW incinerator in year y (tCO ₂ e)	The project activity does not involve MSW incineration, therefore LE _{i,y} is not applicable.

Emissions from residual waste from anaerobic digester (L_{r,y})

According to AM0025 “Avoided emissions from organic wastes through alternative waste treatment process” (version 12), for the residual waste from the anaerobic digestion the weight (A_{ci,x}) of each of the waste types i in year x should be estimated.



As the residual waste is delivered to the landfill, CH₄ emissions are estimated through the equation 8 using estimated weights of each waste type ($A_{ci,x}$).

B.6.2. Data and parameters that are available at validation:

Data / Parameter:	ID. 1 / Article
Data unit:	n.a.
Description:	Regulatory requirements relating to landfill gas projects
Source of data used:	Prime Ministry, Directorate of Legislation Development and Publication Official Website http://www.mevzuat.gov.tr/
Value applied:	0
Justification of the choice of data or description of measurement methods and procedures actually applied :	“Directorate of Legislation Development and Publication” under The Prime Ministry is the official governmental organization responsible for publication of any legislative changes in Turkey.
Any comment:	Relevant regulations for LFG project activities shall be updated at renewal of each credit period. Changes to regulation will be concerted to the amount of methane that would have been destroyed/combusted during the year in the absence of the project activity ($MD_{BL,v}$).

Data / Parameter:	ID. 2 / GWP_{CH_4}
Data unit:	tCO ₂ e/tCH ₄
Description:	Global warming potential of CH ₄
Source of data used:	IPCC
Value applied:	21
Justification of the choice of data or description of measurement methods and procedures actually applied :	Value is 21 for the first commitment period. Shall be updated according to any future COP/MOP decisions.
Any comment:	-

Data / Parameter:	ID. 3 / GWP_{N_2O}
Data unit:	tCO ₂ e/t N ₂ O
Description:	Global warming potential of N ₂ O
Source of data used:	Kyoto Protocol
Value applied:	310
Justification of the choice of data or description of measurement methods	Value is 310 for the first commitment period. Shall be updated according to any future COP/MOP decisions.



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and procedures actually applied :	
Any comment:	-
Data / Parameter:	ID. 4 / D_{CH₄}
Data unit:	tCH ₄ /m ³ CH ₄
Description:	Density of methane
Source of data used:	ACM0001 “Consolidated baseline and monitoring methodology for landfill gas project activities” (version 11)
Value applied:	0.0007168
Justification of the choice of data or description of measurement methods and procedures actually applied :	At standard temperature and pressure the density of the methane is 0.0007168 tCH ₄ /m ³ CH ₄ .
Any comment:	Standard temperature and pressure is defined as 0° degree Celsius and 1.013 bar.

Data / Parameter:	ID. 5 / BE _{CH₄SWDS,Y}																										
Data unit:	tCO ₂ e																										
Description:	Methane generation from the landfill in absence of the project activity at year y																										
Source of data used:	Calculated as per “Tool to determine methane emissions avoided from dumping waste at a solid waste disposal site”.																										
Value applied:	<table><tr><td>Year</td><td>2010</td><td>2011</td><td>2012</td><td>2013</td><td>2014</td><td>2015</td><td>2016</td><td>2017</td></tr><tr><td>BE_{CH₄SWDS}</td><td>245,365</td><td>246,968</td><td>248,502</td><td>247,077</td><td>245,741</td><td>245,119</td><td>244,543</td><td>244,010</td></tr></table>									Year	2010	2011	2012	2013	2014	2015	2016	2017	BE _{CH₄SWDS}	245,365	246,968	248,502	247,077	245,741	245,119	244,543	244,010
Year	2010	2011	2012	2013	2014	2015	2016	2017																			
BE _{CH₄SWDS}	245,365	246,968	248,502	247,077	245,741	245,119	244,543	244,010																			
Justification of the choice of data or description of measurement methods and procedures actually applied :	As required per ACM0001 “Consolidated baseline and monitoring methodology for landfill gas project activities” (version 12)																										
Any comment:	This value is estimated ex-ante																										

Data / Parameter:	ID. 6 / EG_{gross}
Data unit:	MWh
Description:	Gross electricity production by fossil fuel power sources (2007-2009)
Source of data used:	TEIAS (Turkish Electricity Transmission Company) The distribution of gross electricity generation by primary energy resources and the electricity utilities in Turkey (2007, 2008, 2009). http://www.teias.gov.tr/ist2007/40.xls http://www.teias.gov.tr/istatistik2008/41.xls http://www.teias.gov.tr/istatistik2009/37(06-09).xls
Value applied:	See calculations of emission factor (B.6.1)



Justification of the choice of data or description of measurement methods and procedures actually applied :	According to “Turkish Statistics Law and Official Statistics Program” ⁴⁶ 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.
Any comment:	The average correction factor between gross/net generation is 95.8%. Its determination is presented in the Ex-ante calculation sheets.

Data / Parameter:	ID. 7 / FC_{iv}
Data unit:	m ³ / 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 (2007-2009)
Source of data used:	TEIAS (Turkish Electricity Transmission Company) Fuels consumed in thermal power plants in Turkey by the electricity utilities (2007-2009) http://www.teias.gov.tr/istatistik2009/44.xls
Value applied:	See calculations of emission factor (B.6.1)
Justification of the choice of data or description of measurement methods and procedures actually applied :	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.
Any comment:	-

Data / Parameter:	ID. 8 / Electricity Imports
Data unit:	MWh
Description:	Electricity transfers from connected electricity systems to the project electricity system by years (2007-2009)
Source of data used:	TEIAS (Turkish Electrical Transmission Company) Monthly distribution of imported electrical energy by years (2007, 2008, 2009) http://www.teias.gov.tr/istatistik2009/26(06-09).xls
Value applied:	See calculations of emission factor (B.6.1)
Justification of the choice of data or description of measurement methods and procedures actually applied :	According to “Turkish Statistics Law and Official Statistics Program” TEIAS, Turkish Electricity Transmission Company is the official source for the related data, hence providing the most up-to-date and accurate information available.
Any comment:	-

⁴⁶ TEIAS 2005: <http://rega.basbakanlik.gov.tr/Eskiler/2005/11/20051118-1.htm>



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Data / Parameter:	ID. 9 / NCV_{ky}
Data unit:	GJ/tonnes (m ³ for gaseous fuels)
Description:	Net calorific value (energy content) of fossil fuel type <i>i</i> in year <i>y</i>
Source of data used:	TEIAS (Turkish Electricity Transmission Company) Heating values of fuels consumed in thermal plants in Turkey by the electricity utilities (2007- 2009) http://www.teias.gov.tr/istatistik2009/46.xls
Value applied:	See calculations of emission factor (B.6.1)
Justification of the choice of data or description of measurement methods and procedures actually applied :	According to “Turkish Statistics Law and Official Statistics Program” TEIAS, Turkish Electricity Transmission Company is the official source for the related data, hence providing the most up-to-date and accurate information available
Any comment:	In order to convert the data source units to the required units; 1tcal is considered to be 4,187 ⁴⁷ GJ.

Data / Parameter:	ID. 10 / EF_{CO2,i,y}
Data unit:	tCO ₂ /GJ
Description:	CO ₂ emission factor of fossil fuel type <i>i</i> in year <i>y</i>
Source of data used:	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 applied:	See calculations of emission factor (B.6.1)
Justification of the choice of data or description of measurement methods and procedures actually applied :	There is no information on the fuel specific default emission factor in Turkey, hence, IPCC values has been used as referred in the “Tool to calculate the emission factor for an electricity system (version 2)”.
Any comment:	-

⁴⁷ Reference: International Energy Agency (IEA) Unit Converter: <http://www.iea.org/stats/unit.asp> (Accessed 27/04/2010)



Data / Parameter:	ID. 11 / $\eta_{m,y}$										
Data unit:	%										
Description:	Average net energy conversion efficiency of power unit m in year y										
Source of data used:	“Environmental Map” published by Environmental Inventory Head Department under Ministry of Environment and Forestry -/ http://www.cedgm.gov.tr/CED/Files/cevreatlas%C4%B1/atlas_metni.pdf (p.197 table X.3.1; Thermal Plants and Environment) IPCC default values have been applied. Where available Plant specific efficiencies are used instead of default values where available. Please refer to emission reduction calculation sheet for more details.										
Value applied:	See calculations of emission factor (B.6.1) <table border="1"> <thead> <tr> <th></th><th>Average conversion efficiency $\eta_{m,y}$</th></tr> </thead> <tbody> <tr> <td><u>Natural Gas</u></td><td>IPCC default value of 60% for combined cycle</td></tr> <tr> <td><u>Lignite</u></td><td>IPCC default value of 45% for Supercritical IPCC default value of 41.4% for PFBS</td></tr> <tr> <td><u>Coal</u></td><td>IPCC default value of 45% for Supercritical IPCC default value of 41.4% for PFBS</td></tr> <tr> <td><u>Fuel Oil</u></td><td>IPCC default value of 46% for combined cycle</td></tr> </tbody> </table>		Average conversion efficiency $\eta_{m,y}$	<u>Natural Gas</u>	IPCC default value of 60% for combined cycle	<u>Lignite</u>	IPCC default value of 45% for Supercritical IPCC default value of 41.4% for PFBS	<u>Coal</u>	IPCC default value of 45% for Supercritical IPCC default value of 41.4% for PFBS	<u>Fuel Oil</u>	IPCC default value of 46% for combined cycle
	Average conversion efficiency $\eta_{m,y}$										
<u>Natural Gas</u>	IPCC default value of 60% for combined cycle										
<u>Lignite</u>	IPCC default value of 45% for Supercritical IPCC default value of 41.4% for PFBS										
<u>Coal</u>	IPCC default value of 45% for Supercritical IPCC default value of 41.4% for PFBS										
<u>Fuel Oil</u>	IPCC default value of 46% for combined cycle										
Justification of the choice of data or description of measurement methods and procedures actually applied :	The average values of thermal plants in Turkey are taken from the report “Environmental Map” published by the Ministry of Environment and Forestry. IPCC values has been used as referred in the “Tool to calculate the emission factor for an electricity system (version 2)”.										
Any comment:	-										

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Data / Parameter:	ID. 12 / Capacity additions
Data unit:	Name of the plant; Installed capacity (MW); Fuel type; Generation (MWh); Commission date
Description:	Capacity additions to the grid that comprises 20% of the total generation (2006-2008)
Source of data used:	TEIAS (Turkish Electricity Transmission Company) Generation units put into operation in 2005; 2006; 2007; 2008; 2009 http://www.teias.gov.tr/projeksiyon/KAPASITE%20PROJEKSIYONU%202006.pdf , for 2005 http://www.teias.gov.tr/projeksiyon/KAPASITE%20PROJEKSIYONU%202007.pdf , for 2006 http://www.teias.gov.tr/projeksiyon/KAPASITEPROJEKSIYONU2008.pdf, for 2007 http://www.teias.gov.tr/projeksiyon/KAPASITEPROJEKSIYONU2009.pdf, for 2009



	2008 http://www.teias.gov.tr/projeksiyon/KAPASITE%20PROJEKSIYONU%202010.pdf for 2009
Value applied:	Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	According to “Turkish Statistics Law and Official Statistics Program” TEIAS, Turkish Electricity Transmission Company is the official source for the related data, hence providing the most up-to-date and accurate information available.
Any comment:	-

Data / Parameter:	ID. 13 / ϕ
Data unit:	-
Description:	Model correction factor to account for model uncertainties
Source of data used:	“Tool to determine methane emissions avoided from dumping waste at a solid waste disposal site” version 05
Value applied:	0.9
Justification of the choice of data or description of measurement methods and procedures actually applied :	Given the uncertainties associated with the model and in order to estimate emission reductions in a conservative manner, a discount of 10% is applied to model results.
Any comment:	-

Data / Parameter:	ID. 14 / OX
Data unit:	-
Description:	Oxidation factor (reflecting the amount of methane from SWDS that is oxidized in the soil or other material covering the waste)
Source of data used:	IPCC 2006 Guidelines for National Greenhouse Gas Inventories http://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/5_Volume5/V5_3_Ch3_SWDS.pdf (Volume 5 / page 3.15)
Value applied:	0
Justification of the choice of data or description of measurement methods and procedures actually applied :	The oxidation factor (OX) reflects the amount of CH ₄ from SWDS that is oxidised in the soil or other material covering the waste. The baseline scenario the landfill area is uncovered, hence oxidation factor OX is taken zero.
Any comment:	-



Data / Parameter:	ID. 15 / F
Data unit:	-
Description:	Fraction of methane in the SWDS gas (volume fraction)
Source of data used:	IPCC 2006 Guidelines for National Greenhouse Gas Inventories
Value applied:	0.5
Justification of the choice of data or description of measurement methods and procedures actually applied :	This factor reflects the fact that some degradable organic carbon does not degrade, or degrades very slowly, under anaerobic conditions in the SWDS. A default value of 0.5 is recommended by IPCC.
Any comment:	-



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Data / Parameter:	ID. 16 / DOC_f
Data unit:	-
Description:	Fraction of degradable organic carbon (DOC) that can decompose
Source of data used:	IPCC 2006 Guidelines for National Greenhouse Gas Inventories
Value applied:	0.5
Justification of the choice of data or description of measurement methods and procedures actually applied :	In accordance to “the tool to determine methane emissions avoided from dumping waste at a solid waste disposal site” version 5, 0.5 value is justified.
Any comment:	-

Data / Parameter:	ID. 17 / MCF
Data unit:	-
Description:	Methane correction factor
Source of data used:	IPCC 2006 Guidelines for National Greenhouse Gas Inventories
Value applied:	0.8
Justification of the choice of data or description of measurement methods and procedures actually applied :	In accordance to the “Tool to determine methane emissions avoided from dumping waste at a solid waste disposal site” version 5, 0.8 value is justified for unmanaged solid waste disposal sites- deep and/or with high water table.
Any comment:	-



Data / Parameter:	ID. 18 / DOC_i										
Data unit:	-										
Description:	Fraction of degradable organic carbon (by weight) in waste type j										
Source of data used:	IPCC 2006 Guidelines for National Greenhouse Gas Inventories (adapted from Volume 5, Table 2.4 and Table 2.5)										
Value applied:	The following values for the different waste types have been applied: <table border="1"> <thead> <tr> <th>Waste type j</th><th>DOC_i (% 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>Non-food organics⁴⁸</td><td>20</td></tr> </tbody> </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	Non-food organics ⁴⁸	20
Waste type j	DOC _i (% wet waste)										
Wood and wood products	43										
Pulp, paper and cardboard	40										
Food, food waste, beverages and tobacco	15										
Non-food organics ⁴⁸	20										
Justification of the choice of data or description of measurement methods and procedures actually applied :	In accordance to the “Tool to determine methane emissions avoided from dumping waste at a solid waste disposal site” (version 5).										
Any comment:	-										

Data / Parameter:	ID. 19 / k _i		
Data unit:	-		
Description:	Decay rate for the waste type j		
Source of data used:	IPCC 2006 Guidelines for National Greenhouse Gas Inventories (Volume 5, Table 3.3)		
Value applied:	The following values for the different waste types have been applied:		
	Waste type j		Boreal and Temperate (MAT < 20 ⁰ C)
			Dry (MAP/PET <1)
	Slowly degrading	Pulp, paper, cardboard	0.04
		Wood, wood products and straw	0.02
	Moderately degrading	Other (non-food) organic putrescible garden and park waste	0.05
	Rapidly degrading	Food, food waste, sewage sludge, beverages and tobacco	0.06

⁴⁸ Non-food organics refer to textiles, garden, yard and park wastes. Therefore a conservative value of 20% has been chosen.



Justification of the choice of data or description of measurement methods and procedures actually applied :	In accordance to the “Tool to determine methane emissions avoided from dumping waste at a solid waste disposal site” (version 5). According to the latest available report on Adana Provincial Environment Annual Report (2007) ⁴⁹ the Mean Annual Temperature (MAT) is 19 ⁰ C (p44 table 22); Mean Annual Precipitation (MAP) is 574.2 mm (p45 table 23) and Potential Evapotranspiration (PET) is 1466 .1 (p44).
Any comment:	

Data / Parameter:	ID. 20 / f
Data unit:	-
Description:	Fraction of methane captured at the SWDS and flared, combusted or used in another manner.
Source of data to be used:	Written information from the operator of the solid waste disposal site and/or site visits at the solid waste site
Value of data applied for the purpose of calculating expected emission reductions in section B.5	0, according to ACM0001 and AM0025.
Description of measurement methods and procedures to be applied:	Annually
QA/QC procedures to be applied:	
Any comment:	

Data / Parameter:	ID. 21 / CEF_d
Data unit:	tCO ₂ e/MWh
Description:	Emission factor for the production of the electricity in the project activity
Source of data used:	Official utility documents
Value applied:	0.609
Justification of the choice of data or description of measurement methods and procedures actually applied :	The Emission factor for the production of the electricity in the project activity, corresponding to the emission factor of the Turkish grid (EF _{grid,CM,y}), is calculated <i>ex-ante</i> according to the “Tool to calculate emission factor for an electricity system” (version 02, EB50 Annex 14).
Any comment:	

⁴⁹ Reference: <http://www.adana-cevreorman.gov.tr/dosyalar/CDR/2007CDR.pdf> (page 44-45)

**B.6.3. Ex-ante calculation of emission reductions:**

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The ex-ante emission reductions are calculated using the formulas as described under section B.6.1.⁵⁰ In the following section, the assumptions made and the results from the calculations are presented.

Baseline emissions:

The baseline emissions include the baseline emissions from fresh waste, baseline emissions from existing waste and baseline emissions from electricity.

The baseline emissions from methane generated by the landfill in the absence of the anaerobic digestion system with biogas collection are calculated as per equation 8.

The input, assumptions and results of the calculations as described in section B.6.1 are presented in the following:

Table 25 Waste composition of organic waste fed to the Anaerobic Digester, including DOC and k values

Wood		Paper		Food waste		Non-food organics	
4%		9%		74%		8%	
DOC	k	DOC	k	DOC	k	DOC	k
43%	0.02	40%	0.04	15%	0.06	20%	0.05

The amount of organic waste avoided from dumping at the Adana Landfill is estimated to reach 229,950 tonnes per year for the first crediting period.

Table 26 Other parameters applied in the calculation

ϕ	(1-f)	GWP _{CH4}	(1-OX)	16/12	F	DOC _f	MCF
0.9	1	21	1	1.333	0.5	0.5	0.8

Table 27 Baseline emissions from anaerobic digestion (tCO₂e /year)

2010	2011	2012	2013	2014	2015	2016	2017
0	5,220	15,521	25,336	34,605	43,386	51,706	59,589

According to ACM0001 “Consolidated baseline and monitoring methodology for landfill gas project activities” (version 11), the *ex-ante* estimation of the amount of methane that would have been destroyed/combusted, originating from the existing waste during the year, in tonnes of methane will be done with the latest version of the approved “Tool to determine methane emissions avoided from dumping waste at a solid waste disposal site”.

The waste composition of the organic waste in Adana Landfill for the ex-ante estimation of the amount of methane that would have been destroyed is presented as followed:

⁵⁰ As referred to in the approved consolidated baseline methodology ACM0001 “Consolidated methodology for landfill gas project activities” Version 11, ex-ante estimation of the amount of methane that would have been destroyed/combusted yearly (MDproject) has been based on the “Tool to determine methane emissions avoided from dumping waste at a solid waste disposal site.”

**Table 28** Waste composition of Adana Landfill, including DOC and k values

Wood		Paper		Food waste		Non-food organics	
3%		8%		53%		6%	
DOC	k	DOC	k	DOC	k	DOC	k
43%	0.02	40%	0.04	15%	0.06	20%	0.05

Table 29 Ex-ante estimation of the amount of methane that would have been destroyed/combusted during the first crediting period (tCO₂e/year)

2010	2011	2012	2013	2014	2015	2016	2017
245,365	246,968	248,502	247,077	245,741	245,119	244,543	244,110

Emission reductions resulting from the generation of electricity

The baseline emissions from electricity generation have been calculated by equation 6.

Table 30 Baseline emissions from electricity generation

Year	EG _{d,y} (MWh)	CEF _d (tCO ₂ e/MWh)	BE _{elec,y} (tCO ₂ e)
2010	31,500	~~0.609~~ 0.561	~~19,179~~ 17,668
2011	84,000	~~0.561~~ 0.609	~~51,145~~ 47,115
2012	115,500	~~0.561~~ 0.609	~~70,324~~ 64,783
2013	115,500	~~0.561~~ 0.609	~~64,783~~ 70,324
2014	115,500	~~0.561~~ 0.609	~~64,783~~ 70,324
2015	115,500	~~0.561~~ 0.609	~~64,783~~ 70,324
2016	115,500	~~0.561~~ 0.609	~~64,783~~ 70,324
2017	115,500	~~0.561~~ 0.609	~~64,783~~ 70,324

*Summary of the baseline emissions***Table 31** Baseline emissions (BE_y)

Year	MB _y (tCO ₂ e)	MD _{project,y} (tCO ₂ e)	BE _{elec,y} (tCO ₂ e)	BE _y (tCO ₂ e)
2010	0	245,365	~~17,668~~ 19,179	~~264,544~~ 263,033
2011	5,220	246,968	~~47,115~~ 51,145	~~303,332~~ 299,303
2012	15,551	248,502	~~64,783~~ 70,324	~~334,377~~ 328,837
2013	25,336	247,077	~~64,783~~ 70,324	~~342,737~~ 337,196
2014	34,605	245,741	~~64,783~~ 70,324	~~350,670~~ 345,130
2015	43,386	245,119	~~64,783~~ 70,324	~~358,829~~ 353,288
2016	51,706	244,543	~~64,783~~ 70,324	~~366,572~~ 361,032
2017	59,589	244,010	~~64,783~~ 70,324	~~373,923~~ 368,382

**Project emissions**

The project emissions are the direct emissions from the waste treatment process and the emissions from the electricity consumption of the project activity. Project emissions have been calculated according to equation 21.

Table 32 Project emissions from electricity use ($PE_{elec,y}$)

	2010	2011	2012	2013	2014	2015	2016	2017
$EC_{pi,y}$ (MWh/year)	526	2,104	2,893	2,893	2,893	2,893	2,893	2,893
CEF_d (tCO_2e/MWh)	0.561	0.561	0.561	0.561	0.561	0.561	0.561	0.561
$TDL_{j,y}$	1%	1%	1%	1%	1%	1%	1%	1%
$PE_{elec,y}$ (tCO_2e)	298	1,192	1,639	1,639	1,639	1,639	1,639	1,639

Biçimlendirilmiş Tablo

Summary of the project emissions**Table 33** Project emissions (PE_y)

Year	$PE_{elec,y}$ (tCO_2e)	$PE_{a,y}$	PE_y (tCO_2e)
2010	~~323~~ 298	0	~~298~~ 323
2011	~~1,294~~ 1,192	0	~~1,192~~ 1,294
2012	~~1,779~~ 1,639	0	~~1,639~~ 1,779
2013	~~1,639~~ 1,779	0	~~1,639~~ 1,779
2014	~~1,639~~ 1,779	0	~~1,639~~ 1,779
2015	~~1,639~~ 1,779	0	~~1,639~~ 1,779
2016	~~1,639~~ 1,779	0	~~1,639~~ 1,779
2017	~~1,639~~ 1,779	0	~~1,639~~ 1,779

Leakage

It is estimated that 40% of the total amount of incoming waste to the AD system will be residual waste and will be delivered to a landfill.

Table 34 Leakage emissions (LE_y)

Year	LE_y (tCO_2e)
2010	0



2011	2,491
2012	7,408
2013	12,038
2014	16,399
2015	20,506
2016	24,374
2017	28,016

B.6.4 Summary of the ex-ante estimation of emission reductions:

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Table 35 Ex-ante estimation of emission reductions

Years	Estimation of project activity emissions (tCO ₂ e)	Estimation of baseline emissions (tCO ₂ e)	Estimation of leakage emissions (tCO ₂ e)	Estimation of overall emission reductions(tCO ₂ e)
2010 ⁵¹	~~174189~~	~~153,436154~~ ~~-318~~	~~00~~	~~153,262154,129~~
2011	~~1,1921,294~~	~~299,303303~~ ~~-332~~	~~2,4912,491~~	~~295,620299,547~~
2012	~~1,6391,779~~	~~328,837334~~ ~~-377~~	~~7,4087,408~~	~~319,790325,190~~
2013	~~1,6391,779~~	~~337,196342~~ ~~-737~~	~~12,03812,038~~	~~323,519328,920~~
2014	~~1,6391,779~~	~~345,130350~~ ~~-670~~	~~16,39916,399~~	~~327,092332,492~~
2015	~~1,6391,779~~	~~353,288358~~ ~~-829~~	~~20,50620,506~~	~~331,144336,544~~
2016	~~1,6391,779~~	~~361,032366~~ ~~-572~~	~~24,37424,374~~	~~335,019340,420~~
2017 ⁵²	~~683741~~	~~153,493155~~ ~~-801~~	~~11,67311,673~~	~~141,136143,386~~
Number of crediting years	7			
Annual average over the crediting period (tCO ₂ e/y)	~~322,947318,083~~			

Biçimlendirilmiş Tablo

B.7. Application of the monitoring methodology and description of the monitoring plan:**B.7.1 Data and parameters monitored:**⁵¹ 2010 values have been corrected according to starting date of crediting period⁵² 2017 values have been corrected according to ending date of the first crediting period



Data / Parameter:	ID. 22 / $LFG_{total,y}$
Data unit:	m ³
Description:	Total amount of landfill gas captured at normal temperature and pressure
Source of data to be used:	Flow meter
Value of data applied for the purpose of calculating expected emission reductions in section B.5	n.a.
Description of measurement methods and procedures to be applied:	Measurement of total amount of captured landfill gas will be continuously performed by using flow meters installed before each booster and all data will be archived electronically. The data will be aggregated monthly and yearly.
QA/QC procedures to be applied:	The flow meters are subject to a regular maintenance and testing regime to ensure accuracy. Records of calibration and maintenance will be archived.
Any comment:	Data will be archived electronically during the crediting period and two years after.

Data / Parameter:	ID. 23 / $LFG_{flare,y}$
Data unit:	m ³
Description:	Amount of landfill gas flared at normal temperature and pressure
Source of data to be used:	Flow meter
Value of data applied for the purpose of calculating expected emission reductions in section B.5	n.a.
Description of measurement methods and procedures to be applied:	Measurement of flared amount of captured landfill gas will be continuously performed by using flow meters and all data will be archived electronically. The data will be aggregated monthly and yearly.
QA/QC procedures to be applied:	The flow meter(s) are subject to a regular maintenance and testing regime to ensure accuracy. Records of calibration and maintenance will be archived.
Any comment:	Data will be archived electronically during the crediting period and two years after.

Data / Parameter:	ID. 24 / $LFG_{electricity,y}$
Data unit:	m ³
Description:	Amount of landfill gas combusted to produce electricity at normal temperature and pressure



Source of data to be used:	Flow meter
Value of data applied for the purpose of calculating expected emission reductions in section B.5	The value is estimated for the purpose of ex-ante emission reduction calculation.
Description of measurement methods and procedures to be applied:	Measurement of combusted amount of captured landfill gas to produce electricity will be continuously performed by using flow meters and all data will be archived electronically. The data will be aggregated monthly and yearly.
QA/QC procedures to be applied:	The flow meters are subject to a regular maintenance and testing regime to ensure accuracy. Records of calibration and maintenance will be archived.
Any comment:	Data will be archived electronically during the crediting period and two years after.

Data / Parameter:	ID. 25 / T
Data unit:	°C
Description:	Temperature of the landfill gas
Source of data to be used:	Temperature meters
Value of data applied for the purpose of calculating expected emission reductions in section B.5	n/a
Description of measurement methods and procedures to be applied:	Measured continuously to determine the density of methane D_{CH_4} . No separate monitoring of temperature is necessary when using flow meters that automatically measure temperature and pressure, expressing LFG volumes in normalized cubic meters.
QA/QC procedures to be applied:	The temperature meters are subject to a regular maintenance and testing regime to ensure accuracy. Records of calibration and maintenance will be archived.
Any comment:	Data will be archived electronically during the crediting period and two years after. No separate monitoring of temperature is necessary when using flow meters that automatically measure temperature and pressure, expressing LFG volumes in normalized cubic meters.

Data / Parameter:	ID. 26 / P
Data unit:	mbar
Description:	Pressure of the landfill gas
Source of data to be used:	Pressure meters
Value of data applied	1,013 mbar



for the purpose of calculating expected emission reductions in section B.5	The value is estimated for the purpose of ex-ante emission reduction calculation.
Description of measurement methods and procedures to be applied:	Measured continuously to determine the density of methane D_{CH_4} . No separate monitoring of pressure is necessary when using flow meters that automatically measure temperature and pressure, expressing LFG volumes in normalized cubic meters.
QA/QC procedures to be applied:	The pressure meters are subject to a regular maintenance and testing regime to ensure accuracy. Records of calibration and maintenance will be archived.
Any comment:	Data will be archived electronically during the crediting period and two years after. No separate monitoring of pressure is necessary when using flow meters that automatically measure temperature and pressure, expressing LFG volumes in normalized cubic meters.

Data / Parameter:	ID. 27 / T_{flare}
Data unit:	°C
Description:	Temperature in the exhaust gas of the enclosed flare
Source of data to be used:	Project participant
Value of data applied for the purpose of calculating expected emission reductions in section B.5	> 500 °C The value is estimated for the purpose of ex-ante emission reduction calculation.
Description of measurement methods and procedures to be applied:	Measurement of a temperature above 500 °C in the exhaust gas stream in the flare indicates that the flare is operating in a reliable way. (Continuously measurement by thermocouple)
QA/QC procedures to be applied:	The thermocouple is replaced or calibrated according to the supplier's manual.
Any comment:	T_{flare} will be used for the calculation of PE_{flare} .

Data / Parameter:	ID. 28 / $\eta_{flare, h}$
Data unit:	%
Description:	Flare efficiency in hour h
Source of data to be used:	Default value as stated under "Tool to determine project emissions from flaring gases containing methane"
Value of data applied for the purpose of calculating expected emission reductions in section B.5	90% The value is estimated for the purpose of ex-ante emission reduction calculation.
Description of measurement methods	The default value for the flare efficiency in the hour h for the enclosed flare will be defined as stated under the "Tool to determine



and procedures to be applied:	project emissions from flaring gases containing methane “Version 01, EB 28 Annex 13. See explanation in B.7.2.
QA/QC procedures to be applied:	
Any comment:	

Data / Parameter:	ID. 29 / w_{CH_4}
Data unit:	% (m ³ CH ₄ / m ³ LFG)
Description:	Methane fraction in the landfill gas
Source of data to be used:	To be measured continuously by project participants using certified equipment
Value of data applied for the purpose of calculating expected emission reductions in section B.5	50% The value is estimated for the purpose of ex-ante emission reduction calculation.
Description of measurement methods and procedures to be applied:	The methane fraction in the landfill gas will be measured continuously by a gas analyser.
QA/QC procedures to be applied:	The gas analysers are subject to a regular maintenance and testing regime to ensure accuracy.
Any comment:	The methane fraction will be measured with separate gas analysers for each stage of extension.

Data / Parameter:	ID. 30 / Operation of the energy plant
Data unit:	Hours/year
Description:	Operation of the energy plant
Source of data to be used:	Project participant
Value of data applied for the purpose of calculating expected emission reductions in section B.5	7,500 The value is estimated for the purpose of ex-ante emission reduction calculation.
Description of measurement methods and procedures to be applied:	Each engine will have an own internal counting device.
QA/QC procedures to be applied:	-
Any comment:	

Data / Parameter:	ID. 31 / $EC_{PJ,lv}$
Data unit:	MWh
Description:	Amount of electricity consumed from the grid as a result of the



	project activity
Source of data to be used:	Electricity meter
Value of data applied for the purpose of calculating expected emission reductions in section B.5	The value is estimated for the purpose of ex-ante emission reduction calculation.
Description of measurement methods and procedures to be applied:	The electricity consumption is measured from electricity meters and aggregated annually.
QA/QC procedures to be applied:	Maintenance and calibration of equipment will be carried out according to recognised procedures
Any comment:	The monitoring of the electricity consumption will be done from the main electricity meter (bi-directional) which measures both electricity delivered to the grid and electricity consumed from the grid.

Data / Parameter:	ID. 32 / $TDL_{j,y}$
Data unit:	-
Description:	Average technical transmission and distribution losses for providing electricity for source j , in year y .
Source of data to be used:	Used for ex-ante: Meter reading protocols from TEIAS. Best available recent reliable and accurate data.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	1% (The actual value of this parameter is below 1%, however rounded up to 1% for ex-ante calculations)
Description of measurement methods and procedures to be applied:	Annually. In the absence of the data from the relevant year, most recent figures should be used, but not older than 5 years.
QA/QC procedures to be applied:	-
Any comment:	-

Data / Parameter:	ID. 33 / $SG_{a,y}$
Data unit:	$m^3/year$
Description:	Stack volume flow rate
Source of data to be used:	Project participant
Value of data applied for the purpose of calculating expected emission reductions in	For ex-ante estimation the stack emissions from anaerobic digestion is neglected.



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section B.5	
Description of measurement methods and procedures to be applied:	The stack gas flow rate is either directly measured or calculated from other variables where direct monitoring is not feasible. Monitoring will be performed periodically (at least quarterly) from one stack of each type.
QA/QC procedures to be applied:	Maintenance and calibration of equipment will be carried out according to recognised procedures.
Any comment:	



Data / Parameter:	ID. 34 / MC_{N2O,a,y}
Data unit:	tN ₂ O/m ³
Description:	Concentration of N ₂ O in stack gas
Source of data to be used:	Project participant
Value of data applied for the purpose of calculating expected emission reductions in section B.5	For ex-ante estimation the stack emissions from anaerobic digestion is neglected.
Description of measurement methods and procedures to be applied:	Monitoring will be carried out at least quarterly
QA/QC procedures to be applied:	Maintenance and calibration of equipment will be carried out according to recognised procedures.
Any comment:	

Data / Parameter:	ID. 35 / MC_{CH4,a,y}
Data unit:	tCH ₄ /m ³
Description:	Concentration of CH ₄ in stack gas
Source of data to be used:	Project participant
Value of data applied for the purpose of calculating expected emission reductions in section B.5	For ex-ante estimation the stack emissions from anaerobic digestion is neglected.
Description of measurement methods and procedures to be applied:	Monitoring will be carried out at least quarterly
QA/QC procedures to be applied:	Maintenance and calibration of equipment will be carried out according to recognised procedures.
Any comment:	



Data / Parameter:	ID. 36 / W_x																
Data unit:	tonnes																
Description:	Total amount of organic waste prevented from disposal and fed into the anaerobic digester in year x.																
Source of data to be used:	Project participant																
Value of data applied for the purpose of calculating expected emission reductions in section B.5	<table border="1"> <thead> <tr> <th>Year</th><th>Amount (tonnes)</th></tr> </thead> <tbody> <tr><td>2011</td><td>113,150</td></tr> <tr><td>2012</td><td>229,950</td></tr> <tr><td>2013</td><td>229,950</td></tr> <tr><td>2014</td><td>229,950</td></tr> <tr><td>2015</td><td>229,950</td></tr> <tr><td>2016</td><td>229,950</td></tr> <tr><td>2017</td><td>229,950</td></tr> </tbody> </table>	Year	Amount (tonnes)	2011	113,150	2012	229,950	2013	229,950	2014	229,950	2015	229,950	2016	229,950	2017	229,950
Year	Amount (tonnes)																
2011	113,150																
2012	229,950																
2013	229,950																
2014	229,950																
2015	229,950																
2016	229,950																
2017	229,950																
Description of measurement methods and procedures to be applied:	The amount will be measured continuously and aggregated at least annually.																
QA/QC procedures to be applied:	The total amount waste fed into the anaerobic digester will be weighed with a belt scale, especially designed to weigh materials which are carried on conveyers. The scale will be subject to calibration in accordance with the suppliers specifications																
Any comment:																	

Data / Parameter:	ID. 37 / $p_{n,i,x}$		
Data unit:	%		
Description:	Weight fraction of the waste type j in the sample n collected during the year x		
Source of data to be used:	Project participant		
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Wood Paper & Cb Food waste/sewage sludge Non food organics Inorganic, inert waste	4% 9% 74% 8% 5%	For ex-ante calculation the following values were applied:
Description of measurement methods and procedures to be applied:	The waste prevented from disposal, using the waste categories j, as provided in the table for DOC_j and k_j will be sampled and each waste fraction will be weighed.		
QA/QC procedures to be applied:	The size and frequency of sampling will be statistically significant with a maximum uncertainty range of 20% at a 95% confidence level.		



	The sampling will be undertaken at least four times a year.
Any comment:	



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Data / Parameter:	ID. 38 / z
Data unit:	-
Description:	Number of samples collected during the year x
Source of data to be used:	Project participant
Value of data applied for the purpose of calculating expected emission reductions in section B.5	n.a.
Description of measurement methods and procedures to be applied:	The sampling will take place at least quarterly.
QA/QC procedures to be applied:	
Any comment:	This parameter will only be monitored if the waste prevented from disposal includes several waste categories j, as categorized in tables for DOC_j and k_j .

Data / Parameter:	ID. 39 / MB _y							
Data unit:	tCO _{2e}							
Description:	Methane produced in the landfill in the absence of the project activity in year y.							
Source of data to be used:	Calculated as per the “Tool to determine methane emissions avoided from dumping waste at a solid waste disposal site” version 4.							
Value of data applied for the purpose of calculating expected emission reductions in section B.5	2010	2011	2012	2013	2014	2015	2016	2017
	0	5,220	15,551	25,336	34,605	43,386	51,706	59,589
	Value is estimated for the purpose of ex-ante emission reduction calculation.							
Description of measurement methods and procedures to be applied:	As per the “Tool to determine methane emissions avoided from dumping waste at a solid waste disposal site” version 5.							
QA/QC procedures to be applied:	As per the “Tool to determine methane emissions avoided from dumping waste at a solid waste disposal site” version 5.							
Any comment:	MB _y is part of the baseline emissions produced in the absence of the Anaerobic Digestion system defined under the project activity and calculated as per AM0025.							

Data / Parameter:	ID. 40 / EG_{d,y}
Data unit:	MWh
Description:	The amount of electricity generated utilizing the biogas and LFG.
Source of data to be	Electricity meters



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used:	
Value of data applied for the purpose of calculating expected emission reductions in section B.5	115,500 MWh (after reaching 15,4 MW installed capacity) The value is estimated for the purpose of ex-ante emission reduction calculation.
Description of measurement methods and procedures to be applied:	The electricity generated from utilization of biogas and LFG is measured from electricity meters continuously.
QA/QC procedures to be applied:	Maintenance and calibration of equipment will be carried out according to the instructions of the manufacturer.
Any comment:	

Data / Parameter:	ID. 41 / AF
Data unit:	%
Description:	Methane destroyed due to regulatory or other requirements
Source of data to be used:	“Environmental Law” Law number: 2827
Value of data applied for the purpose of calculating expected emission reductions in section B.5	The value is fixed to “0” for the first crediting period.
Description of measurement methods and procedures to be applied:	The amendments to the “Environmental Law” will be monitored at renewal of crediting period and the AF will be predetermined accordingly.
QA/QC procedures to be applied:	n.a.
Any comment:	

Data / Parameter:	ID. 42 / LFG usage
Data unit:	-
Description:	Percentage of LFG applied to PGUs divided by the total amount of LFG captured.
Source of data to be used:	Data will be derived from monitoring parameters ID.21 and ID. 23
Description of measurement methods and procedures to be applied:	The percentage of LFG applied to PGU divided by the total amount of LFG captured will be calculated using data already covered by monitoring parameters ID.21 and ID.23. Thus no additional measurements are necessary.
QA/QC procedures to be applied:	



Data / Parameter:	ID. 43 / PE_{flare,y}
Data unit:	tCO ₂ e
Description:	Project emissions from flaring of the residual gas stream in year y
Source of data to be used:	Calculated as per the “Tool to determine project emissions from flaring gases containing methane” version 01.
Description of measurement methods and procedures to be applied:	As per “Tool to determine project emissions from flaring gases containing methane” version 01.
QA/QC procedures to be applied:	As per “Tool to determine project emissions from flaring gases containing methane” version 01.
Any Comment	-

Data / Parameter:	ID. 44 / A_{ci,x}
Data unit:	tonnes/year
Description:	Amount of residual waste type “ci” from anaerobic digestion
Source of data to be used:	Project Participant
Description of measurement methods and procedures to be applied:	Weigh bridge
QA/QC procedures to be applied:	Weighbridge will be subject to periodic calibration in accordance with the suppliers specifications
Any Comment	

Data / Parameter:	ID. 45 / Other flare operation parameters
Data unit:	
Description:	Data and parameters that are required to monitor whether the flare operates within the range of operating conditions according to manufacturer’s specifications.
Source of data to be used:	Project participant
Description of measurement methods and procedures to be applied:	n.a.
QA/QC procedures to be applied:	n.a.
Any Comment	

Data / Parameter:	ID. 46 / Utilization Ratio
Data unit:	%
Description:	Ratio between the volume of the biogas captured, on an annual basis, and used to deliver energy services.
Source of data to be	Project participant



used:	
Description of measurement methods and procedures to be applied:	The utilization ratio will be calculated based on the monitoring parameters LFG _{total} (ID22) and LFG _{electricity} (ID24).
QA/QC procedures to be applied:	In line with the requirements of Gold Standard, at least 65% of the volume of the biogas captured, on an annual basis, is used to deliver energy services.
Any Comment	

B.7.2. Description of the monitoring plan:

>>

Monitoring Plan

Monitoring will be carried out following the procedures set by the consolidated baseline methodology ACM0001 version 11 and AM0025 version 12, and all applicable tools of the above explained parameters. The monitoring consists of:

- Amount of landfill gas combusted in power generation units
- Amount of landfill gas flared
- Temperature in the exhaust gas of the enclosed flares to estimate the flare efficiency
- 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
- Project emissions due to Anaerobic treatment
- The amount and composition of fresh waste avoided from dumping waste at the solid waste disposal site

Measuring of exported electricity

The main meter for the monitoring of the electricity is at grid connection. Monthly protocols will be signed by project participants and grid operator and stored. At the stage of PDD writing it was planned to monitor the amount of electricity produced by each type of gas directly at the engines.

Flare efficiency

Temperature and inlet flow rate of LFG in normal operation will be monitored according to manufacturer's specification.

In case of enclosed flares and use of the default value for the flare efficiency, the efficiency in the hour h ($n_{\text{flare}, h}$) is:

- 0% if the temperature in the exhaust gas of the flare (T_{flare}) is below 500°C for more than 20 minutes during the hour h .
- 50% if the temperature in the exhaust gas of the flare (T_{flare}) is above 500°C for more than 40 minutes during the hour h , but the manufacture's specifications on proper operation of the flare are not met at any point in time during the hour h .

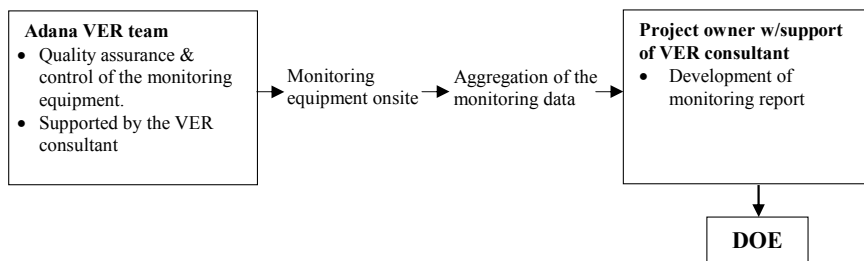


- 90% if the temperature in the exhaust gas of the flare (T_{flare}) is above 500°C for more than 40 minutes during the hour h and the manufacture's specifications on proper operation of the flare are met continuously during the hour h.

Responsibilities for monitoring

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

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



Registration of the monitored data

The Adana 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. Equipments and facilities will be subject to a regular maintenance and testing regime to ensure accuracy following supplier's manual.

B.8. Date of completion of the application of the baseline study and monitoring methodology and the name of the responsible person(s)/entity(ies):

>>



Date of completing the final draft of this baseline section:
11/08/2011

Name of person/entity determining the baseline:

The baseline has been prepared by OakDanışmanlık in consultation with ITC Invest, Trading & Consultant AG

Company name: OakDanışmanlık
Visiting Address: Acıbadem Mah. Şemibey Sok. Belkıs Apt. N:3 D:6
Kadıköy / İstanbul, TURKEY
Contact Person: Ömer Akyürek
Telephone number: +90 216 3471671
E-mail: oak@oakdanismanlik.com

SECTION C. Duration of the project activity / crediting period

C.1. Duration of the project activity:

C.1.1. Starting date of the project activity:

>>
24/08/2009

C.1.2. Expected operational lifetime of the project activity:

>>
30 years

C.2. Choice of the crediting period and related information:

C.2.1. Renewable crediting period:

C.2.1.1. Starting date of the first crediting period:

>>
01/06/2010⁵³

C.2.1.2. Length of the first crediting period:

>>
7 years

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

>>
N/A

C.2.2.2. Length:

>>

⁵³ Start of operation landfill gas extraction and utilization for electricity generation.



N/A

SECTION D. Environmental impacts

>>

D.1. Documentation on the analysis of the environmental impacts, including transboundary impacts:

>>

An Environmental Impact Assessment⁵⁴ has been conducted by the Adana Greater Municipality before the landfill was transferred to the Project Participant. The EIA report has been submitted on 15.05.2007 to the Ministry of Environment. Based on the Environmental Impact Assessment, Ministry of Environment and Forestry / General Directorate of Environmental Impact Assessment and Planning has granted “EIA positive” license on 12/06/2007 (considered as the date of EIA). Therefore the Project Participant did not require an EIA. In line with the requirements of “Regulation on Environmental Impact Assessment”, the Project Participant has been exempted from performing an Environmental Impact Assessment.⁵⁵

D.2. If environmental impacts are considered significant by the project participants or the host Party, please provide conclusions and all references to support documentation of an environmental impact assessment undertaken in accordance with the procedures as required by the host Party:

>>

A summary of the outcomes from the EIA conducted by Adana Greater Municipality is as follows:

With the implementation of the project the following benefits will be gained;

- Provide a more effective and quality solid waste management system for the public,
 - Raise the environmental awareness,
 - Utilization of packaging wastes and biodegradable wastes in higher rates,
 - Raise the environmental quality,
 - Bringing segregated wastes to the economy,
 - Despite of healthy management, reduction in cost per storage area.
-
- Especially thanks to the disposal of landfill gas in these systems, the negative effects of the methane gas, which constitutes majority of the gas volume, will be eliminated.
 - Plant species within the project area are not endangered, under protection or endemic ones. They are the cosmopolitan common ones
 - The project area does not include any feeding, inhabiting and breeding areas. The species have very wide living areas and there are alternative suitable habitats for them within close proximate of the project area.
 - There is no flora or fauna included in the Bern Convention or Red Data Book within the project area. Therefore, the facility has no negative effect on the natural ecological system.
 - The project site and surrounded areas do not include any national parks, natural parks, wetland, natural monuments, nature protection areas, wildlife protection areas, wild animal breeding area,

⁵⁴ The EIA Report is available to the DOE.

⁵⁵ “EIA Positive” license has been provided to the validating DOE



cultural estates, natural estates, protected zones, areas under protection by Bosphorus Law, bio-genetic reserve areas, biosphere reserves, special environment protection areas, special protection areas, protection areas related with drinking and potable water, tourism area and centres and other areas under protection.

- The odour to be aroused from the landfill area will be rapidly decreased and lose its significance by the reduction of the biodegradable organic material ratio under the aim of the project. Besides, the reduction of the biodegradable organic material ratio will alter the characteristics of the leachate, pollution ratio will be decreased and the odor causing emission of the leachate will be lessened. odor problem to be faced during the operation phase of the facility is a big problem. Because, the climate is humid and hot in Adana. The dominant wind direction in the project site is north north-west. The nearest side of the project, there is a housing estate at 1200 m north-west of the area. In order to decrease the odor problem in this area, laying waste will be covered by soil daily and its contact with the air will be prevented. Since the media is airy (aerobic) until the daily covering is performed, there will not be a disturbing odor emission (except the wastes' own odor). The daily cover soil will prevent the odor to be spread and will act as a filter.
- There is no agricultural facility in the close approximate.
- In the old dumping area, gas is released to atmosphere. However, the polluting effect of the methane is not eliminated. To stop this action, gases will be sent to burning or co-generation facilities. Therefore active collection system will be applied.
- The leachate will be discharged and treated according to the environmental regulations.

In general there are no significant negative impacts identified under the Environmental Impact Assessment conducted by the Greater Municipality of Adana and a EIA Positive License has been granted on 12/06/2007.

SECTION E. Stakeholders' comments

>>

E.1. Brief description how comments by local stakeholders have been invited and compiled:

>>

As required by the Gold Standard a preliminary consultation and a second round consultation (stakeholders 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 Passport⁵⁶.

Local Stakeholder Consultation (LSC)

The Local Stakeholders Consultation Meeting was held on 30th of May 2009 at a restaurant close to the landfill. The stakeholders were invited by means of email, public announcements by the Muhtar (local chief), newspaper announcements, telephone and email. In order to ensure that all the invitations were received and responded upon, follow up calls were made. In all 40 attended the meeting, among them local people, the village headmans, scavengers, ITC employees and regional administrators.

⁵⁶ Gold Standard v2 rules and requirements are applicable to the proposed project activity.



The meeting was opened by Tuğba Kirer from ITC, with an introduction on the purpose of the consultation and a presentation of the project. The non-technical summary was distributed to the participants, as well as the participant list. Throughout the meeting, the participants were allowed to raise any questions, concerns or recommendations. The Blind Sustainable Development Matrix exercise was performed with the stakeholders, enabling a discussion on relevant indicators and their impacts. Finally, the participants filled out evaluation forms, in which they were encouraged to express their opinion on the monitoring of the parameters, since there was no interest to do so under the Blind SD Matrix exercise. The meeting was held in Turkish, the local language.

Stakeholder Feedback Round (SFR)

The stakeholders feedback round is a two month period, where all necessary documents are made publically available. On 11st of May 2011, the translation of the LSC report and the GS Passport have been provided as hard copies to the locals through the muchtars and were invited to provide comments on the documents. ITC has also announced the SFR inside the company for employees feedback with making available documents at the secretary.

Furthermore the documents were made available on the webpage of ITC www.itcturkiye.com as well for feedback. The documents were also submitted to the stakeholders invited to the Local Stakeholders Consultation Meeting and were asked kindly to provide a feedback on the project. The feedback round has ended on 11st of July 2011 with no negative comments from the stakeholders.

E.2. Summary of the comments received:

>>

Local Stakeholder Consultation:

The general outcome of the Local Stakeholders 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.

Details on the outcome of the Local Stakeholders Consultation Meeting could be found under the LSC report.

Stakeholder Feedback Round:

The stakeholders feedback round is a two month period, where all necessary documents are made publically available. On 11st of May 2011, the translation of the LSC report and the GS Passport have been provided as hard copies to the locals through the muchtars and were invited to provide comments on the documents. ITC has also announced the SFR inside the company for employees feedback with making available documents at the secretary.

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E.3. Report on how due account was taken of any comments received:

>>

Local Stakeholder Consultation:

Details on the outcome of the Local Stakeholders Consultation Meeting could be found under the LSC report.

Stakeholder Feedback Round:

The stakeholders feedback round is a two month period, where all necessary documents are made publically available. On 11st of May 2011, the translation of the LSC report and the GS Passport have been provided as hard copies to the locals through the muchtars and were invited to provide comments on the documents. ITC has also announced the SFR inside the company for employees feedback with making available documents at the secretary.

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Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY.

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Represented by:	Mr. Erdoğan Göğen
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Salutation:	
Last name:	
Middle name:	
First name:	
Department:	
Mobile:	

Organization:	OakDanışmanlık
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Annex 2

INFORMATION REGARDING PUBLIC FUNDING

**Annex 3****BASELINE INFORMATION**

2009			
Plant Name	Fuel Type	Added Installed Capacity MW	Generation MWh
Ak Gıda San. Ve Tic. A.Ş. (Pamukova)	Natural Gas	7.50	61,000
Aksa Akrilik Kimya San. A.Ş. (Yalova)	Natural Gas	70.00	539,000
Aksa Enerji (Antalya)	Natural Gas	16.20	124,740
Aksa Enerji (Antalya)	Natural Gas	300.00	2,310,000
Aksa Enerji (Antalya)	Natural Gas	300.00	2,310,000
Aksa Enerji (Manisa)	Natural Gas	10.50	83,144
Antalya Enerji	Natural Gas	41.80	302,096
Arenko Elektrik Üretim A.Ş. (Denizli)	Natural Gas	12.00	84,000
Bil Enerji (DG+M)(Balgat)	Natural Gas	36.60	255,000
Cam İş Elektrik	Natural Gas	126.10	1,008,000
Çelikler Taah. İnş. (Rixox Grand)	Natural Gas	2.00	16,000
Dalsan Alçı San. Ve Tic A.Ş.	Natural Gas	1.20	9,000
Delta Enerji Üretim ve Tic. A.Ş.	Natural Gas	47.00	365,817
Delta Enerji Üretim ve Tic. A.Ş.	Natural Gas	13.00	101,183
Desa Enerji Elektrik Üretim A.Ş.	Natural Gas	9.80	70,000
E. Şehir. End. Enerji (DG+M)(Eskişehir-2)	Natural Gas	59.00	452,000
Ege Birleşik Enerji (LPG+DG+M)(Aliağa)	Natural Gas	12.80	107,000
Entek Köseköy (İztek)	Natural Gas	0.80	6,366
Entek Köseköy (İztek)	Natural Gas	36.30	288,876
Falez Elektrik Üretim A.Ş.	Natural Gas	11.70	88,000
Global Enerji (Pelitlik)	Natural Gas	8.60	65,665
Gül Enerji Elkt. Üret. Sn. Ve Tic. A.Ş.	Natural Gas	24.30	170,000
Habaş Aliağa	Natural Gas	224.50	1,796,000
Hayat Kağıt	Natural Gas	7.50	56,000
Kasar Dual Tekstil San. A.Ş. (Çorlu)	Natural Gas	5.70	38,000
Ken Kipaş Elektrik Üretim (Karen)	Natural Gas	41.80	180,000
Ken Kipaş Elkt. Ür. (Karen) (K.Maraş)	Natural Gas	17.50	75,359
Maksi Enerji EeLEKTRİK Üretim A.Ş.	Natural Gas	7.70	55,000
Marmara Pamuklu Mens. Sn. Tic. A.Ş.	Natural Gas	34.90	271,533
Mauri Maya San A.Ş.	Natural Gas	0.30	2,478
Mauri Maya San A.Ş.	Natural Gas	2.00	16,522
Modern Enerji (B. Karıştırıcı)	Natural Gas	96.80	
MOSB Enerji Elektrik Üretim Ltd. Şti.	Natural Gas	84.80	595,702
Nuh Çimento San. Tic. A.Ş.	Natural Gas	47.00	329,000
Rasa Enerji (VAN)	Natural Gas	78.60	500,000
Selkasan Kağıt Paketleme	Natural Gas	9.90	73,000



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Sönmez Elektrik (Uşak)	Natural Gas	8.70	67,057
Şahinler Enerji (Çorlu/Tekirdağ)	Natural Gas	26.00	185,000
TAV İstanbul Terminal İşletme A.Ş.	Natural Gas	3.30	27,612
TAV İstanbul Terminal İşletme A.Ş.	Natural Gas	6.50	54,388
Tesko Kipa Kitle Paz. Tic. Ve Gıda A.Ş.	Natural Gas	2.30	18,000
Yurtbay Elektrik Üretim A.Ş. (DG+M)	Natural Gas	6.90	50,000
Zorlu Enerji (B. Karşıtıran)	Natural Gas	49.50	394,970
Natural Gas 2009		1,909.40	13,602,509

Erdemir (Ereğli-Zonguldak)	Fuel Oil	39.20	240,000
Habaş Bilecik Paşalar	Fuel Oil	18.00	144,000
Habaş İzmir Habaş	Fuel Oil	36.00	288,000
Petkim (Aliağa)	Fuel Oil	222.00	1,554,000
Petkim (Aliağa)	Fuel Oil	52.00	364,000
Silopi Elektrik Üretim A.Ş.	Fuel Oil	44.80	315,000
Süper Film (G. Antep)	Fuel Oil	25.30	203,000
Tire Kutsan (Tire)	Fuel Oil	8.00	37,000
Tüpraş Rafineri (Aliağa/İzmir)	Fuel Oil	24.70	171,777
Tüpraş O.A. Rafineri (Kırıkkale)	Fuel Oil	10.00	70,000
Silopi Elektrik Üretim A.Ş.	Fuel Oil	135	945,000
Fuel Oil 2009 Total		615.00	4,331,777

Alkim Alkali Kimya	Lignite	0.40	3,000
Lignite 2009 Total		0.40	3,000

İçdaş Çelik	Coal	135.00	961,667
İçdaş Çelik	Coal	135.00	961,667
Coal 2009 Total		270.00	1,923,333

Akçay Hes Elektrik Üretim (Akçay HES)	Hydro	28.80	45,000
Akua Enerji (Kayalık Reg ve HES)	Hydro	5.80	20,000
Anadolu Elektrik (Çakırlar HES)	Hydro	16.20	28,000
Bağışlı REG ve HES (Ceykar Elekt.)	Hydro	9.90	15,720
Bağışlı REG ve HES (Ceykar Elekt.)	Hydro	19.70	31,280
Bereket Enerji (Koyul Hisar)	Hydro	42.00	155,000
Beyobası En. Ür. A.Ş. (Sırma HES)	Hydro	5.90	11,000
Cindere HES (Denizli)	Hydro	19.10	30,000
Değirmenüstü En (Kahramanmaraş)	Hydro	12.90	17,378
Denizli Elektrik (EGE I HES)	Hydro	0.90	2,000
Elestaş Elektrik (Yaylabel HES)	Hydro	5.10	10,000
Elestaş Elektrik (Yazı HES)	Hydro	1.10	3,000
Erva Enerji (Kabaca Reg ve HES)	Hydro	4.20	7,412



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Erva Enerji (Kabaca Reg ve HES)	Hydro	4.20	7,412
Filyos Enerji (Yalnızca Reg ve HES)	Hydro	14.40	33,000
Kalen Enerji (Kalen I II HES)	Hydro	15.70	23,575
Karel Enerji (Pamukova)	Hydro	9.30	40,000
Kayen Alfa Enerji (Kaletepe HES)	Hydro	10.20	17,000
Kısıık	Hydro	9.60	20,000
Lamas II IV HES (TGT Enerji Üretim)	Hydro	35.70	71,000
Obruk HES	Hydro	212.40	337,000
Öztay Enerji (Günayşe Reg ve HES)	Hydro	8.30	14,000
Özyakut Elek. Ü. A.Ş. (Güneşli HES)	Hydro	0.60	1,333
Özyakut Elek. Ü. A.Ş. (Güneşli HES)	Hydro	1.20	2,667
Reşadiye 3 HES (Turkon MNG Elekt.)	Hydro	22.30	88,000
Sarıtepe HES (Genel Dinamik Sis. El)	Hydro	2.50	4,592
Sarıtepe HES (Genel Dinamik Sis. El)	Hydro	2.50	4,592
Şirikçioğlu El. (Kozak Bendi ve HES)	Hydro	4.40	7,000
Taşova Yenidereköy HES (Hameka A.Ş.)	Hydro	2.00	6,000
Tektuğ (Erkenek)	Hydro	6.00	14,400
Tektuğ (Erkenek)	Hydro	6.50	15,600
Tocak I HES (Yurt Enerji Üretim Sn.)	Hydro	4.80	6,000
Tüm Enerji (Pınar Reg ve HES)	Hydro	30.10	65,000
Uzunçayır HES (Tunceli)	Hydro	27.30	49,000
Yapısan (Karıca Reg ve Darıca HES)	Hydro	48.50	77,000
Yapısan (Karıca Reg ve Darıca HES)	Hydro	48.50	77,000
Yeşilbaş Enerji (Yeşilbaş HES)	Hydro	14.00	26,000
ypm Gölova HES (Suşehri / Sivas)	Hydro	1.10	2,000
YPM Sevindik HES (Suşehri / Sivas)	Hydro	5.70	18,000
Hydro 2009 Total		719.40	1,402,961

Gürmat Elektrik (Gürmat Jeotermal)	Geothermal	47.40	313,000
Alize Enerji (Sarıkaya RES) (Şarköy)	Wind	28.80	96,000
Baki Elektrik (Şamlı Rüzgar)	Wind	36.00	176,000
Baki Elektrik (Şamlı Rüzgar)	Wind	33.00	161,333
Belen Elektrik Belen Rüzgar-Hatay	Wind	15.00	47,500
Belen Elektrik Belen Rüzgar-Hatay	Wind	15.00	47,500
Borasko Enerji (Bandırma RES)	Wind	21.00	83,533
Borasko Enerji (Bandırma RES)	Wind	24.00	95,467
Cargill Tarım ve Gıda San. Tic. A.Ş.	Biogas	0.10	700
Ortadoğu Enerji (Kömürcüoda)	Waste	5.80	45,000
Ortadoğu Enerji (Oda Yeri)	Waste	4.20	33,071
Ortadoğu Enerji (Oda Yeri)	Waste	5.70	44,882
Ütopya Elektrik (Düzova RES)	Wind	15.00	46,000
Renewable 2009 Total		253.80	1,189,986.09

2009 Total		3,768.00	22,453,566
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2008			
Plant Name	Fuel Type	Added Installed Capacity MW	Generation MWh
MB Şeker Nişasta San A.Ş	Natural Gas	8.80	0
Aksa Enerji (Antalya)	Natural Gas	183.80	133,736
Aksa Enerji (Manisa)	Natural Gas	52.38	79,183
Antalya Enerji (İlave)	Natural Gas	17.46	85,341
Ataç İnşaat San. A.S.B. (Antalya)	Natural Gas	5.40	10
Bahçivan Gıda (Lüleburgaz)	Natural Gas	1.17	0
Can Enerji (Çorlu Tekirdağ) (İlave)	Natural Gas	52.38	255,164
Four Seasons Otel (Atik Paşa Tur A.Ş.)	Natural Gas	1.17	0
Fritolay Gıda San. Ve Tic. A.Ş. (İlave)	Natural Gas	0.01	0
Melike Tekstil (Gaziantep)	Natural Gas	1.58	0
Misis Apre Tekstil Boya En. San.	Natural Gas	2.00	5,324
Modern Enerji (Lüleburgaz)	Natural Gas	13.40	70,453
Polat Turz (Polat Reniassance Ist. Ot.)	Natural Gas	1.60	490
Yıldız Sunta (Uzunçiftlik Köseköy)	Natural Gas	22.63	136,018
Sönmez Elektrik	Natural Gas	8.73	61
Natural Gas 2008		372.50	765,780

Karkey (Silopi 5) (154kV) (İlave)	Fuel Oil	14.78	16,362
Fuel Oil 2008 Total		14.78	16,362

Akköy Enerji (Akköy I HES)	Hydro	101.94	21,608
Alp Elektrik (Tınaztepe) Antalya	Hydro	7.69	9,245
Cansu Elektrik (Murgul/Artvin)	Hydro	9.18	12,518
Çaldere Elk. (Çaldere HES) Dalaman Muğla	Hydro	8.74	11,153
Daren HES Elkt. (Seyrantepe Barajı ve HES)	Hydro	49.70	14,370
Değirmenüstü En. (Kahramanmaraş)	Hydro	25.70	0
Gözüde HES (Temsal Elektrik) Bursa	Hydro	2.40	6,107
H.G.M. Enerji (Keklice HES) (Yeşilyurt)	Hydro	8.67	120
Hamzalı HES (Turkon MNG Elektrik)	Hydro	16.70	2,936
Hidro KNT. (Yukarı Manahoz Reg. Ve HES)	Hydro	22.40	13,772
İç-En Elk. (Çalkışla Regülatörü ve HES)	Hydro	7.66	3,364
Kalen Enerji (Kalen II Regülat. Ve HES)	Hydro	15.65	10,281
Maraş Enerji (Fırıns Regülatörü ve HES)	Hydro	7.22	0
Sarmaşık I HES (Fetaş Fethiye Enerji)	Hydro	21.04	1,472
Sarmaşık II HES (Fetaş Fethiye Enerji)	Hydro	21.58	1,221
Torul	Hydro	105.60	18,551
Yeşil Enerji Elektrik (Tayfun HES)	Hydro	0.82	0
Zorlu Enerji (Mercan)	Hydro	1.28	1,427
Hydro 2008 Total		433.97	128,145



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2008 Total	821,25	910.286
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2007			
HABAŞ (Aliağa-ilave)	Natural Gas	9.10	72,800
Moder Enerji	Natural Gas	5.20	38,717
Arenko	Natural Gas	0.70	5,567
Altınmarka Gıda	Natural Gas	0.10	806
Tekboy Enerji	Natural Gas	0.10	727
Velsan Akrilik	Natural Gas	0.10	263
Acıbadem Sağlık Kadıköy	Natural Gas	0.50	6,250
Acıbadem Sağlık Kozyatağı	Natural Gas	0.60	5,000
Acıbadem Sağlık Bursa	Natural Gas	1.30	11,000
Akateks Tekstil Sanayi	Natural Gas	1.80	14,000
Flokser Tekstil Poliser	Natural Gas	2.10	17,000
Flokser Tekstil Süetser	Natural Gas	2.10	17,000
Fritolay Gıda	Natural Gas	0.50	4,000
Kıvanç Tekstil	Natural Gas	3.90	33,000
Kil San	Natural Gas	3.20	25,000
Superboy Boya San	Natural Gas	1.00	8,000
Swiss Hotel	Natural Gas	1.60	11,000
TAV Esenboğa	Natural Gas	3.90	33,000
Nuh Enerji 2	Natural Gas	73.00	514,000
Boğazlıyan Şeker	Liquid + Natural Gas	16.40	43,075
Kartonsan	Liquid + Natural Gas	5.00	40,000
Eskişehir End. Enerji	Liquid + Natural Gas	3.50	26,814
Eskişehir Şeker	Liquid + Natural Gas	2.90	7,617
İgşaş	Liquid + Natural Gas	2.20	15,200
Bil Enerji	Natural Gas	0.10	697
BİS Enerji Üretim	Natural Gas	43.00	354,802
Aliağa Çakmaktepe Enerji	Natural Gas	34.80	278,000
Bis Enerji Üretim	Natural Gas	28.30	233,510
BİS Enerji Üretim	Natural Gas	48.00	396,059
Bosen Enerji Elektrik	Natural Gas	142.80	1,071,000
Sayenerji Elektrik Üretim A.Ş.	Natural Gas	5.90	47,000
T Enerji Üretim A.Ş.	Natural Gas	1.60	13,000
Natural Gas 2007		445.30	3,343,903

Akteks	Fuel Oil	0.80	2,504
Süper filmcilik	Fuel Oil	0.10	802
Zorlu Enerji Kayseri	Fuel Oil	7.20	54,964
Siirt	Fuel Oil	25.60	190,000
Mardin Kızıltepe	Fuel Oil	34.10	106,734
Karen	Fuel Oil	24.30	180,000
İdil 2	Fuel Oil	24.40	180,000
Desa	Naphta	0.70	4,623
Dentaş	Naphta	0.30	2,280



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Ataer Enerji	Naphta	0.10	566
	Fuel Oil 2007 Total	117.60	722,473

Uşak Şeker	Lignite	1.70	3,084
	Lignite 2007 Total	1.70	3,084

Borçka HES	Hydro	300.60	600,000
Tektuğ	Hydro	5.00	20,000
YPM Ener Yat A.S. Altintepe Hidro	Hydro	4.00	10,000
YPM Ener Yat A.S. Beypınar Hidro	Hydro	3.60	9,000
YPM Ener Yat A.S. Konak Hidro	Hydro	4.00	1,000
Kurteks Tekstil	Hydro	2.40	19,000
Iskur Tekstil	Hydro	4.60	4,000
Özgür Elek. A.Ş.	Hydro	6.30	27,216
Özgür Elek. A.Ş. (ilave)	Hydro	6.30	27,216
	Hydro 2007 Total	336.80	717,432

2007 Total		901.40	4.786.892
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2006			
Ekoten Tekstil GR-I	Natural Gas	1.93	14,015
Erak Giyim GR-I	Natural Gas	1.37	9,750
Alarko Altek GR-III	Natural Gas	21.89	158,302
Aydın Örne GR-I	Natural Gas	7.52	60,160
Nuh Enerji 2 GR-II	Natural Gas	26.08	180,059
Marmara Elektrik (Çorlu) GR-I	Natural Gas	8.73	62,499
Entek GR-IV	Natural Gas	47.62	378,198
Else Tekstil (Çorlu) GR-I II	Natural Gas	3.16	24,688
Sönmez Elektrik (Çorlu) GR-I II	Natural Gas	17.46	125,712
Denizli Çimento (Düzeltilme)	Natural Gas	0.45	3,179
Kastamonu Entegre (Balıkesir) GR I	Natural Gas	7.52	54,144
Boz Enerji GR I	Natural Gas	8.73	70,241
Amylum Nişasta (Adana)	Natural Gas	14.25	33,881
Şık Makas (Çorlu) GR I	Natural Gas	1.58	12,838
Antalya Enerji GR I II III IV	Natural Gas	34.92	245,140
Hayat TEM ve Sağlık GR I II	Natural Gas	15.04	108,288
Eroğlu Giyim (Çorlu) GR I	Natural Gas	1.17	8,738
Cam İş Elektrik (Mersin) GR I	Natural Gas	126.10	1,008,000
Yıldız Ent. Ağaç (Kocaeli) GR I	Natural Gas	6.18	39,897
Çerkezköy Enerji GR I	Natural Gas	49.16	389,715
Çırağan Sarayı GR I	Natural Gas	1.32	11,203
Akmaya (Lüleburgaz) GR I	Natural Gas	6.91	50,072
Burgaz (Lüleburgaz) GR I	Natural Gas	6.91	54,078
	Natural Gas 2006	416	3,102,795

Elbistan B GR III	Lignite	360.00	2,340,000
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Elbistan B GR II	Lignite	360.00	2,340,000
Elbistan B GR IV	Lignite	360.00	2,340,000
Lignite 2006 Total		1,080.00	7,020,000

Menderes Elektrik GR-I	Geothermal	7.95	55,657
Adana Atıksu Arıtma Tesisi	Biogaz	0.80	6,023
Ekolojik Enerji (Kemerburgaz) GR I	LFG	0.98	5,880
Ertürk Elektrik Tepe RES GR I	Wind	0.85	1,889
Renewable 2006 Total		11	69,448

Seyhan I II	Hydro	0.30	1,171
Şanlıurfa GR I II	Hydro	51.80	0
Bereket Enerji Gökyar HES 3 Grup	Hydro	11.62	28,048
Molu En. Zamanlı Bahçelik GR I II	Hydro	4.22	10,501
Su Enerji (Balıkesir) GR I II	Hydro	4.60	4,203
Bereket Enerji (Mentaş Reg) GR I II	Hydro	26.60	93,333
Ekin (Başaran HES) (Nazilli)	Hydro	0.60	2,900
Ere (Sugözü rg. Kızıldüz HES) GR I II	Hydro	15.43	7,916
Ere (Aksu Reg. Ve Şahmallar HES) GR I II	Hydro	14.00	6,600
Tektuğ (Kalealtı) GR I II	Hydro	15.00	11,000
Bereket EN. (Mentaş Reg) GR III	Hydro	13.30	46,667
Hydro 2006 Total		157	212,339

2006 Total		1,664.06	10,404,583
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2005			
AKÇA ENERJİ GR-III	Natural Gas	8.73	65,000
BOSEN GR-III	Natural Gas	50.00	350,000
Natural Gas 2005		58.73	415,000

KARKEY(SİLOPİ-4) GR-V	Fuel Oil	6.75	52,000
Fuel Oil 2005 Total		6.75	52,000

2005 Total		65.48	467,000
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Annex 4

MONITORING INFORMATION

