THE GOLD STANDARD:
Project Design Document for Gold Standard Voluntary Offset projects

(GS-VER-PDD)

For more information, please contact The Gold Standard:

http://www.cdmgoldstandard.org
info@cdmgoldstandard.org

phone +41 61 283 09 16
fax +41 61 271 10 10

April 2006

This document was developed by: ECOFYS

The Gold Standard for VERs has received financial support from:

Explanatory information on how to complete the PDD and how to obtain Gold Standard registration can be found in the project developer's manual available on the Gold Standard website.

This template of the PDD is applicable for micro-, small- and large-scale projects. Note that the shaded boxes present information on the Gold Standard VER project development procedures. Project developers should delete these shaded boxes when preparing their PDD.

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

CONTENTS

Annexes

SECTION A. General description of project activity

A.1. Title of the project activity:

>>
Mamak Landfill Waste Management Project – Turkey
Version number of the document: 07
Date: 20.04.2009

A.2. Description of the project activity:

>>
Summary:
The Mamak Landfill Waste Management Project, developed by the Turkish Ankara Branch of "ITC Invest Trading & Consulting A.G." (hereafter referred to as the "project participant") is located at the Mamak landfill site in Ankara the capital city of Turkey. The landfill receives the waste of approximately 3.6 million people living in 6 municipalities of the Ankara Greater Municipality[1]. The landfill has an average depth of 30 meters and covers approximately 1 million square meters. The landfill currently holds 20 million tons of municipal solid waste MSW). Approximately 60% of the waste consists of organic materials. The average daily amount of waste land filled is estimated at 3500 ton/day.

The project participant has acquired the right to commercially operate the Mamak Landfill in 2005. Their vision is to develop the landfill as a "zero waste" landfill, where the environmental impacts of the existing and future land filled waste is limited, or even neutralised. The vision includes two solutions; the first for the existing waste and the second for the fresh waste entering the landfill. The solution for the existing waste is the implementation of a Land Fill Gas (LFG) extraction and utilisation system. For the fresh (or future) waste the envisaged solution is the implementation of a bio-digester and a gasifier. The successful implementation of this vision is considered to be only viable with the income from carbon credits. All of the activities and implementations defined within the frame of the vision can be called as the "generic project".

To lower the financial and technical risks, the project participant has decided to implement the generic project in several phases. The first two phases include the installation of a LFG extraction and utilisation system and the required civil works (covering of the landfill and installation of a leachate draining system). Furthermore these phases include the construction of a sorting facility and recycling centre. The successful implementation of the first two phases, which depends on the income from carbon credits creates the financial stability required for the implementation of the third phase of the "zero-waste" vision. This third phase includes the installation of an anaerobic digester and a gasification system.
The proposed project activity involves:

- covering of the landfill area;
- gas engines (utilization of the recovered LFG, biogas from anaerobic digestion, and syngas from gasification);
- gas extraction system;
- leachate drainage system;
- flaring system;
- anaerobic digester system;
- gasification system;
- recycling centre.

[1] The municipalities served by Mamak Landfill are namely; Golbasi, Mamak, Cankaya, Kecioren, Yenimahalle and Altındag Municipalities. At total Ankara Greater Municipality have 8 municipalities under.

However the gasification system is not eligible under the Gold Standard rules and therefore no VER credits will be claimed from emission reductions from gasification[2]. This condition creates a difference between the generic project activities and to be called the VER project activities, which defines the activities resulting in emission reduction credits.

The VER project activity involves:

- covering of the landfill area;
- gas engines (utilization of the recovered LFG, biogas from anaerobic digestion);
- gas extraction system;
- flaring system;
- anaerobic digester system;

For the purpose to follow a consistent description of terminology, hereafter the generic project will be referred as "the project" and the VER project activity will be stated specifically where applicable.

The proposed project will reduce GHG emissions in two ways:

1. By recovering, preventing and utilisation of methane. In the baseline situation, the municipal waste is left for decay at the landfill site, which leads to the production of large amounts of landfill gas. Landfill gas contains approximately 50% methane, which is a potent greenhouse gas (GHG). The recovered LFG and, produced biogas and syngas will be utilised in gas engines, excess gas will be flared; and
2. By displacing electricity which otherwise would have been generated by the power plants attached to the Turkish grid.

The sequential phases of project activity are summarised in the table 1 below.

[2] The gasification system is not eligible under Gold Standard version 1 rules because the gasifier feedstock is a mix of renewable and non-renewable waste.

Table 1 Sequential phases of the proposed project.

Year	Phase	Sub-Activity	Total Installed Capacity[3] (MW)	Operational? (yes/no)
1980	The Landfill was under the control of Municipality	The area started to be used as a landfill area under the control of Municipality	0	N.A.
2005		The project participant ITC has been granted the "Right of Use" for 49 years.	0	N.A.
2006	Start of Phase I	- Covering of the Landfill - Leachate system - Sorting Plant - LFG Recovery system	5.6 MW (from LFG)	Yes
2007	Start of Phase II,	- LFG Recovery system	16.8 MW (from LFG)	Yes (currently 11.2 MW capacity has been installed)
2009/I	Start of Phase III	- Anaerobic digester system - Gasification system	9 MW (from AD) 14 MW (from gasification)	No

At the time of the PDD preparation 75% of the landfill area has been covered with gas extraction systems and 8 engines with a total capacity of 11.2 MW have been installed. These engines are generating electricity, which is delivered to the Turkish national grid. The aim of the project is to cover 100% of the landfill area with a gas extraction system. The III phase of the project is expected to commence in the first half of 2009. This includes the construction of an anaerobic digester system and a gasifier.

Total emission reductions are estimated to be 4,006,240 tCO_2eq over the first 7 year crediting period.

Contribution to sustainable development:
The project contributes significantly to the region's sustainable development in the following ways:

- The project sets an example for waste management in Turkey. The project including capture of LFG, anaerobic digestion and gasification show cases and contributes to the transfer of knowledge these technologies;
- The project results in the creation of local employment both during the construction and operational phase. Within the project, more than 200 employees are employed, most of which are recruited from the surrounding settlement units;
- If the project is completed and the zero waste vision is achieved, area required for land filling will be reduced, reducing the impact of the landfill on the surroundings;
- The project reduces the risk of explosion, release of bad odours. Furthermore by covering of the landfill the waste is no longer in sight, improving the visible surroundings;
- A greenhouse area is constructed on the landfill. In the greenhouse various types of flowers, vegetables and fruits are grown. Besides the greenhouse a public café is to be constructed. This area will play an important role in raising awareness and training the public, including children, in the field of recycling and waste management;
- The sorting facility and the recycling plant ensure that metals, plastics, aluminium, paper, nylon and glass are recycled.

[3] Taking into account that the Project is first of its kind in Turkey and integration of an anaerobic digester and gasfier in a LFG capture and utilisation system is not common worldwide, the total capacities indicated in Table1 might be amended during the crediting period. Furthermore, since the gasifier is a challenging technology it cannot be guaranteed that this part of the Project will run successfully over the complete crediting period.

- A leakage drainage system prevents leakage from the landfill area into the nearby •mrahor creek.
- Utilisation of LFG not only reduces the emissions from the power generation sector in Turkey, it also reduces Turkey's dependency on imported electricity.
- Within the scope of the project, four thousand trees, have been planted.
- The Landfill is stabilised by covering the waste with soil originating from demolition sites. Otherwise landfilled waste is now used for the construction of terraces to cover the landfill and prevent erosion.

Results from the sustainable development matrix:
According to the requirements of the Gold Standard, the project activity must be assessed against a matrix of sustainable development indicators. The contribution of the proposed activity to the sustainable development of Turkey is based on contribution to local and/or global environmental sustainability, social sustainability & development and economic & technological development. The results from the sustainable development matrix are presented below:

Sustainable Development Indicators Matrix for the Gold Standard

Component Indicators	Score –2 to +2
Local/regional/global environment	
1. Water quality*	+2
2. Air quality (emissions other than GHG)*	+2
3. Other pollutants (Total Suspended Particles, odours)	+1
4. Soil condition (quality and quantity)*	+1
5. Biodiversity	0
Sub total	+6
Social sustainability and development	
6. Employment (job quality)*	+1
7. Livelihood of the poor*	+1
8. Access to essential services (facilities)	0
9. Human and institutional capacity*	+1
Sub total	+3
Economic and technological development	
10. Employment (numbers)*	+2
11. Balance of payments (sustainability)	0
12. Technological self reliance	0
Sub total	+2
TOTAL	+11

(*) added to the monitoring plan

As required by the "Gold Standard", indicators that are critical for a positive contribution of the project to sustainable development, or that are particularly sensitive must be clearly identified. These indicators are marked with an asterisk (*) and added to the monitoring plan.

The indicators are described in more detail below.

Explanation of the indicators:

1 *Water quality (+2)*: The leachate from the landfill dissolved in the surrounding soil and the neighbouring Imrahor Creek became heavily polluted after the discharge of leachate. The leachate has a capacity of 2,75 lt/sec, and contains high inorganic loads (such as TKN origination from ammonia[4]). These inorganic materials can not be biologically degraded and harm the environment. The proposed project activity includes the installation of a leachate draining system which collects the landfill leachate and transports this to Ankara Water and Sewerage Administration[5] (ASKI) where it is treated in a waste water treatment system. The waste water treatment technology used in the facility includes aerobic digestion. As a result of the project activity the leachate is treated in a environmentally friendly manner, therefore this indicator scores a "+2";

2 *Air Quality (+2)*: LFG contains components such as hydrogen sulphide (H_2S), which result in a strong, pungent and unpleasant odour[6]. This nuisance is not only limited to the landfill area but also affects the nearby region. It manifests itself as nausea, vomiting, headache and other undesired physiological effects. The project activity involves the covering of the landfill and utilisation of the LFG, this significantly reduces the odours and therefore results in a major improvement in the air quality. Therefore this sustainable indicator scores a "+2";

3 *Other pollutants (+1)*: Besides the methane, the LFG contains toxic organic compounds called Volatile Organic Compounds (VOCs), in a uncontrolled landfill these can react with sunlight to form ground-level ozone (smog)[7]. If the LFG is combusted these organic compounds chemically react with oxygen to form water vapour and other less volatile compounds[8]. Based on the above this sustainable indicator scores a "+1";

4 *Soil condition (+1)*: The landfill will be covered with a layer of soil, which will enable the land to be used for other purposes[9]. One of the possible uses for the land, which is discussed with the Municipality is usage as a public park.. By terracing erosion will be reduced.[10]. This indicator scores "+1";

5 *Biodiversity (0)*: The project activity involves the planting of 4500 trees around the landfill area which will positively affect the biodiversity of the area. However, tracking the positive impact to the biodiversity is very difficult; therefore this sustainable indicator scores "0".

6 *Employment (job quality) (+1)*: The project activity involves the installation of equipment and technology from outside Turkey. Local knowledge on how to install the equipment is not available; therefore the employees will be trained for operation and maintenance of the system. This sustainable indicator therefore scores a "+1".

---

[4] Reference: "Characterization of Mamak Municipal Solid Waste Dump Site Leachate as Surface Seepage and Its Effect on Imrahor Creek" Report / Chamber of Environmental Engineers, Environmental Science & Technology Magazine Volume 2, No1 p. 102-116 (year 2004).

[5] Ankara Water and Sewerage Administration / http://www.aski.gov.tr/m.asp?tid=15&pn=2

[6] For more information on the negative affects refer: http://www.atsdr.cdc.gov/hac/landfill/html/ch3.html

[7] Reference: http://www.epa.gov/landfill/faq-3.htm (Website of Landfill Methane Outreach Program)

[8] Reference: U.S. Environmental Protection Agency; Landfill Methane Outreach Program (LMOP) / http://www.epa.gov/lmop/faq-3.htm#9

[9] Reference: Mamak Landfill Waste Management Project – Turkey, PDD assessment by Local Expert Dr. Nuri Mol / Section 2. Contribution to sustainable development. Validation report Annex III Assessment Letter of the Local Expert, page 5.

[10] Source: Baryla, Perzgalski 2008: Ridged Terraces – Functions, Construction and Use: http://www.jeelm.vgtu.lt/upload/environ_zurn/2008_2_105-110-ia-if-jelem-2008-2-baryla.pdf

7 *Livelihood of the poor (+1)*: People, who were scavenging the wastes for a living before the implementation of the project, are going to be recruited by the project participant[11]. Therefore scavengers, who had no stable income will be on a regular salary and will be included in the social security system. Therefore this indicator scores a "+1";

8 *Access to essential services (facilities) (0)*: Turkey's energy supply is mainly based on fossil fuel resources. The project's generation of electricity based on landfill gas and methane replaces electricity otherwise generated by the grid, increasing the share of clean energy services provided. It also reduces dependency on foreign import and bridges the increasing gap between electricity supply and demand in Turkey[12].. This indicators scores a "0";

9 *Human capacity (education)(+1)*: The project participant has signed a protocol with the greater municipality. Within the scope of this protocol an awareness campaign will be carried out in defined areas regarding the separation of the packaging wastes from other wastes for recycling purposes. Residents will be visited and the importance of 'recycling at source' will be explained and related document brochures will be delivered. 'Recycled at source' materials are collected on pre-announced days and transferred to Mamak Landfill. A similar protocol has also been signed with Yenimahalle Municipality[13]. This sustainable indicator scores "+1";

10 *Employment (numbers) (+2)*: The project will create local and regional employment both during the construction phase and operational phase. During the operational phase the project will create jobs for approximately 200 people, which 70 of them are recruited locally. Considering the unemployment rate of Turkey, this sustainable indicator scores a "+2";

11 *Balance of payments (sustainability) (0)*: Although the proposed project will have a positive impact on the net foreign currency savings due from reducing dependency on energy import, the magnitude of this impact will be limited taking into account the share of the proposed project within the total electricity generation in Turkey[14]. Furthermore it would be very difficult to provide a quantitative figure. This indicator scores "0";

12 *Technological self reliance (0):* The project results in the transfer of knowledge on waste management principles, landfill gas extraction, landfill gas utilisation, and anaerobic digesters. The Project is first of its kind in Turkey. Its implementation and viability demonstrates the potential of this type of waste management and leads to further experiences of the applied technologies in Turkey. This can lead to the further implementation of such plants in Turkey[15]. This sustainable indicator scores "0".

To meet the requirements of the Gold Standard, each of the components of the sustainability matrix, must have a positive sub-total score, the total score must be positive, and none of the indicators should score –2. As the project scores +11, this project satisfies all three requirements to meet the Gold Standard.

---

[11] Reference: Mamak Landfill Waste Management Project – Turkey, PDD assessment by Local Expert Dr. Nuri Mol / Section 2. Contribution to sustainable development / Comment on issue 2. Validation report Annex III Assessment Letter of the Local Expert, page 5.

[12] Source: IEA Energy Statistics, Energy Balances for Turkey: http://www.iea.org/Textbase/stats/balancetable.asp?COUNTRY_CODE=TR

[13] More information can be found under the preliminary stakeholders report.

[14] Reference: Reference: Turkish Electricity Transmitting Company Official Statistics. The distribution of Installed capacity by primary energy resources and the electric utilities in Turkey; http://www.teias.gov.tr/ist2007/7.xls

[15] Reference: UNEP 2001 / Managing Technological Change; http://www.unep.fr/energy/information/publications/other/pdf/mantechchange_en.pdf

A.3. Project participants:

>>

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)
Turkey (host country)	• ITC Invest Trading & Consulting A.G. Turkish Ankara Branch	No

ITC Invest Trading & Consulting A.G. Turkish Ankara Branch is the operating company of the project activity.

OneCarbon International BV is the carbon consultant for this project.

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

A.4. Technical description of the project activity:

A.4.1. Location of the project activity:

>>

A.4.1.1. Host Party(ies):

>>
Turkey

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

>>
Central Anatolia Region / Ankara Province / Mamak District

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

>>
The Mamak Landfill Gas Recovery and Utilisation Project is located in the Ankara Province, in the Mamak district. The Mamak landfill area is located 2 km from the nearest residential area, the Imrahor village. Ankara, the capital of Turkey has a population of approximately 4 million and is the second largest city in Turkey. The Mamak Landfill area serves approximately 3.6 million people, which is around 90% of the population of Ankara and 5% of the total population of Turkey[16].

[16] Reference: Turkish Statistics Institute / (Statistics for Municipalities)
http://www.tuik.gov.tr/PreIstatistikTablo.do?istab_id=496

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

>>

Figure 1 General map of Turkey and the project area

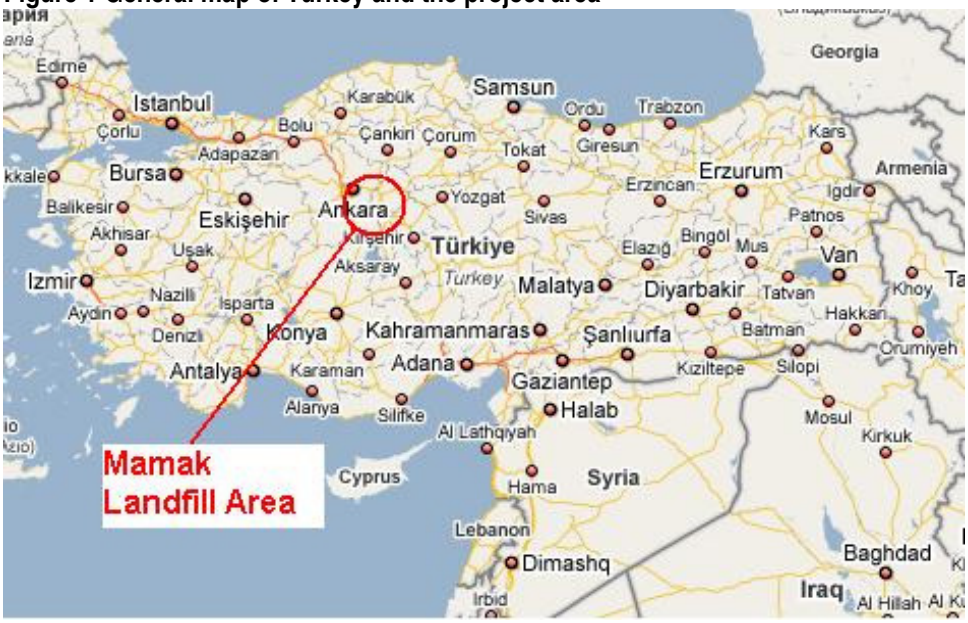


Figure 2 Map of Ankara District and project location

The project area is located at 39^{0}52’59.36” E / 32^{0}55’50.72” N (the area inside the red borders in figure 2)
The postal address of the project area is as followed:
Nato Yolu, Ege Mahallesi 06480/ Mamak Katı Atık Alanı
Ankara / Turkey

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

>>

According to Gold Standard VER Manual for Project Developers[17], the VER Project falls into the category:

a. A.1.1.2.1 landfill gas
b. A1.1.2.3 methane avoidance[18]

The Gold Standard requires for LFG recovery projects that at least 65% of the captured methane is utilised for energy generation. In the proposed VER project activity it is estimated that a yearly average of almost 100% LFG is utilised over the total crediting period. The summary of the LFG utilization estimates are summarized as followed:

	2007[19]	2008	2009	2010	2011	2012	2013	2014
LFG flared ($1000m^3$)	2,616	171	250	250	250	250	250	250
LFG utilized ($1000m^3$)	19,336	34,023	79,200,	79,200	79,200	79,200	79,200	79,200
Total Capture ($1000m^3$)	21952	34,194	79,450	79,450	79,450	79,450	79,450	79,450
Percentage of utilization (%)	88%	99%	99%	99%	99%	99%	99%	99%

The Gold Standard for voluntary offset projects refers to three scales of the projects. The cut-off threshold is shown in the following box[20].

Micro-Scale	Small-Scale	Large-Scale
0 - 5,000 tCO_2e/year	5,000 – 60,000 tCO_2e/year	>60,000 tCO_2e/year

Based on the ex-ante calculation of the emission reductions, the proposed project activity is considered as a large scale project activity.

[17] Reference: http://www.cdmgoldstandard.org

[18] According to Gold Standard rules, co-firing of renewable wastes is not permitted for eligibility. Although the gasifier is a part of the generic project, it is excluded from the VER project and no emission reduction credits will be claimed.

[19] Year 2007 and 2008 figures are based on actual data provided by the Project Participant.

[20] Reference: The Gold Standard, Gold Standard Rules and Procedures Updates and Clarifications, December 2007

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

>>

The proposed project involves the capture and utilisation of LFG, biogas and syngas. The utilisation of the syngas is not a part of the VER project activity.

Within the project several activities can be identified, these are summed in table 2.

Table 2 Activities under the proposed projectActivity	Generic / VER	Impacts		
		Environment	Safety	Electricity Production
Sorting Facility & Recycling Centre	Generic	Saves natural resources		
Covering of the landfill	VER	Reduction of odour nuisance,	Reduce health hazards	Increase the amount of LFG which can be captured
Landfill leachate drainage system	VER	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.
Landfill gas collection system	VER	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.
Gas flaring system	VER	Reduce environmental effects of Methane	Combustion of methane reduces the risk on explosion and fires.	Required as safety device.
Anaerobic digester system	VER	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
Gasification System	Generic	Utilisation of inorganic materials otherwise landfilled	Controlled capture of syngas reducing the risk on explosion and fires	Increases the amount of electricity produced
Energy generation units	VER	Displace electricity otherwise produced by the grid	Combustion of methane reduces the risk on explosion and fires.	Renewable energy production from a waste stream
Connection to the grid via transmission line	Generic			Delivery of the generated electricity to the national grid

Sorting facility & Recycling Centre.
The project includes the implementation of a sorting facility. This facility sorts, organic waste and inorganic waste. Recyclable materials are removed from the waste stream in the recycling centre. Sorting facility and the recycling centre is not a part of the VER project activity.

Covering of the landfill:
In order to reduce the odour and increase the efficiency of the gas collection system, the project activity includes the covering of the landfill area. The total landfill area of approximately 1 million square meters will be covered by a 1 meter thick layer of soil, which mainly originates from construction/demolition sites. The landfill area will be terraced in order to reduce the explosion risks. The landfill area will consist of 6 terraces at total.

Landfill leachate drainage system:
The Mamak Landfill has been in operation since the 1980's. However a leachate management system was only installed in 2006. Until this period, the landfills' leachate was discharged into the Imrahor Creek[21]. The proposed project includes the installation of a leachate management system. The leachate is collected with undergrounds canals and transported to ASK• water treatment centre, 70 km away from the landfill. 8 km part of this canal is constructed by ITC. It is expected that annually approximately 70,000 m^3 /year of leachate is transported to ASK•, where the waste water is treated through several steps including aerobic treatment[22].

Landfill gas collection system:
The LFG collection system consists of vertical gas wells and horizontal collectors. To prevent condensation of LFG before it enters the gas turbines, the project participant has chosen to use an innovative system called "Regole". This system was designed as a result of the water level reaching the surface and regular vertical wells couldn't be used for the LFG collection. The system prevents the leachate water to get into the combustion unit, hence increases the efficiency of the gas collection system.

Gas flaring system:
The project includes an enclosed flaring system. The flaring system will only be used if the captured amount of gas exceeds the amount which 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. Abundant gas will be burned to prevent explosion or fire.

Anaerobic digester system:
The third phase of the project involves an anaerobic digester system to be included in the project. 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 wastes will be decomposed and the methane will be recovered. This results in less fresh waste entering the landfill. The residence time will be approximately 15-22 days and the system operated continuously. At first, 600 tons of organic waste will be entering the digester daily. The biogas from the anaerobic digester system will be fed to biogas engines. At first 3300 Nm^3/h[23] of biogas with 65% methane content is estimated to be recovered by the anaerobic digester system. The capacity of the anaerobic digester system will be gradually increased to 900 ton/day organic input and is estimated to

[21] Reference: "Characterization of Mamak Municipal Solid Waste Dump Site Leachate as Surface Seepage and Its Effect on Imrahor Creek" Report / Chamber of Environmental Engineers, Environmental Science & Technology Magazine Volume 2, No1 p. 102-116 (year 2004)

[22] Reference: ASKI official website / water treatment process http://www.aski.gov.tr/m.asp?tid=15&pn=2

[23] Estimation based on 600ton/day input.

support 9 MW installed capacity for electricity generation. The residues from the anaerobic digestion system will be landfill.

Gasification system:
The third phase of the project will involve waste management technology called gasification. 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 organic and in-organic fresh waste will be fed into the gasification system; this will reduce the amount of waste which will be delivered to the landfill. At first the amount of daily fresh waste fed into the gasifier will be 50 t/day which gradually increase to 350 t/day. The gasification system is not eligible under Gold Standard version 1 rules because the gasifier feedstock is a mix of renewable and non-renewable waste and therefore is not a part of the VER project activity.

Energy generation units:
The captured LFG, biogas from the anaerobic digesters and syngas from the gasifier[24] will be utilised in gas engines. Currently, 8 units of 1.4 MW Gas Fuel Burning Engine Generators[25] are installed. The total energy generation capacity is expected to gradually increase for the purpose to utilize the LFG, the biogas recovered and the produced syngas. The annual energy generation is estimated as approximately 340 GWh/year[26].

Grid connection:
The project activity further involves the development of a connection to the national grid. The grid connection will be 5 km long and at 34.5 kV level. The Project will be connected to the grid at •mrahor transformer station.

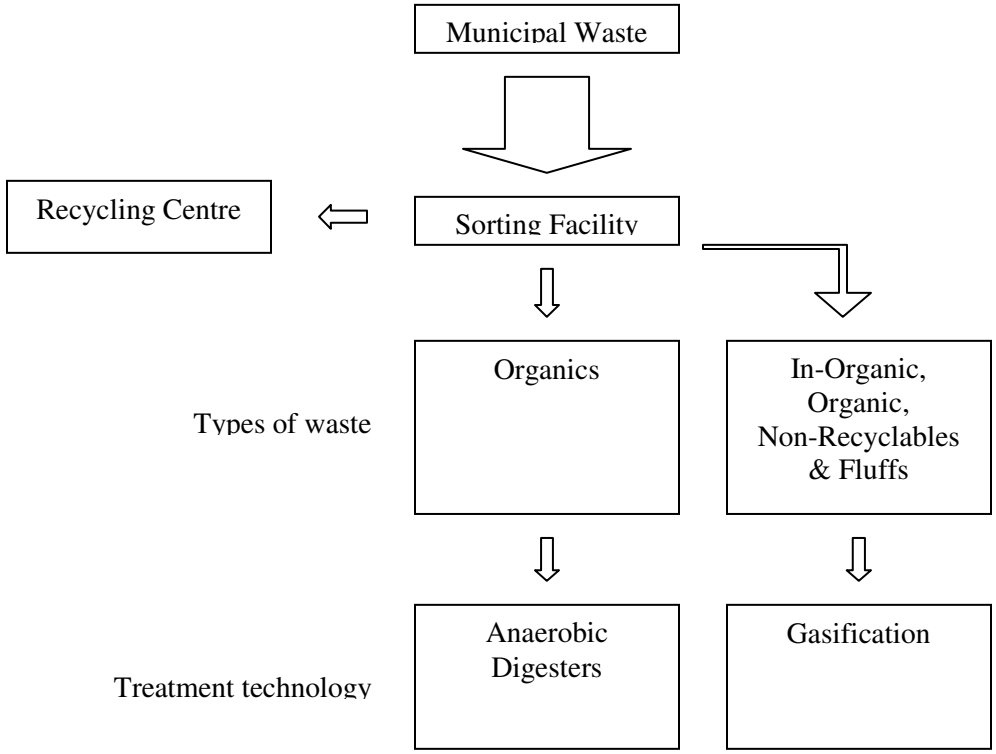
The capacity development, which can be related with phase III of the generic project, and input output figures for anaerobic digester and gasification system are presented in figure 3 below.

[24] The gasifier is not a part of the VER Project activity and no emission reduction credits will be claimed from utilization of the syngas.

[25] The selected engines are GE Jenbacher Gas Motors / http://www.gepower.com/prod_serv/products/recip_engines/en/index.htm .

[26] Based on current expectations, see also Table 1.

Figure 3 Capacity projection for anaerobic digester and gasification system



Breakdown of the implementation stages of Phase III: installation of a biodigester and gasifier

		Anaerobic Digester				Gasifier[27]	
		Waste Input (t/day)	Waste Output (t/day)	Installed Capacity (MWe)		Waste Input (t/day)	Installed Capacity (MWe)
1st Stage	2009/I	600	400	6		-	-
2nd Stage	2009/II	600	400	6		50	2
3rd Stage	2010	900	600	9		150	6
	2011	900	600	9		350	14

[27] The gasification system is not eligible under Gold Standard version 1 rules because the gasifier feedstock is a mix of renewable and non-renewable waste. No VER credits will be claimed from the gasification system.

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

>>

Years	Annual estimation of emission reductions in tonnes of tCO_2eq
2007	203,554
2008	399,335
2009	563,199
2010	625,198
2011	643,760
2012	661,524
2013	678,295
2014[28]	231,376
Total emission reductions (tonnes of CO_2-eq)	4,006,240
Total number of crediting years	7
Annual average over the crediting period of estimated reductions (tonnes of CO_2-eq)	572,320

A.4.5. Public funding of the project activity:

>>

The project does not obtain public funding and no ODA has been used for the purchase of the VERs. The project is financed by a combination of equity and loans from commercial private banks[29].

[28] The registration date of the project is estimated as 01/05/2009. Therefore, for the ex-ante emission reduction calculations the crediting period is estimated to start on 01/05/2007 and end on 30/04/2014, taking into account the requirements of Gold Standard with regards to retroactive crediting.

[29] The financial structure of the proposed project activity is available for 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:

>>

Applied approved baseline and monitoring methodologies:

- Approved consolidated baseline methodology ACM0001 "Consolidated methodology for landfill gas project activities" Version 8.1, EB39;
- Approved baseline and monitoring methodology AM0025 "Avoided emissions from organic waste through alternative waste treatment process" Version 10.

Used tools:

- "Tool for the demonstration and assessment of additionality" Version 05.2, EB39;
- "Tool to determine project emissions from flaring gases containing methane "Version 01, EB 28 Annex 13;
- "Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site" Version 04, EB41;
- "Tool to calculate the emission factor for an electricity system" Version 01, EB35;
- 'Tool to calculate baseline, project and/or leakage emissions from electricity consumption' version 01.1, EB39.

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

B.2. Justification of the choice of the methodology and why it is applicable to the project activity:

>>

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 8.1). 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:

a) The captured gas is flared; and/or
b) The captured gas is used to produce energy(e.g. electricity/thermal energy);
c) The captured gas is used to supply consumers through natural gas distribution network.

The baseline scenario of the proposed project is total atmospheric release of the gas (see 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 8.1) is applicable to the project activity.

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 10). AM0025 is applicable for the following reasons:

a. The project activity involves the combination of gasification to produce anaerobic digestion with biogas collection and flaring (the excess gas) for fresh waste that would have otherwise been disposed of in the landfill is now fed to the anaerobic digester.
b. The residual waste from the anaerobic digestion process is delivered to the landfill.
c. The proportion and characteristics of different types of organic waste processed in the project activity can be determined, in order to apply a multiphase landfill gas generation model to estimate the quantity of the landfill gas that would have been generated in the absence of the project activity.
d. The proposed VER project activity includes electricity generation from the biogas captured from the anaerobic digester. The electricity is exported to the national grid.
e. The waste handling in the baseline scenario shows a continuation of current practice of disposing the waste in the landfill.
f. The project activity does not involve thermal treatment process of neither industrial or hospital waste.
g. The anaerobic digester of the VER project activity does not involve capture and flaring of methane from existing waste in the landfill.

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

>>

Emission sources:

According to ACM0001 'Consolidated baseline methodology for landfill gas project activities' (version 8.1) the emission sources are incomplete combustion of landfill gas in the flare and electricity used for operating of the project activity. The emissions from the anaerobic digester are included as direct emissions from the waste treatment process according to AM0025 "Avoided emissions from organic waste through alternative waste treatment process" (version 10). Since the generated electricity replaces electricity otherwise generated by the grid, the emissions from electricity production are included.

Spatial extent:

According to AM0025 "Avoided emissions from organic waste through alternative waste treatment process" (version 10) 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 8.1), which defines the project boundary as the site of the project activity where the gas is captured and destroyed/used**.**

Although the gasifier is included in the project boundary as a part of the generic project activity, no emission reduction credits will be claimed as the gasifier is co-firing both non-renewable and renewable resources.

The spatial extent of the project boundary also include the plants connected to the national grid as the project provides electricity to the national grid as required by ACM0001 "Consolidated baseline methodology for landfill gas project activities" (version 8.1)and AM0025 "Avoided emissions from organic waste through alternative waste treatment process" (version 10).

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

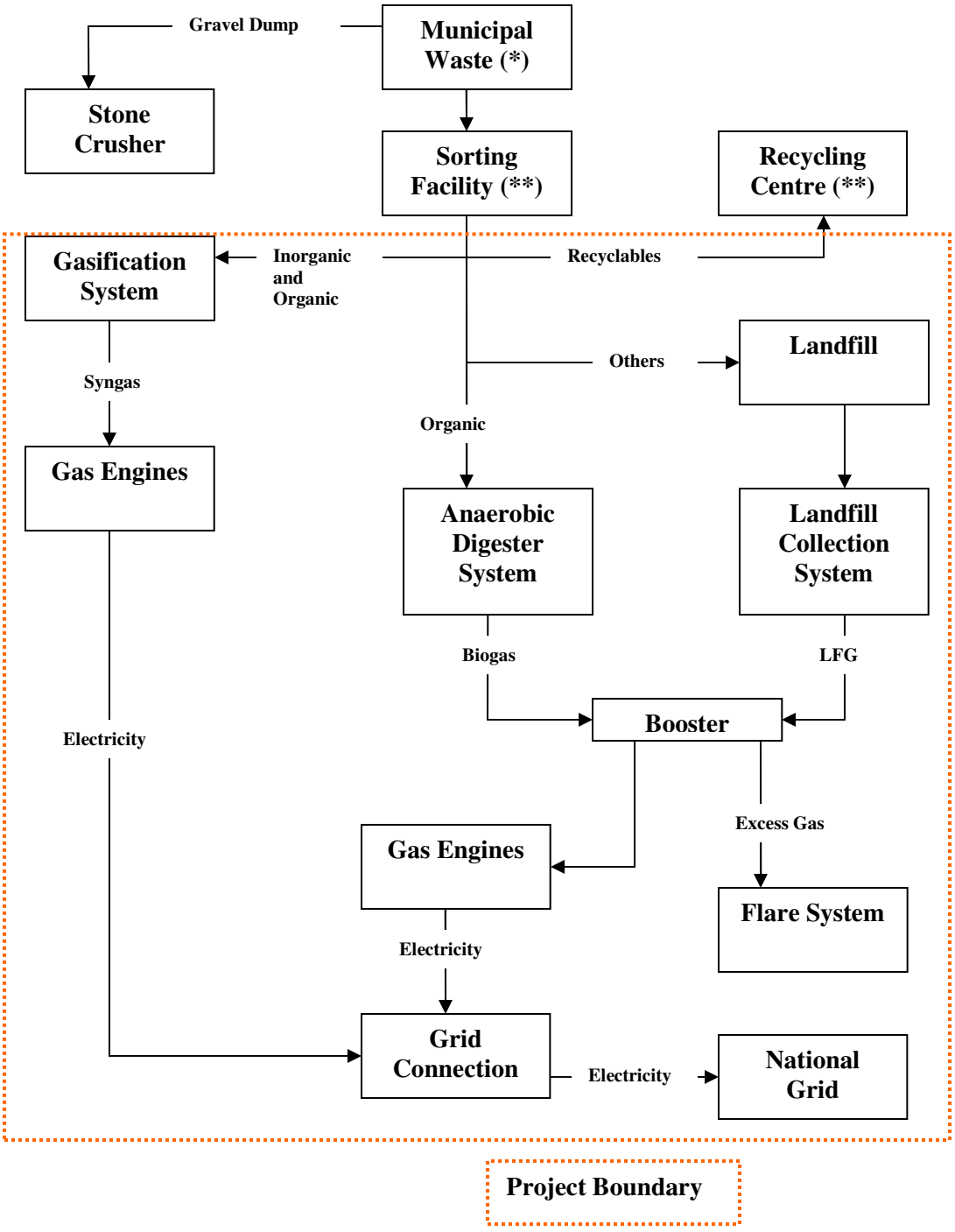
The gases and sources relevant to the project are listed in Table 3.

Table 3 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_2O	No	N_2O 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_2O	No	Minor emission source
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_2O	No	Excluded for simplification. This emission source is assumed to be very small
	Direct emissions from the waste treatment process	N_2O	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

The physical boundary of the proposed project is the site of the project activity where the gas will be captured and destroyed/used (including gas collection system, electric generators and flaring system) and all plants physically attached to the Turkish National Grid.

Figure 4 The project boundary in the project activity.



(*) Collection and transfer of the municipality waste is under the responsibility of Ankara Municipality.
(**) Sorting facility and recycling centre is not included in the project boundary as stated in AM0025 "Avoided emissions from organic waste through alternative waste treatment process" (version 10). This is also in line with ACM0001 "'Consolidated baseline methodology for landfill gas project activities' (version 8.1) requirements. However as a conservative approach, emissions resulting from electricity usage from both facilities are included as project emissions.

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

>>

The baseline scenario for the project activity is identified using step 1of the 'Tool for demonstration and assessment of additionality' (Version 05.2), as agreed in the Executive Board's 39th meeting, and by taken into account the procedures described in ACM0001 'Consolidated baseline methodology for landfill gas project activities' (version 08.1), and AM0025 "Avoided emissions from organic waste through alternative waste treatment process" (version 10).

Step 1. Identification of alternatives to the project activity consistent with current laws and regulations

Realistic and credible alternatives to the Project activity that can be part of the baseline scenario are defined through the following sub-steps:

Sub-step 1a. Define alternatives to the project activity:

The alternatives to the proposed project activity are listed in table 4, 5 and 6:

Table 4 Alternatives for the baseline methane emissions for landfill extraction (ACM001)

LFG 1	The project activity (capture and utilisation of LFG) not implemented as VER project
LFG 2	Continue the current practice of not extracting, and utilising or flaring the landfill gas.

Table 5 Alternatives for the baseline methane emissions for anaerobic digester (AM0025)

M 1	The project activity (anaerobic digestion and gasification) 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

Since electricity is delivered to the Turkish National Grid alternatives should also be identified for the electricity generation in the absence of the project activity.

Table 6 Alternatives for the baseline electricity production (ACM0001 & AM0025)

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

At the landfill site no infrastructure is available for the utilization or transportation of heat. Therefore the development of a cogeneration plant would not be an alternative for the electricity production and alternatives P2 and P3 can be discarded. The development of captive power plants would not be economically competitive with purchasing power from the grid..The most widely accepted and realistic way for electricity generation is to generate the electricity by a diesel engine. Taking into account that only fuel costs are triple compared with diesel[30]; we may conclude that the most feasible and realistic to generate the

[30] Reference for fuel prices: http://www.teknikyayincilik.com/tablolar/1156_110.xls

mentioned amounts of electricity is trough purchasing electricity from the national grid. Therefore scenarios P4 and P5 are also discarded. From the alternatives the following baseline scenarios have been identified:

Table 7 Alternative scenarios to the project activity

Scenario	Baseline			Description of the situation
	Landfill gas	Waste	Electricity	
1	LFG 1	M 1	P1	The project activity (the capture and utilisation of LFG, biogas and syngas for electricity generation) without being registered as a VER project.
2	LFG 1	M 1	P6	The capture and destruction of LFG, biogas and syngas without being registered as a VER project and electricity generation by the grid.
3	LFG 2	M3	P6	Disposal of the waste at a landfill without the capture of landfill gas. The electricity is generated by existing grid connected power plants.

Note: the scenario LFG2 + P1 is excluded since this is not a realistic scenario, if the LFG is not captured (LFG2) it can not be utilised (P1). Baseline alternative M2 (disposal of waste at a landfill where landfill gas captured is flared) is discarded since there are no legislative obligations to capture and flare the LFG. Furthermore this alternative is not a commercially attractive option, since no revenues will be generated while an investment is required.

Sub-step1b. Consistency with mandatory laws and regulations

The landfills in Turkey are regulated by the "Regulation on Solid Waste Management" Regulation number: 20814 Enactment Date: 14/03/1991[31]. In this regulation, the only article regarding LFG is article 27, stating that:

"The composites such as CO_2, Nitrogen, Ammoniac, Hydrogen-Sulfide and Methane, which may cause poisoning and/or explosion, are collected by horizontal and vertical gas extraction systems and released to the air or utilized".

In the regulation no references can be found to a standard regarding these systems, and no penalty sanctions are mentioned. This implies that the regulation can be considered as a guideline on safe operation of a landfill. The releasing of landfill gas to the air 'venting' occurs at several landfills, however the utilisation of landfill gas does not occur in Turkey (also see B.5 step 4).

Since electricity is generated the following applicable mandatory laws and regulations are also applicable to the project activity:

- Electricity Market Law[32] [Law Number: 4628 Ratification Date: 20.02.2001 Enactment Date: 03.03.2001]

Reference for diesel engine:
http://www.borusangucsistemleri.com/dokumanlar/urunler/Caterpillar/900_kVA_Standby_Low_BSFC.pdf

[31] Reference: Prime Ministry, Directorete of Legislation Development and Publication Official Website http://mevzuat.basbakanlik.gov.tr/mevzuat/metinx.asp?mevzuatkod=7.5.8132&sourceXmlSearch=kat%FD%20at%FDk

[32] Reference: Prime Ministry, Directorete of Legislation Development and Publication Official Website http://mevzuat.basbakanlik.gov.tr/mevzuat/metinx.asp?mevzuatkod=1.5.4628&sourceXmlSearch=elektrik%20piyasas%FD

- Law on Utilization of Renewable Energy Resources for the Purpose of Generating Electricity Energy[33] [Law Number: 5346 Ratification Date: 10.05.2005 Enactment Date: 18.05.2005]
- Environment Law[34] [Law Number: 2827 Ratification Date: 09.08.1983 Enactment Date: 11.08.1983]

It can be concluded that all the alternatives to the project outlined in Table 4 above are in compliance with applicable laws and regulations.

Step 2: Identification of the fuel for the baseline choice of energy source taking into account the national and/or sectoral policies as applicable:

The project activity produces electricity and delivers this to the Turkish National grid. Therefore the baseline energy source is the electricity produced by the power plants attached to the Turkish National grid. The CO_2 emissions from the baseline energy source are calculated using the "Tool to calculate the emission factor for an electricity system".

Step 3: Application of Step 3 (Barrier Analysis) of the "Tool for the demonstration and assessment of additionality:

Sub-step 3a. Identify barriers that would prevent the implementation of the proposed VER project activity:

The project faces several barriers that prevent the implementation of the project. The most important barrier that prevents the development of the Mamak Landfill Waste Management Project is that the project is first of its kind. Furthermore the project without the income from VERs can not be considered as economically attractive. For a detailed analysis of the barriers, please see section B.5 sub-step 3. Based on this it can be concluded that baseline scenario 1, the project activity not undertaken as VER project faces barriers that prevent the implementation. Therefore this scenario is not the baseline scenario and can be discarded. The second baseline scenario the implementation of the project activity without the utilisation of the LFG, biogas and syngas for electricity generation does not result in any income. However it does involve the investment in a capture system, anaerobic digester and gasifier, therefore this is not a realistic baseline scenario and can be discarded.

It can be concluded that baseline scenario 3, disposal of the waste at a landfill without the capture of landfill gas and the electricity generated by existing grid connected power plants is the only realistic baseline scenario.

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):

>>

As required in the Gold Standard Voluntary Emission Reductions Manuel for Project Developers and approved consolidated baseline methodology ACM0001 "Consolidated baseline and monitoring methodology for landfill gas project activities" version 8.1. In addition to approved baseline and monitoring methodology AM0025 "Avoided emissions from organic waste through alternative waste treatment process"

[33] Reference: Prime Ministry, Directorete of Legislation Development and Publication Official Website http://mevzuat.basbakanlik.gov.tr/mevzuat/metinx.asp?mevzuatkod=1.5.5346&sourceXmlSearch=yenilenebilir

[34] Reference: Prime Ministry, Directorete of Legislation Development and Publication Official Website http://mevzuat.basbakanlik.gov.tr/mevzuat/metinx.asp?mevzuatkod=1.5.2872&sourceXmlSearch=%E7evre

Version 10 the project additionality is demonstrated through use of the "Tool for the demonstration and assessment of additionality" (version 05.2).

Step 1. Identification of alternatives to the project activity consistent with current laws and regulations

See section B.4 where step 1 is used for the identification of the baseline scenario.

Step 2. Investment analysis
This step has not been applied

Step 3. Barrier analysis

Sub-step 3a. Identify barriers that would prevent the implementation of the proposed VER project activity:

The project activity without being registered as a VER project faces barriers that prevent the implementation. In this section these barriers are identified.

In Table 8 an overview is presented of the barriers that prevent the implementation of the proposed project if it was not developed as a VER project. Each barrier is described in more details in the section below.

Table 8 Identified barriers for development of the project activity.

Type of barrier	Identified barrier	Internal/External barrier
Investment	Low project IRR (Internal Rate of Return) and ADSCR (Average Debt Service Coverage Ratio).	INT
Prevailing practice	First of its kind	EXT
Other	Bureaucratic and legislative	EXT

The most important barrier that prevents the development of the Mamak Landfill Waste Management Project is the project being first of its kind.

Investment Barriers
Low project IRR and ADSCR[35]*:* The Internal Rate of Return (IRR) and (Annual Debt Service Cover Ratio) ADSCR of the first two phases of the project without the income from VERs is too low to secure project financing. The additional income from VERs has increased the IRR of the project significantly, which positively influenced the decision of the banks to issue the loans[36]. The impact of the registration as a VER project is given by comparison of the project IRR with and without VER revenues (Table 9).

[35] The financial feasibility studies represent the financial structure of phase I and II of the project activity.

[36] Reference: Written statements of the creditor banks. Available to DOE.

The main assumptions for the project IRR calculations are:
- Electricity price: 6.98 $cent/kWh
- VER price: 7.25 $/$tCO_2eq$
- Electricity production: 11,200 MWh/yearPGU (Net Generation)
- LFG extraction: 800 m^3/hr per PGU
- Operation hours: 8000 hrs/year
- Methane content: 53%
- Density of methane: 0.67 kg/m^3

Table 9 IRR comparison

Project IRR	10 Years	15 years	20 years
Without VERs	n.a.	-4%	1%
With VERs	11%	17%	19%

Barriers due to prevailing practice

First of its kind: The commercial capture and utilisation of landfill gas for the existing waste is a first of its kind in Turkey as well as the commercial operation of an anaerobic digestion system and gasification system for the fresh waste. Within Turkey there are no local suppliers of critical equipment such as boosters; flares generators etc, for the mentioned technologies therefore these technologies are imported. The transfer of technology and know-how result in relatively high investment and operational costs.

There are 3213 municipalities in Turkey. From these municipalities 3,115 have a municipality waste service, which covers 81% of the total population of Turkey. The amount of waste collected in 2006 was 25,280,000 tons. Only 22 of these landfills are classified as “controlled landfills”. From these controlled landfills only 4 have a composting plant and 3 of them have an incineration plant (table 11). There is no indication that any of these landfills captures the landfill gas, biogas/syngas or has a flaring and/or utilisation plant in operation.

Table 10 Main solid waste indicators of the municipalities over years 1994-2006[37]

		1994	1995	1996	1997	1998	2001	2002	2003	2004	2006
Number of municipalities receiving solid waste services		1,985	2,126	2,172	2,275	2,579	2,915	2,984	3,018	3,028	3,115
Rate of population receiving solid waste services in total population (%)		71	72	71	71	72	75	76	76	77	81
Amount of solid waste collected (1000 tonnes/year)		17,757	20,910	22,483	24,180	24,945	25,134	25,373	26,118	25,014	25,280
Amount of solid waste per capita (kg/capita-day)		1.10	1.27	1.37	1.48	1.51	1.35	1.34	1.38	1.31	1.21
Solid waste disposal plants											
Controlled Landfill	Number	2	6	6	8	8	12	12	15	16	22
	Capacity	9,250	202,527	202,527	206,690	206,690	261,282	277,195	278,015	278,060	376,974
	Amount of solid waste disposed of (1000 tonnes/year)	809	1,444	2,847	4,364	5,258	8,304	7,047	7,432	7,002	9,942
Composting plant	Number	2	2	2	2	2	3	4	5	5	4
	Capacity	245	245	245	245	245	299	664	667	667	606
	Amount of waste received by composting plant (1000 tonnes/year)	192	159	179	180	166	218	383	326	351	268
Incineration plant	Number	0	1	1	2	2	3	3	3	3	3
	Capacity	0	9	9	44	44	44	44	44	44	44
	Amount of medical waste incinerated (1000 tonnes/year)	0	0,3	3	9	15	7	7	9	8	6
Rate of population served by solid waste disposal plants in total population		4	5	9	13	15	24	24	24	25	29

From the above it can be concluded that the common practice for the treatment of waste is collection and dumping at an uncontrolled landfill. None of the existing landfills have a waste management model or similar treatment technologies in place which are comparable to the proposed project.

To cross check if no projects including LFG and/or biogas and/or syngas utilisation for the production of electricity are operational in Turkey an analysis of the electricity generation licenses listed under (Energy Market Regulatory Authority[38]) (EMRA) has been made. The results are displayed in Table 11 below.

[37] Reference: Turkish Statistics Institute official website / Main solid waste indicators of municipalities http://www.turkstat.gov.tr/PreIstatistikTablo.do?istab_id=496

[38] Reference: Energy Market Regulatory Authority official website www.epdk.gov.tr

Table 11 Waste management projects in Turkey

Company	Location	Installed Capacity (MW)	Electricity Generation (GWh/year)	Brief description of the project
İSTAÇ A.Ş.	Istanbul/ Kemergurgaz	4	7.24	Municipality owned facility for LFG utilization[39]
Ekolojik Enerji Ltd. Şti.	İstanbul Kemerburgaz	0.98	6.15	Private owned gasification facility for hazardous wastes[40]
Yeni Adana İmar İnşaat Ticaret A.Ş.	Adana / Adana Batı Atıksu Arıtma Tesisi	0.93	5.92	Municipality owned autoproducer facility for biogas utilization from waste water treatment[41]
BEL-KA Ankara Katı Atıkları Ayıklama Değerlendirme, Bilgisayar, İnşaat Sanayi ve Ticaret A.Ş.	Ankara-Sincan	3.2	24.1	Municipality owned autoproducer facility for biogas utilization from waste water treatment[42]
Aksa Enerji Üretim A.Ş.	Bursa / Demirtaş	1.39	11.12	Constructed as Built Operate and Transfer Model. Biogas from old waste is utilized[43] (technically having problems).
Mauri Maya Sanayi A.Ş.	Balıkesir / Kavakpınar mevkii	0.33	- (not operational)	Autoproducer License. The biogas recovered from yeast process wastes[44].
Gaski Enerji Yat. Hiz. İnş. San. Ve Tic. A.Ş.	Gaziantep	1.66	5.29	Municipality owned facility for biogas utilization from waste water treatment[45]
Cargill Tarım ve Gıda Sanayi Ticaret A.Ş.	Bursa / Orhangazi	0.12	- (Not operational)	Autoproducer license. Not based on municipality waste[46]
Yeni Adana İmar İnşaat Ticaret A.Ş.	Adana / Adana Batı Atıksu Arıtma Tesisi	0.8	5.92 (not operational)	Municipality owned facility for biogas utilization from waste water treatment[47]
Akdeniz Yeşil Enerji Üretim Taahhüt San. ve Tic. A.Ş.	Antalya / Odabaşı	10	70 (Not operational)	The majority of the production is based on solar energy[48].

Note: Also generation license has been issued for "Ortadogu Enerji Sanayi ve Ticaret A.S."[49], which is not constructed yet but planned to utilize extracted LFG. This project is to be developed based on income of carbon credits.

The projects found during the crosscheck are:

[39] Reference: http://www.istac.com.tr/faaliyetler.asp?faal=copgazielektrik

[40] Reference: http://www.istanbulcevor.gov.tr/pdf/atiklar/LISANS_%20GECICI_CALISMA_%20IZNI_ALAN%20TEHLIKELI_%20ATIK_GERI_%20KAZANIM_BERTARAF_%20TESISLERI.pdf

[41] Reference: http://www.epdk.gov.tr/lisans/elektrik/yek/ozelhukum/yeniAdanaDoguAtiksu.pdf

[42] Reference: http://web.deu.edu.tr/cevre/pala/aski.ppt

[43] Reference: http://web.deu.edu.tr/cevre/kabi2006/pdf/6-3_MSen.pdf

[44] Reference: http://www.epdk.gov.tr/lisans/elektrik/yek/ozelhukum/mauriMayaBiyogaz.pdf

[45] Reference: http://www.epdk.gov.tr/lisans/elektrik/yek/ozelhukum/gaskiGaziantepAi%C4%B1kSu.pdf

[46] Reference: http://www.cargill.com.tr/

[47] Reference: http://www.epdk.gov.tr/lisans/elektrik/yek/ozelhukum/yeniAdanaDoguAtiksu.pdf

[48] Reference: http://www.epdk.gov.tr/lisans/elektrik/yek/ozelhukum/AkdenizYesil.pdf

[49] Reference; http://www.epdk.gov.tr/lisans/elektrik/lisansdatabase/verilentesistipisorgula.asp

- small scale applications
- most rely on different treatment technologies, compared to the project activity (e.g. waste water treatment technology, composting).
- owned by the municipality
- or; developed as BOT (Built Operate and Transfer) model projects[50].

Based on this it can be concluded the project is a first of its kind.

Other Barriers

Bureaucratic and legislative: In 2002[51] an agreement was reached between the Ankara Greater Municipality and the project owner on the exploitation of the Mamak landfill area. However the project was only able to start construction in August 2006. Part of the agreement on the exploitation of the landfill between the Ankara Greater Municipality and the project owner, was that the construction period was defined as 18 months starting from the actual transfer of the landfill area to the project owner[52]. The actual transfer occurred on 04.04.2005. Although the project owner's decision to invest in the project was based on carbon credits[53], this obligation forced the project owner to start the construction phase which lowers the risk of losing the exploitation right for the landfill.

Major milestones of the proposed project can be summarised as followed:

- 1980 The landfill area has started to accept waste from the municipalities
- 2002 Project participant has reached an agreement with Ankara Greater Municipality
- 2005 The actual transfer of the landfill area to the project participant has been made and in parallel requested approval from the ministry with regards to carbon credits
- 2006 A board decision was taken to invest on the project based on the VER revenues, which followed by the start of the project activity

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):

[50] BOT was initiated by the Turkish Government in order to decrease the external debt of the National Treasury. In these kinds of projects the debt is on the investor company. On the other side the Government issues various financial incentives for these projects. Therefore BOT projects have a low risk profile. The various advantages preceded by the Government for BOT projects such as; a) Exemption from customs b)Discount on investment and c) Exemption from and postponement of VAT. Apart from these advantages the investment company who has undertaken a BOT project signed a Guarantee Agreement with the National Treasury. This agreement assures the sales of the electricity produced by the project. That is if the designated public entity could not buy the electricity produced by the project, the National Treasury shall pay and buy the produced amount. It should also be noted that BOT projects are not private investments. By definition they actually are government projects developed a private company and operated by a public entity at a later stage. For more detailed information please refer to the link under the official website of Prime Ministry, Supreme Councel of Supervision of Turkish Republic: http://www.ydk.gov.tr/seminerler/turkiyede_yid_modeli.htm

[51] Reference: The agreement between Ankara Greater Municipality and the Project owner on transfer of right of use of the Mamak landfill area dated 17.09.2002. Available for DOE.

[52] Reference: The agreement between Ankara Greater Municipality and the Project owner on transfer of right of use of the Mamak landfill area dated 17.09.2002 / article 3. Available for DOE.

[53] Reference: Feasibility study regarding "Carbon Financing for Mamak" prepared in March 2005; correspondence with the Ministry of Environment and Forestry in April 2005; board decision on investment decision based on VER revenues in February 2006. Available for DOE.

Baseline scenario 3: Continuation of the current practice of not extracting, and utilising or flaring the landfill gas, biogas and syngas. And where the electricity is generated by the grid, is not hindered by the identified barriers.

Step 4. Common practice analysis
Not applicable as per "Tool for the demonstration and assessment of additionality" version 05.2.

Based on the above it can be concluded that the proposed project activity is not the baseline scenario and the common practice for the treatment and/or management of municipality waste. The additionality analysis shows that the project activity faces barriers that prevent the implementation of the project without VER revenues and that the income from VERs alleviate the identified barriers. Therefore the project activity can be considered as 'additional'.

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

>>

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_2e/year)
BE_y	Baseline emissions in year y (tCO_2e/year)
PE_y	Project emissions in year y (tCO_2e/year)
L_y	The leakage in year y (tCO_2e/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 10).
- 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 8.1.

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 1.

Baseline emissions from fresh waste

According to AM0025 "Avoided emissions from organic waste through alternative waste treatment process" (version 10) 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_2e)
MB_y	is the methane produced in the landfill in the absence of the project activity in year y (tCO_2e)
$MD_{reg,y}$	is the methane that would be destroyed in the absence of the project activity in year y (tCO_2e)
$BE_{EN,y}$	baseline emissions from generation of energy displaced by the project activity in year y (tCO_2e

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 (tCO_2e)
MB_y	is the methane produced in the landfill in the absence of the project activity in year y (tCO_2e)
AF	Adjustment factor for MB_y (%)

There is no legislation, contractual requirement or safety/odour requirement in Turkey in force that regulates the destruction of methane, consequently baseline methane destruction ($MD_{reg,y}$) is "zero".

Baseline emissions from existing waste

According to ACM0001 "Consolidated methodology for landfill gas project activities" Version 08.1, 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 (tCO_2e)
$MD_{project,y}$	The amount of methane that would have been destroyed/combusted during year y, in tonnes of methane (tCH_4) in project scenario
$MD_{BL,y}$	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)
GWP_{CH4}	Global Warming Potential value of methane for the first commitment period is 21 tCO_2e/tCH_4
$EL_{LFG,y}$	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)
$CEF_{elec,BL,y}$	CO_2 emissions intensity of the baseline source of electricity displaced, in tCO_2e/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 legislation or contractual requirement in Turkey in force that regulates the amount of LFG destroyed or captured, consequently baseline methane destruction is “zero”.

Baseline emissions from electricity
According to AM0025 Avoided emissions from organic waste through alternative waste treatment process” (version 10)”, 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 08.1, 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_2eq/MWh)

Total baseline emissions
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) and (5) are as follows:

$$BE_y = MB_y + (MD_{project,y} * GWP_{CH4}) + BE_{elec,y}$$

Equation 7

Where:

BE_y	Baseline emissions in year y (tCO_2e)
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_2e)
$MD_{project,y}$	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_{2e}/year)
GWP_{CH4}	Global Warming Potential value of methane for the first commitment period is 21 tCO_2e/tCH_4

B.6.1.a.1 Baseline Emissions due from methane generation from the landfill in the absence of the anaerobic digestion system with biogas (According to AM0025).

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:

$$MB_y = BE_{CH4,SWDS,y}$$

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_2e)
$BE_{CH4,SWDS,y}$	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 dumping waste at a solid waste disposal site" version 02.

The amount of methane produced in year y ($BE_{CH4, SWDS,y}$) is calculated as follows:

$$BE_{CH4,SWDS,y} = \varphi \cdot (1-f) \cdot GWP_{CH4} \cdot (1-OX) \cdot \frac{16}{12} \cdot F \cdot DOC_f \cdot MCF \cdot \sum_{x=1}^{y} \sum_{j} W_{j,x} \cdot DOC_j \cdot e^{-k_j (y-x)} \cdot (1-e^{-k_j})$$

Equation 9

Where:

$BE_{CH4, SWDS,y}$	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_2e)
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_{CH4}	Global Warming Potential of methane valid for the commitment period (tCO_2e/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 (tons)
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 followed:

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

Equation 10

Where:

$W_{j,x}$	Amount of organic waste type j prevented from disposal in the SWDS in year x (tons)
W_x	Total amount of organic waste prevented from disposal in year x)tons=
$P_{n,j,x}$	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

B.6.1.a.2 The methane destroyed by the project activity (according to ACM001)

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:

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

Equation 11

Where:

$MD_{project,y}$	The amount of methane destroyed/combusted during year y, in tonnes of methane 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 total quantity of methane capture

$$MD_{total,y} = (LFG_{total,y} * w_{CH_{4,y}} * D_{CH4})$$

Equation 12

Where:

$MD_{total,y}$	total quantity of methane captured (tCH_4) in year y
$LFG_{flare,y}$	Quantity of the landfill gas captured during the year measured in cubic meters (m^3),
$w_{CH4,y}$	Average methane fraction of the landfill gas as measured during the year and expressed as a fraction (in m^3CH_4/m^3LFG)
D_{CH4}	Methane density expressed in tonnes of methane per cubic meter of methane (tCH_4 / m^3CH_4)

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 13

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 flares during the year measured in cubic meters (m^3),
$w_{CH4,y}$	Average methane fraction of the landfill gas as measured during the year and expressed as a fraction (in m^3CH_4/m^3LFG)
D_{CH4}	Methane density expressed in tonnes of methane per cubic meter of methane (tCH_4 / m^3CH_4)
$PE_{flare,y}$	Project emissions from flaring residual gas stream in year y (tCO_2e) determined following the procedure described in the "*Tool to determine project emissions from flaring gases containing methane*"
GWP_{CH4}	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 14

Where:

$PE_{flare,y}$	Project emissions from flaring of the residual gas stream in year y (tCO_2e)
$TM_{RG,h}$	Mass flow rate of methane in the residual gas in the hour h (kg/h)
$n_{flare,h}$	Flare efficiency in hour h
GWP_{CH4}	Global Warming Potential of methane valid for the commitment period (tCO_2e/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:

$$MD_{electricity,y} = LFG_{electricity,y} * w_{CH4,y} * D_{CH4}$$

Equation 15

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)
$w_{CH4,y}$	Is the average fraction of methane in the landfill gas (fraction)
D_{CH4}	Is the methane density expressed in tonnes of methane per cubic meter of methane (tCH_4 / m^3CH_4)

B.6.1.a.3 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 emission factor of the Turkish grid (CEF_d) is calculated in the section below.

,B.6.1.a.4 Calculation of CEF_d

As referred in ACM0001 "Consolidated methodology for landfill gas project activities" Version 8.1 and AM0025 "Avoided emissions from organic waste through alternative waste treatment process" (version 10). CEF_d is calculated according to the "Tool to calculate the emission factor for an electricity system" version 01. 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 01, 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.

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 tCO_2/MWh emission factor has been determined for net electricity imports ($EF_{grid, import, y}$) from the connected electricity system.

Step 2. Selection of an operating margin (OM) method

According to the "Tool to calculate the emission factor for an electricity system", 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 0.1% of the total electricity generation and is therefore not taken into consideration (see table 12). 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 25.1% of the total electricity generation (see Table 12). Therefore the requirements for the use of the Simple OM calculations (option a) are satisfied.

Table 12 Breakdown by sources of the electricity generation from the Turkish grid 2006[54]

Power plants by fuel type	2006 Generation	
	Generation (GWh)	Share (%)
Natural Gas	80,691	45.8
Coal	46,649	26.5
Hydro power	44,244	25.1
Fuel Oil	4,340	2.5
Renew.+Geoth.+Waste+Wind	220	0,1
Total	**176,299**	**100**

Since the Simple OM calculation (option a) is selected, the emission factor is calculated by the generation-weighted average emissions per electricity unit (tCO_2/MWh) and averaged over the past three years of all generating sources serving the system, not including low-operating cost and must-run power plants.

The tool gives two options for the calculation of $CEF_{d,y}$;

- 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 2004 – 2006[55] which are the most recent data available at the time of submission of the PDD[56] to DOE.

Step 3. Calculating the operating margin emission factor according to the selected method.
The simple OM emission factor is calculated as the generation-weighted average CO_2 emissions per unit net electricity generation (tCO_2/MWh) of all generating power plants serving the system, not including low-cost / must run power plants / units. It may be calculated:

- Based on data on fuel consumption and net electricity generation of each power plant / unit (Option A), or
- Based on the data on net electricity generation, the average efficiency of each power unit and the fuel type(s) used in each power unit (Option B), or
- Based on data on the total net electricity generation of all power plants serving the system and the fuel types and total fuel consumption of the project electricity system (Option C)

[54] Reference: TEIAS (Turkish Electricity Transmission Company) / "The distribution of gross electricity generation by primary energy resources and the electricity utilities in Turkey 2006" http://www.teias.gov.tr/ist2006/40.xls

[55] On 06.11.2007 an official information request has been made to TEIAS regarding for 2007 data. However, TEIAS rejected the inquiry, giving reference to the "Law on Procurement of Information".

[56] The index "y" in the equations refers to the years 2004-2006 to calculate the emission factor *ex-ante*.

As the fuel consumption and the average efficiency data for each power plant / unit is not available Option C is used for simple OM calculation[57].

As Option C 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:

$$CEF_{d,OM,y} \frac{\sum FC_{i,y} \times NCV_{i,y} \times EF_{CO_2,i,y}}{EG_y}$$

Equation 16

Where:

$CEF_{d, OM, y}$	Simple operating margin CO_2 emission factor in year y (tCO_2/GWh)
$FC_{i, y}$	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)
$EF_{CO2, I,}$	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)

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 13 below.

Table 13 Fuel consumption of generation sources connected to the grid (2004-2006)

$FC_{i,y}$ 1000m^3 or tons (m^3 is used for gaseous fuels)				
	2004	**2005**	**2006**	**Total**
Natural Gas	13,325,721	15,756,764	17,034,548	**46,117,033**
Lignite	33,776,660	48,319,143	50,583,810	**132,679,613**
Coal	4,564,713	5,259,058	5,617,863	**15,441,634**
Fuel Oil	2,653,901	2,131,730	1,821,357	**6,606,988**

Turkey specific net calorific values ($NCV_{i,y}$) values for fossil fuel types are used, however data from IPCC guidelines for national greenhouse gas inventory has been used for emission factor of fossil fuel types ($EF_{CO2, I, y}$) as the source of data.

The NCV and emission factors are presented in Table 14 below.

[57] There are no nuclear power plants in Turkey and the share of the renewable energy is very small (pls refer to table 12).

Table 14 NCV and emission factor of fossil fuel type

	NCV_i (TJ/Gg)			$EF_{CO2,I}$ (kg/TJ)
	2004	2005	2006	
Natural Gas	36.9	37.3	37.0	54,300
Lignite	7.6	5.9	6.9	90,900
Coal	22.5	21.1	22.0	94,600
Fuel Oil	40.3	40.4	40.3	72,600

The electricity generated 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 15 shows the gross electricity production for 2004-2006 produced by fossil fuel power sources.

Table 15 Gross electricity production by fossil fuel power sources 2004-2006[58]

$EG_{gross,y}$ GWh				
	2004	2005	2006	Total
Natural Gas	62,241.8	73,444.9	80,691.2	216,377.9
Lignite	22,449.5	29,946.3	32,432.9	84,828.7
Coal	11,998.1	13,246.2	14,216.6	39,460.9
Fuel Oil	7,670.3	5,482.5	4,340.4	17,493.2

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. The annual publication of TUIK (Turkish Statistical Institute) is the most accurate official source of data, which provides most up-to-date information publicly available. This relation is derived in table 16 below.

Table 16 Relation between net and gross electricity generation 2002-2004[59]

	2002	2003	2004
Gross generation [GWh]	129,400	140,581	150,698
Net generation [GWh]	123,727	135,248	145,066
Relation	95.6%	96.2%	96.3%
Average correction factor	96%		

The net electricity delivered to the grid by the fossil fuel plants ($EG_{net,y}$) is calculated in Table 17. The calculation of $CEF_{d,OM,y}$ requires the inclusion of electricity imports with an emission factor of 0 tCO_2/GWh. By including the imports in the electricity production this requirement is fulfilled.

[58] For further information please see section B.6.2.

[59] For further information please see section B.6.2.

Table 17 Net electricity production by fossil fuel power plants and electricity imports 2004-2006[60]

		2004	2005	2006	Total
Net electricity production $EG_{net,y}$ [GWh]	**Natural Gas**	59,780.1	70,540.1	77,499.8	**207,820.1**
	Lignite	21,561.6	28,761.9	31,150.2	**81,473.7**
	Coal	11,523.6	12,722.3	13,654.3	**37,900.2**
	Fuel Oil	7,366.9	5,265.7	4,168.7	**16,801.3**
Electricity imports [GWh]		463.5	635.9	573.2	**1,672.6**
Electricity supplied to grid EG_y [GWh]		100,695.7	117,925.9	127,046.3	**345,667.9**

The **$CEF_{d,OM}$** which is calculated through equation (16) is **652 tCO_2-eq/GWh**.

Step 4. Identifying the cohort of the 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 recently[61].

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.

Step 5. Calculation of the build margin emission factor.
The built margin emissions factor is the generation-weighted average emissions factor (tCO_2/MWh) of all power units m during the most recent year y[62] for which power generation data is available, calculated as follows:

$$CEF_{d,BMsimple,y} = \frac{\sum EG_{m,y} \times EF_{EL,m,y}}{\sum_{m} EG_{m,y}}$$

Equation 17

Where:

$CEF_{d,BM,y}$	Build margin CO_2 emissions factor in year y (tCO_2/GWh)
$EG_{m,y}$	Net quantity of electricity generated and delivered to the grid by power unit m in year y (GWh)
$EF_{EL,m,y}$	CO_2 emission factor of the power unit m in year y (tCO_2/GWh)

As per the "Tool to calculate the emission factor for an electricity system" version 01, the CO_2 emission factor of each power unit m ($EF_{EL,m,y}$) should be determined as per the guidance from the tool in step 3 for

[60] For further information please refer to section B.6.2.

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

[62] The index "y" refers to the year 2006, the most recent year.

simple OM, using options B1, B2 or B3, 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 B2 has been selected for the calculation of the CO_2 emission factor of each power unit m ($EF_{EL,m,y}$) as follows:

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

Equation 18

Where:

$EF_{EL,m,y}$	CO_2 emission factor of the power unit m in year y (tCO_2/GWh)
$EF_{CO2,m,l,y}$	Average CO_2 emission factor of fuel type I used in power unit m in year y (tCO_2/GJ)
$n_{m,y}$	Average net energy conversion efficiency of power unit m in year y (%)

Where several fuel types are used in the power unit, the lowest CO_2 emission factor for $EF_{CO2,m,l,y}$ has been used.

The average CO_2 emission factor of fuel types ($EF_{CO2,m}$) and the average net energy conversion efficiency of the power plants ($n_{m,y}$) used for the calculation of emission factor of the power units ($EF_{EL,m,y}$) through equation (18) are presented in table 18 below.

Table 18 Emission factor of the power units[63]

	Average emission factor ($EF_{CO2,m}$)	Average conversion efficiency (n_m)	Emission factor of the power unit ($EF_{EL,m,y}$)
	tCO_2/GWh	%	tCO_2/GWh
Natural Gas	54,300	45	425
Lignite	90,900	32	1001
Coal	94,600	33	1014
Fuel Oil	72,600	33	788
Hydro	n.a.	n.a.	0
Wind	n.a.	n.a.	0

The data regarding the electricity generated and delivered to the grid by power units ($EG_{m,y}$) are presented in Table 19 below.

[63] For further information please refer to section B.6.2.

Table 19 Electricity generated by the power units included in the build margin calculation[64].

$EG_{m,y}$ [GWh]					
	2003	**2004**	**2005**	**2006**	**TOTAL**
Natural Gas	692.3	8,877.4	7,117.8	3,283.5	**19,971.0**
Lignite			4,420.0	7,020.0	**11,440.0**
Coal		337.5	1,125.0		**1,462.5**
Fuel Oil		793.3	100.9		**894.2**
Hydro		241.8	1,028.8	478.1	**1,748.6**
Renewables			87.4	100.0	**187.4**
TOTAL					**35,703.7**

The **$CEF_{d,BM}$**, which is calculated through equation (17) is **620 tCO_2-eq/GWh**.

Step 6. Calculation of the combined margin emission factor.
The combined margin emissions factor is calculated as follows:

$$CEF_{d,CM} = CEF_{d,OM} \cdot w_{OM} + CEF_{d,BM} \cdot w_{BM}$$

Equation 19

Where:

$CEF_{d,CM}$	Combined Margin emission factor (tCO_2/GWh)
$CEF_{d,OM}$	Operating margin emission factor (tCO_2/GWh)
$CEF_{d,BM}$	Build margin emission factor (tCO_2/GWh)
w_{OM}	Weight of the operating margin emission factor
w_{BM}	Weight of the build margin emission factor

The weighs for the operating margin and build margin emission factors are by default 0.5 and 0.5 respectively.

The $CEF_{d,CM}$ which is calculated through equation (19) is **636 tCO_2-eq/GWh.**

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 10).
- ACM0001 "Consolidated methodology for landfill gas project activities" Version 8.1 requires the determination of the emissions from on-site electricity use. These emissions are included in the project emissions as defined under AM0025. These emissions are calculated according to the tool 'Tool to calculate baseline, project and/or leakage emissions from electricity consumption' version 01.1.

The project emissions are therefore described in AM0025 "Avoided emissions from organic waste through alternative waste treatment process" version 10 as follows:

[64] For further information please refer to section B.6.2.

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

Equation 20

Where:

PE_y	is the project emissions during the year y (tCO_2e)
$PE_{elec,y}$	is the emissions from electricity consumption on-site due to the project activity in year y (tCO_2e)
$PE_{fuel,on-site,y}$	is the emissions on-site due to fuel consumption in year y (tCO_2e)
$PE_{c,y}$	is the emissions during the composting process in year y (tCO_2e)
$PE_{a,y}$	is the emissions from the anaerobic digestion process in year y (tCO_2e)
$PE_{g,y}$	is the emissions from the gasification process in year y (tCO_2e)
$PE_{r,y}$	is the emissions from combustion of RDF/stabilized biomass in year y (tCO_2e)
$PE_{i,y}$	is the emissions from the waste incineration in year y (tCO_2e)
$PE_{w,y}$	is the emissions from waste water treatment in year y (tCO_2e)

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_2e)	Not applicable since no fuel will be consumed.
$PE_{c,y}$	is the emissions during the composting process in year y (tCO_2e)	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_2e)	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_2e)	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_2e)	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 greater municipality of Ankara (ASKI). Here the wastewater is treated using aerobic treatment processed[65].

Consequently equation (20) can be simplified as follows:

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

Equation 21

Where:

PE_y	is the project emissions during the year y (tCO_2e)
$PE_{elec,y}$	is the emissions from electricity consumption on-site due to the project activity in year y (tCO_2e)
$PE_{a,y}$	is the emissions from the anaerobic digestion process in year y (tCO_2e)
$PE_{g,y,net}$	is the net emissions from the gasification process in year y (tCO_2e)

[65] Reference: Official website of ASKI http://www.aski.gov.tr/m.asp?tid=15&pn=2

B.6.1.b.1 Project emissions from electricity use

The project emissions from electricity usage are calculated using the 'Tool to calculate baseline, project and/or leakage emissions from electricity consumption' version 01.1. This tool is applicable as the electricity is purchased from the grid only. (Scenario A). The project emissions are calculated as:

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

Equation 22

Where:

$PE_{elec,y}$	is the emissions from electricity consumption on-site due to the project activity in year y (tCO_2e)
$EC_{PJ,j,y}$	Is the quantity of electricity consumed by the project electricity source (MWh/year)
CEF_d	is the carbon emission factor for the displaced electricity source in the project scenario (tCO_2eq/MWh)
$TDL_{j,y}$	Average technical transmission and distribution losses for providing electricity for source j, in year y.

B.6.1.b.2 Project emissions from anaerobic digestion

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

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

Equation 23

Where:

$PE_{a,y}$	is the emissions from the anaerobic digestion process in year y (tCO_2e)
$PE_{a,l,y}$	is the CH_4 leakage emissions from the anaerobic digester in year y (tCO_2e)
$PE_{a,s,y}$	is the total emissions of N_2O and CH_4 from stacks of the anaerobic digestion process in year y (tCO_2e)

CH_4 emissions from leakage ($PE_{a,l,y}$)

Under AM0025 "Avoided emissions from organic waste through alternative waste treatment process" version 10, three options are provided for quantifying of 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 project participant want to implement only advanced technologies. However at the time of PDD development no contracted had been closed with a technology supplier to supply the anaerobic digester system. From preliminary talks with identified technology suppliers it was found that the systems to be considered suitable for the project do not result in any physical leakage[66].

[66] The technical specifications of the anaerobic digester to be implemented are available to the DOE.

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 24

Where:

$PE_{a,s,y}$	is the total emissions of N_20 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/yr)
$MC_{N2O,a,y}$	is the monitored content of nitrous oxide in the stack gas from anaerobic digestion in year y (tN_2O/m^3)
GWP_{N2O}	is the Global Warming Potential of nitrous oxide (tCO_2e/tN_2O)
$MC_{CH4,a,y}$	is the monitored content of methane in the stack gas from anaerobic digestion in year y (tCH_4/m^3)
GWP_{CH4}	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 $MC_{N2O,a,y}$ and $MC_{CH4,a,y}$ are not available. In the project activity the emissions from anaerobic digestion stacks will be determined based on ex-post monitoring of $MC_{N2O,a,y}$ and $MC_{CH4,a,y}$. 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"[67].

B.6.1.b.3 Project net emissions from gasification

The gasifier is not eligible under the Gold Standard. However, together with the energy generated from the syngas this is part of the generic project activity. The gasifier results in GHG emissions, while the produced electricity and avoided land filling of organics results in mitigated GHG emissions, therefore the net emissions resulting from the gasifier and the electricity production are considered as project emissions.

The *"net emissions*" are defined as the difference between the emissions from gasification and the (baseline) emissions from the displaced electricity and utilisation of syngas. Calculated as follows:

$$PE_{g,y,net} = PE_{g,y} - BE_{elec,g,y} - BE_{g,org}$$

Equation 25

[67] Reference: 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

Where:

$PE_{g,y,net}$	is the net emissions from the gasification process in year y (tCO_2e)
$PE_{g,y}$	is the emissions from the gasification process in year y (tCO_2e)
$BE_{elec,g,y}$	is the baseline emissions from generation of electricity that is displaced by utilization of syngas in year y (tCO_2e)
$BE_{g,org}$	is the baseline emissions avoided from preventing organic waste disposal at a SWDS by applying it to the gasifier(tCO_2eq)[68]

Only Project emissions will be taken into account if the net-emissions are positive.

Emissions from gasification ($PE_{g,y}$)

The stack gas from the gasification process may contain small amounts of methane and nitrous oxide. Moreover, fossil-based waste CO_2 emissions from the gasification process shall be accounted for, emission from gasification are calculated as followed:

$$PE_{g,y} = PE_{g,f,y} + PE_{g,s,y}$$

Equation 26

Where:

$PE_{g,y}$	is the emissions from the gasification process in year y (tCO_2e)
$PE_{g,f,y}$	is the fossil-based waste CO_2 emissions from gasification in year (tCO_2e)
$PE_{g,s,y}$	is the N_2O and CH_4 emissions from the final stacks from gasification in year y (tCO_2)

Emissions from fossil-based waste ($PE_{g,f,y}$)

The CO_2 emissions from the gasification of fossil-based waste are calculated based on the amount of fossil-based waste fed into the gasifier, the fossil-derived carbon content, and the combustion efficiency. It is calculated as follows:

$$LE_{g,f,y} = \sum_i A_i * CCW_i * FCF_i * EF_i * \frac{44}{12}$$

Equation 27

Where:

$PE_{g,f,y}$	is the fossil-based waste CO_2 emissions from gasification in year y (tCO_2e)
A_i	is the amount of waste type i fed into the gasifier (t/yr)
CCW_i	is the fraction of carbon content in waste type I (fraction)
FCF_i	the fraction of fossil carbon in waste type I (fraction)
EF_i	is the combustion efficiency for waste type I (fraction)
44/12	is the conversion factor (tCO_2/tC)

Emissions from gasification stacks ($PE_{g,s,y}$)

The emissions from the gasification stacks might include N_2O and CH_4. Methodology AM0025 Avoided emissions from organic waste through alternative waste treatment process" (version 10)." Gives two options for the calculation of these emissions. For the proposed project activity option 1 is selected.

[68] The baseline emissions from the degradable organic carbon fraction of the waste (Ai) fed to the gasifier will be calculated according to the "Tool to determine methane emissions from dumping waste at a solid disposal site".

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

Equation 28

Where:

$PE_{g,s,y}$	is the total emissions of N_2O and CH_4 from gasification in year y (tCO_2e)
$SG_{g,y}$	is the total volume of stack gas from gasification in year y (m^3/yr)
$MC_{N2O,g,y}$	is the monitored content of nitrous oxide in the stack gas from gasification in year y (tN_2O/m^3)
GWP_{N2O}	is the Global Warming Potential of nitrous oxide (tCO_2e/tN_2O)
$MC_{CH4,g,y}$	is the monitored content of methane in the stack gas from gasification in year y (tCH_4/m^3)
GWP_{CH4}	is the Global Warming Potential of methane (tCO_2e/tCH_4)

Baseline Emissions for utilisation of syngas ($BE_{elec,g,y}$)
The baseline emissions from generation of electricity displaced by utilisation of syngas can be calculated through the equation as follows:

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

Equation 29

Where:

$BE_{elec,g,y}$	is te baseline emissions from generation of electricity that is displaced by utilization of syngas in year y (tCO_2e)
$EG_{d,g,y}$	is the amount of electricity generated utilizing the syngas 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_2eq/MWh)

Baseline emissions of organic matter applied to the gasifier ($BE_{g,org}$)
Baseline emissions avoided from preventing organic waste disposal at a SWDS by applying it to the gasifier can be calculated through the equation as follows:

$$BE_{g,org} = BE_{CH4,SWDS,y}$$

Equation 30

Where:

$BE_{g,org}$	Is the baseline emissions avoided from preventing organic waste disposal at a SWDS by applying it to the gasifier(tCO_2eq)
$BE_{CH4,SWDS,y}$	Is the methane emissions avoided from preventing organic waste disposal at a SWDS by applying it to the gasifier; calculated as per the "Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site", Vers. 04 (tCO_2eq)

B.6.1.c Leakage

According to AM0025 "Avoided emissions from organic wastes through alternative waste treatment process" version 10, the sources of leakage are CO_2 emissions from off-site transportation of waste materials in addition to CH_4 and N_2O 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. 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:

$$LE_y = LE_{t,y} + LE_{r,y} + LE_{S,y}$$

Equation 29

Where:

LE_y	Is the leakage emissions in the year y (tCO_2e)
$LE_{t,y}$	Is the leakage emissions from increased transport in the year y (tCO_2e)
$LE_{r,y}$	is the leakage emissions from the residual waste from the anaerobic digestion and gasification (tCO_2e)
$LE_{s,y}$	Is the leakage emissions from stabilised biomass in the year y (tCO_2e)

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_2e)	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_2e)	The project activity does not involve RDF or stabilised biomass, therefore $LE_{s,y}$ is not applicable.

B.6.1.c.1 Emissions from residual waste from anaerobic digester and gasifier ($L_{r,y}$)

According to am0025 "Avoided emissions from organic wastes through alternative waste treatment process" version 10, for the residual waste from the anaerobic digestion and the gasification process 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, CH_4 emissions are estimated through the equation 3 using estimated weights of each waste type ($A_{ci,x}$).

There is no legislation or contractual requirement in Turkey in force that regulates the destruction of methane, consequently the adjustment factor (AF) is "zero". Therefore the leakage emissions from the residual waste from the anaerobic digestion and gasification ($LE_{r,y}$) can be taken as "0".

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.

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

(Copy this table for each data and parameter)

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://mevzuat.basbakanlik.gov.tr/mevzuat/metinx.asp?mevzuatkod=7.5.8132&sourceXmlSearch=kat%FD%20at%FDk
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 ($MD_{BL,y}$).

Data / Parameter:	**ID. 2 / GWP_{CH4}**
Data unit:	tCO_2e/tCH_4
Description:	Global warming potential of CH_4
Source of data used:	Kyoto Protocol
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_{N2O}**
Data unit:	$tCO_2e/t\ N_2O$
Description:	Global warming potential of N_2O
Source of data used:	Kyoto Protocol
Value applied:	310
Justification of the choice of data or description of measurement methods and procedures actually applied :	Value is 310 for the first commitment period. Shall be updated according to any future COP/MOP decisions.
Any comment:	-

Data / Parameter:	**ID. 4 / D_{CH4}**
Data unit:	tCH_4/m^3CH_4
Description:	Density of methane
Source of data used:	ACM0001 'Consolidated baseline and monitoring methodology for landfill gas project activities' version 08.1'
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^3CH_4.
Any comment:	Standard temperature and pressure is defined as 0° degree Celsius and 1,013 bar.

Data / Parameter:	**ID. 5 / $BE_{CH4,SWDS,y}$**
Data unit:	tCO_2e
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:	

Year	2007	2008	2009	2010	2011	2012	2013	2014
$BE_{CH4SWDS}$ (tCO2e)	158,300	344,151	439,261	471,004	476,595	481,892	486,910	491,665

Justification of the choice of data or description of measurement methods and procedures actually applied :	As required per methodology 'Consolidated baseline and monitoring methodology for landfill gas project activities' version 08.1'
Any comment:	This value is estimated ex-ante

Data / Parameter:	**ID. 6 / EG_{gross}**
Data unit:	GWh
Description:	Gross electricity production by fossil fuel power sources (2004-2006)
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 (2004, 2005, 2006). http://www.teias.gov.tr/istat2004/42.xls http://www.teias.gov.tr/istatistik2005/43.xls http://www.teias.gov.tr/ist2006/40.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"[69] TEIAS, Turkish Electricity Transmission Company is the official source for the related data, hence providing the most up-to-date and accurate information available.

[69] Reference: http://rega.basbakanlik.gov.tr/Eskiler/2005/11/20051118-1.htm

Any comment:	

Data / Parameter:	**ID. 7 / FC_i**
Data unit:	m^3 / tons (m^3 for gaseous fuels)
Description:	Amount of fossil fuel consumed in the project electricity system by generation sources (2004-2006)
Source of data used:	TEIAS (Turkish Electricity Transmission Company) Fuels consumed in thermal power plants in Turkey by the electric utilities (2004-2005, 2006) http://www.teias.gov.tr/ist2006/42.xls for 2004 and 2005 data http://www.teias.gov.tr/ist2006/43.xls for 2006 data
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:	-

Data / Parameter:	**ID. 8 / Electricity Imports**
Data unit:	GWh
Description:	Electricity transfers from connected electricity systems to the project electricity system by years (2004-2006)
Source of data used:	TEIAS (Turkish Electrical Transmission Company) Monthly distribution of imported electrical energy by years (2004, 2005, 2006) http://www.teias.gov.tr/ist2006/47.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:	-

Data / Parameter:	**ID. 9 / NCV**
Data unit:	TJ/Gg
Description:	Net calorific value (energy content) of fossil fuel type
Source of data used:	TEIAS (Turkish Electricity Transmission Company) Heating values of fuels consumed in thermal plants in Turkey by the electricity utilities (2004-2005, 2006) http://www.teias.gov.tr/ist2006/44.xls for 2004 and 2005 data http://www.teias.gov.tr/ist2006/45.xls for 2006 data
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; 1cal is considered to be 4.187[70] joules.

Data / Parameter:	**ID. 10 / EF_{co2}**
Data unit:	kg/TJ
Description:	Default CO_2 emission factor of fossil fuel type
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 1)".
Any comment:	-

Data / Parameter:	**ID. 11 / η**
Data unit:	%
Description:	Plant specific generation efficiency for type of fuel
Source of data used:	"Environmental Map" published by Environmental Inventory Head Department under Ministry of Environment and Forestry / http://www.cedgm.gov.tr/dosya/cevreatlasi/atlasin_metni.pdf or http://www.cedgm.gov.tr/dosya/cevreatlasi.htm (p.197 table X.3.1; Thermal Plants and Environment)
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 :	The average values of thermal plants in Turkey are taken from the report "Environmental Map" published by the Ministry of Environment and Forestry.
Any comment:	-

Data / Parameter:	**ID. 12 / Capacity additions**
Data unit:	Name of the plant; Installed capacity (MW); Fuel type; Generation (GWh); Comissionary date
Description:	Capacity additions to the grid that comprises 20% of the total generation (2003-2006)
Source of data used:	TEIAS (Turkish Electricity Transmission Company) Generation units put into operation in 2003; 2004; 2005; 2006 http://www.teias.gov.tr/istatistik/7.xls for 2003 http://www.teias.gov.tr/istat2004/7.xls for 2004 http://www.teias.gov.tr/istatistik2005/7.xls for 2005 http://www.teias.gov.tr/projeksiyon/ekler.htm for 2006 (see Annex II (Ek II) on the web page)

[70] Reference: International Energy Agency (IEA) Statistics, Natural Gas Information / p.xxv, Abbreviations and conversion factors

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 04
Value applied:	0.9
Justification of the choice of data or description of measurement methods and procedures actually applied :	OOnk et el. (1994) have validated several landfill gas models based on 17 realized landfill gas projects. The mean relative error of multi-phase models was assessed to be 18%. 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 CH4 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:	-

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 4, 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 4, 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_j**
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, Table2.4 and Table 2.5)
Value applied:	The following values for the different waste types have been applied:

Waste type j	DOC_j (% wet waste)
Wood and wood products	43
Pulp, paper and cardboard	40
Food, food waste, beverages and tobacco	15
Non-food organics[71]	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 4.
Any comment:	-

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

Data / Parameter:	**ID. 19 / k_j**
Data unit:	-
Description:	Decay rate of the waste
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 an Temperate (MAT < 20°C)
		Dry (MAP/PET <1)
Slowly degrading	Pulp, paper, cardboard	0.04
	Wood, wood products and straw	0.02
Moderatly degrading	Other (non-food) organic putrescible garden and park waste	0.05
Rapidly degrading	Food, food waste, sewage sludge, beverages and tobacco	0.06

Justification of 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 4.
Any comment:	

Data / Parameter:	**ID. 20 / CEF_d**
Data unit:	tCO_2e/MWh
Description:	Emission factor for the production of the electricity in the project activity
Source of data used:	Official utility documents
Value applied:	0.636
Justification of the choice of data or description of measurement methods and procedures actually applied :	Calculated *ex-ante* according to the "Tool to calculate emission factor for an electricity system" version 01, EB35 Annex 12.
Any comment:	

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

>>

The ex-ante emission reductions are calculated using the formulas as described under section B.6.1[72]. In this 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 is calculated as per equation (8)

The input (assumptions) and results for the calculations as described under B.6.1 are as follows:

Table 20 Waste composition of organic waste fed to Anaerobic Digester and DOC, k values in calculation

Wood		Paper		Food waste		Non-food organics	
1%		1%		97%		1%	
DOC	K	DOC	k	DOC	k	DOC	k
43%	0.02	40%	0.04	15%	0.06	20%	0.05

The total amount of organic waste avoided from dumping at the Mamak landfill site is estimated as 328,500 tonnes per year.

Table 21 Other parameters used 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 22 baseline emissions from anaerobic digester

Year	2007	2008	2009	2010	2011	2012	2013	2014
BECH4SWDS,y (tCO2e/year)	0	0	9,727[73]	23,759	36,986	49,454	61,207	72,285

According to ACM0001 "consolidated methodology for landfill gas project activities" version 8.1. The *ex-ante* estimation of the amount of methane that would have been destroyed/combusted, originating from the existing waste[74] 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 Mamak Landfill for the ex-ante estimation of the amount of methane that would have been destroyed are presented as followed:

---

[72] As refered in Approved consolidated baseline methodology ACM0001 "Consolidated methodology for landfill gas project activities" Version 8.1, ex-ante estimation of the amount of methane that would have been destroyed/combusted the year ($MD_{project}$) has been based on the "Tool to determine methane emissions avoided from dumping waste at a solid waste disposal site.

[73] As the waste input to the AD is expected to be 600t/day in 2009, the calculation has been corrected accordingly with a factor of 2/3.

[74] A daily amount of waste entrance of 3500t is estimated for ex-ante estimation of the amount of methane that would have been destroyed/combusted during the first crediting period.

Table 23 Waste composition of organic waste at Mamak Landfill and DOC, k values in calculation

Wood		Paper		Food waste		Non-food organics	
0%		6%		50%		20%	
DOC	K	DOC	k	DOC	k	DOC	k
43%	0.02	40%	0.04	15%	0.06	20%	0.05

Table 24 Ex-ante estimation of the amount of methane that would have been destroyed/combusted during the first crediting period[75].

Year	2007	2008	2009	2010	2011	2012	2013	2014
BECH4SWDS,y (tCO2e/year)	158,300	344,151	439,261	471,004	476,595	481,892	486,910	491,665

Emission reductions resulting from the production of electricity:

The baseline emissions from electricity generation are calculated by equation (6).

Table 25 Baseline emissions from electricity generation

Year	$EG_{d,y}$ (MWh)	CEF_d (tCO_2e/MWh)	$BE_{elec,y}$ (tCO_2e)
2007	72,310	0.636	45,987
2008	88,500	0.636	56,284
2009	181,600	0.636	115,493
2010	207,400	0.636	131,901
2011	207,400	0.636	131,901
2012	207,400	0.636	131,901
2013	207,400	0.636	131,901
2014	207,400	0.636	131,901

Summary of the baseline emissions:

Table 26 Baseline emission (BE_y)

Year	$MD_{project,y}$ (tCO_2e)	MB_y (tCO_2e)	$BE_{elec,y}$ (tCO_2e)	BE_y (tCO_2e)
2007	158,300	0	45,987	204,288
2008	344,151	0	56,284	400,435
2009	439,261	9,727	115,493	564,482
2010	471,004	23,759	131,901	626,664
2011	476,595	36,986	131,901	645,483
2012	481,892	49,454	131,901	663,247
2013	486,910	61,207	131,901	680,018
2014	491,665	72,285	131,901	695,851

Project emissions

The project emissions are the direct emissions from the waste treatment process and the emissions from the electricity consumption due from the project activity. Project emissions are calculated according to equation (21).

[75] As the actual figures are available for 2007 and 2008, ex-ante estimation of the amount of methane that would have been destroyed / combusted during the first crediting period, have been corrected by a "correction factor". A correction factor of 0.315; 0.675 and 0.85 have been applied for the years 2007; 2008 and 2009 in the respective manner. The correction factor has been set to 0.9 for the year 2010 and onwards.

Table 27 Project emissions from electricity use

Year	2007	2008	2009	2010	2011	2012	2013	2014
$EC_{pj,i,y}$ (MWh/year)	1,500	1,500	1,750	2,000	2,350	2,350	2,350	2,350
CEF_d (tCO_2e/MWh)	0.636	0.636	0.636	0.636	0.636	0.636	0.636	0.636
$TDL_{i,y}$ (%)	15%	15%	15%	15%	15%	15%	15%	15%
$PE_{elec,y}$ (tCO_2e)	1,100	1,100	1,283	1,467	1,723	1,723	1,723	1,723

Table 28 Project emissions from gasification

	2007	2008	2009	2010	2011	2012	2013	2014
$EG_{d,g}$ (MWh/year)	0	0	8,600	51,600	120,400	120,400	120,400	120,400
$BE_{elec,y}$ (tCO2e/year)	0	0	5,469	32,816	76,571	76,571	76,571	76,571
$BE_{g,org}$ (tCO2e/year)[76]	0	0	0	0	0	0	0	0
$PE_{g,f,y}$ (tCO2e/year)	0	0	1,276	12,757	17,860	17,860	17,860	17,860
$PE_{g,s,y}$ (tCO2e/year)	0	0	0	0	0	0	0	0
$PE_{g,y,net}$ (tCO2e/year)	0	0	0	0	0	0	0	0

Summary of the project emissions:

Table 29 Project emissions (PE_v)

Year	PEelec (tCO_2e)	PEg,y,net	PEa,y	PE_y (tCO_2e)
2007	1,100	0	0	1,100
2008	1,100	0	0	1,100
2009	1,283	0	0	1,283
2010	1,467	0	0	1,467
2011	1,723	0	0	1,723
2012	1,723	0	0	1,723
2013	1,723	0	0	1,723
2014	1,723	0	0	1,723

Leakage

As described under the section B.6.1.c, leakage emissions due to the project activity can be discarded.

[76] For ex-ante estimation the baseline emissions avoided from preventing organic waste disposal at a SWDS by applying it to the gasifier are neglected.

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

>>

Table 30 Ex-ante estimation of emission reductions

Years	Estimation of project activity emissions (tCO_2e)	Estimation of baseline emissions (tCO_2e)	Estimation of leakage emissions (tCO_2e)	Estimation of overall emission reductions(tCO_2e)
2007[77]	733	204,288	0	203,554
2008	1,100	400,435	0	399,335
2009	1,283	564,482	0	563,199
2010	1,467	626,664	0	625,198
2011	1,723	645,483	0	643,760
2012	1,723	663,247	0	661,524
2013	1,723	680,018	0	678,295
2014[78]	574	231,950	0	231,376
Total tCO_2e	10,327	4,016,567	0	4,006,240

[77] For ex-ante estimation of the emission reductions, the start of the first crediting period is taken as 01/05/2007. The figures for this year have been corrected accordingly.

[78] The end of the first crediting period is taken as 30/04/2014. The figures for this year have been corrected accordingly.

B.7. Application of the monitoring methodology and description of the monitoring plan:

B.7.1 Data and parameters monitored:

(Copy this table for each data and parameter)

Data / Parameter:	**ID. 21 / $LFG_{total,y}$**
Data unit:	m^3
Description:	Total amount of landfill gas captured
Source of data to be used:	Measured continuously by 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 and all data will be archived electronically.
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:	The total flow will be measured with separate flow meters for each stage of extension (currently there are 2 groups each including 4 engines). Data will be archived electronically during the crediting period and two years after.

Data / Parameter:	**ID. 22 / $LFG_{flare,y}$**
Data unit:	m^3
Description:	Amount of landfill gas flared
Source of data to be used:	Measured continuously by 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
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:	The LFG flow to the flares will be measured with separate flow meters for each flare. Data will be archived electronically during the crediting period and two years after.

Data / Parameter:	**ID. 23 / $LFG_{electricity,y}$**
Data unit:	m^3
Description:	Amount of landfill gas combusted to produce electricity
Source of data to be used:	Measured continuously by 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.
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:	The LFG flow to the power gene ration units will be measured with separate flow meters for each PGU group. Data will be archived electronically during the crediting period and two years after.

Data / Parameter:	**ID. 24 / Temperature**
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	0°C 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_{CH4}. 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. 25 / Pressure**
Data unit:	mbar
Description:	Pressure of the landfill gas
Source of data to be used:	Pressure meters
Value of data applied for the purpose of calculating expected emission reductions in section B.5	1013 mbar 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_{CH4}. 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	The pressure meters are subject to a regular maintenance and testing regime

applied:	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. 26 / 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:	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. 27 /** $\eta_{flare,h}$
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 and procedures to be applied:	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 project emissions from flaring gases containing methane "Version 01, EB 28 Annex 13.
QA/QC procedures to be applied:	
Any comment:	

Data / Parameter:	**ID. 28 / w_{CH4}**
Data unit:	% (m^3 CH4 / m^3 LFG)
Description:	Methane fraction in the landfill gas
Source of data to be used:	Project participant
Value of data applied for the purpose of calculating expected emission	50% The value is estimated for the purpose of ex-ante emission reduction calculation.

reductions in section B.5	
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. 29 / 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	8,000 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. 30 / $EC_{PJ,j,y}$**
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:	

Data / Parameter:	**ID. 31 / $TDL_{j,y}$**
Data unit:	-
Description:	Average technical transmission and distribution losses for providing electricity for source j, in year y.
Source of data to be	Used for ex-ante: Official report from the Turkish electricity distribution

used:	comany TEDAS. http://www.oib.gov.tr/tedas/teaser_english.pdf (page 10) Best available recent reliable and accurate data.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	15% The value is estimated for the purpose of ex-ante emission reduction calculation.
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. 32 / $SG_{a,y}$**
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 section B.5	For ex-ante estimation the stack emissions from anaerobic digestion is neglected.
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. 33 / $MC_{N2O,a,y}$**
Data unit:	tN_2O/m^3
Description:	Concentration of N_2O 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. 34 / $MC_{CH4,a,y}$**
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. 35 / $A_{.}$**
Data unit:	Tonnes/year
Description:	Amount of waste type "I" fed into the gasifier
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 project will reach to 127,750 tonnes/year waste, which consists of:

	Waste type I fed into the gasifier							
	Food Waste	Paper and Cardboard	Textiles	Nappies	Rubber and Leather	Plastics	Glass	Inert Waste
Fraction	15%	1.5%	1%	1%	1.5%	1.5%	1.5%	77%

Description of measurement methods and procedures to be applied:	It is planned to measure the total amount of waste fed to the gasifier continuously. In case this is not feasible the total amount of waste will be measured periodically. In any case the waste composition will be measured by periodic sampling which will take place at least quarterly.
QA/QC procedures to be applied:	
Any comment:	

Data / Parameter:	**ID. 36 / CCW_i**
Data unit:	Fraction
Description:	Fraction of carbon content in waste type "I"
Source of data to be used:	IPCC 2006 Guidelines for National Greenhouse Gas Inventories
Value of data applied for the purpose of calculating expected emission reductions in section B.5	<table><tr><th></th><th>CCW_i</th></tr><tr><td>Paper & Cardboard</td><td>46%</td></tr><tr><td>Textiles</td><td>50%</td></tr><tr><td>Nappies</td><td>70%</td></tr><tr><td>rubber and leather</td><td>67%</td></tr><tr><td>Plastics</td><td>75%</td></tr><tr><td>Glass</td><td>0%</td></tr><tr><td>inert waste</td><td>3%</td></tr><tr><td>food waste</td><td>38%</td></tr><tr><td>wood</td><td>50%</td></tr></table> The value is determined ex-ante and fixed for the first crediting period.
Description of measurement methods and procedures to be applied:	N.A
QA/QC procedures to be applied:	N.A.
Any comment:	

Data / Parameter:	**ID. 37 / FCF_i**
Data unit:	Fraction
Description:	Fraction of fossil carbon in waste type "I"
Source of data to be used:	IPCC 2006 Guidelines for National Greenhouse Gas Inventories
Value of data applied for the purpose of calculating expected emission reductions in section B.5	The value is determined ex-ante and fixed for the first crediting period.
Description of measurement methods and procedures to be applied:	N.A.
QA/QC procedures to be applied:	N.A.
Any comment:	

Data / Parameter:	**ID. 38 / W_x**
Data unit:	tons
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	328,500 tons
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:	
Any comment:	

Data / Parameter:	**ID. 39 / $p_{n,j,x}$**
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	For ex-ante calculation the following values were applied: Wood 3,285 1% Paper & Cb 3,285 1% Food waste / sewage sludge 318,645 97% Non food organics 3,285 1%
Description of measurement methods and procedures to be applied:	The waste prevented from disposal, using the waste catagories 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 minimum uncertainty range of 20% at a 95% confidence level. The sampling will be undertaken at least four times a year.
Any comment:	

Data / Parameter:	**ID. 40 / 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 monitored if the waste prevented from disposal

	includes several waste catagories j, as catagorized in tables for DOC_j and k_j.

Data / Parameter:	**ID. 41 / EF_i**
Data unit:	Fraction
Description:	Combustion efficiency of waste type "I"
Source of data to be used:	IPCC 2006 Guidelines for National Greenhouse Gas Inventories or laboratory data.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	100% The value is determined ex-ante and fixed for the first crediting period.
Description of measurement methods and procedures to be applied:	It is planned to determine the combustion efficiency in a laboratory by simulating the conditions in the gasifier. However at the moment of PDD development it is not sure yet if this is feasible. If it is not feasible a default value of 100 % is used which is conservative
QA/QC procedures to be applied:	N.A.
Any comment:	

Data / Parameter:	**ID. 42 / $SG_{g,y}$**
Data unit:	m^3/year
Description:	Total volume of stack gas from gasification
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 gasification is neglected.
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 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. 43 / $MC_{N2O,g,}$**
Data unit:	tN_2O/m^3
Description:	Monitored content of nitrous oxide in the stack gas from gasification in year y.
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 gasification 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. 44 / $MC_{CH4,g,y}$**
Data unit:	tCH_4/m^3
Description:	Monitored content of methane in the stack gas from gasification in year y.
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 gasification 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. 45 / 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	253,419 tCO_{2e} (for the first crediting period) The 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 4.
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 4.
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. 46 / EG_{total}**
Data unit:	MWh
Description:	Amount of electricity provided to the grid as a result of the whole 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	
Description of measurement methods and procedures to be applied:	The electricity provided is measured from electricity meters and aggregated annually.
QA/QC procedures to be applied:	Maintenance and calibration of equipment will be carried out by the grid company.
Any comment:	

Data / Parameter:	**ID. 47 / $EG_{d,gy}$**
Data unit:	MWh
Description:	The amount of electricity generated utilizing syngas.
Source of data to be used:	Electricity meters
Value of data applied for the purpose of calculating expected emission reductions in section B.5	120,400 MWh (after reaching full 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 syngas 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. 48 / $EG_{d,y}$**
Data unit:	MWh
Description:	The amount of electricity generated utilizing the biogas and LFG.
Source of data to be used:	Electricity meters
Value of data applied for the purpose of calculating expected emission reductions in section B.5	207,400 MWh (after reaching full 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. 49 / AF**
Data unit:	%

Description:	Methane destroyed due to regulatory or other requirements
Source of data to be used:	"Regulation on Solid Waste Management" Regulation number: 20814
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 "Regulation on Solid Waste Management" 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:	

According to "Gold Standard" the parameters that have significant impact in the sustainability matrix should be monitored. In line with this requirement the parameters mentioned below will be monitored.

Data / Parameter:	**ID 50/ 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:	**SDI.1[79] / Water Quality**
Description:	One of the main sources of pollution from landfills is the uncontrolled drainage of leachate (baseline situation). With the implementation of the project activity the leachate will be collected and transferred to the ASKI water treatment plant.
Description of measurement methods and procedures to be applied:	The collection of the leachate will be demonstrated to the DOE by official documents or other proofs which are available.
Proof:	
Frequency:	Annually
QA/QC procedures to be applied:	
Any comment:	The actual treatment of the leachate will be done within the jurisdiction of the

[79] The numbering of the Sustainable Development Indicators is applied according to the numbering in the SDI matrix in paragraph A.2.

	ASKI water treatment plant and is therefore not under control of the project proponents.

Data / Parameter:	**SDI.2 / Air Quality**
Description:	One of the major sources for air pollution of uncovered landfills is hydrogen sulphide (H_2S) which not only results in a strong, pungent and unpleasant odour but also can be harmful as it causes nausea, vomiting, headache and other undesired physiological effects. The project activity will minimise this negative effect by collecting and burning the landfill gas. Hydrogen sulphide and other components will be destroyed. Apart from landfill gas also syngas from gasification may contain pollutants and is hence subject to an advanced multistep gas treatment system.
Description of measurement methods and procedures to be applied:	However there is the general scientific understanding that it is not possible to directly measure odours in an objective way. Thus it was decided to define sulphides[80] as key parameter representing odour. Between 0-1% of volume of the landfill gas is known to contain sulfides[81]. The amount of sulphide will be calculated based on the amount of landfill gas combusted in the engines as followed: $V_{sulphide\ destroyed}=V_{LFG\ destroyed} * 0.005$ Where "V" represents the volume in m^3. A conservative approach of 0.5% is set for the sulphide content. Pollutants from the stacks form the gasifier will be monitored periodically and the results obtained will be compared to national regulations.
Proof:	Measurements.
Frequency:	At least annually.
QA/QC procedures to be applied:	If unusual values of sulfides are measured, provisions will be performed to identify the reason and improve the destruction efficiency of the project.
Any comment:	

Data / Parameter:	**SDI.4 / Soil Condition**
Description:	One of the main mechanisms for soil contamination due to landfill activities is the uncontrolled drainage of leachate. As leachate will be collected and transferred to the treatment plant the contamination of the soil layers beneath the landfill will be reduced significantly. Another mechanism for soil degradation is erosion. By terracing erosion will be reduced.
Description of measurement methods and procedures to be applied:	Terracing will be shown to the DOE during on site visits. Progresses will be also documented by photos from earlier stages. The monitoring of the drainage system is already covered by the parameter SDI.1 / Water Quality.
Proof:	First hand impression of DOE during on site visit and documentation of progress by photos.
Frequency:	Annually.
QA/QC procedures to be	If the DOE or the project participant identify that the measures to minimise

[80] Sulfides (e.g., hydrogen sulfide, dimethyl sulfide, mercaptans) are naturally occurring gases that give the landfill gas mixture its rotten-egg smell

[81] Reference: US Department of Health and Human Services, Agency for Tosic Substances & Disease Registry official website http://www.atsdr.cdc.gov/hac/landfill/html/ch2.html#t2_1

applied:	erosion do not fulfil their purpose, countermeasures will be performed to maximise the positive impact of the project activity against erosion.
Any comment:	

Data / Parameter:	**SDI.6 / Employment (job quality)**
Description:	Trainings are an important issue to improve the job quality of employees.
Description of measurement methods and procedures to be applied:	The number of trainings and attendance of employees will be monitored.
Proof:	Documentation of trainings. Documentation of attendance.
Frequency:	Annually.
QA/QC procedures to be applied:	
Any comment:	

Data / Parameter:	**SDI.7/ Livelihood of the poor**
Description:	The creation of formalized jobs can give jobless the opportunity of a stable income and access to social security.
Description of measurement methods and procedures to be applied:	Employees will be asked whether or not they had a stable income and access to social security before.
Proof:	Documentation of interviews or questionnaires or via the national social security records.
Frequency:	Annually.
QA/QC procedures to be applied:	
Any comment:	

Data / Parameter:	**SDI.9 / Human and institutional capacity**
Description:	It is planned to conduct campaigns to raise awareness of communities for avoidance of waste and recycling.
Description of measurement methods and procedures to be applied:	Campaigns will be documented as e.g. areas where such campaigns took place and how citizens where approached and what type of information was accessible to them.
Proof:	Training documents. Procedures of campaigns.
Frequency:	Annually.
QA/QC procedures to be applied:	
Any comment:	

Data / Parameter:	**SDI.10 / Employment (quantity)**
Description:	The project activity will create a substantial number of jobs in the project area.
Description of measurement methods	Job contracts will be archived.

and procedures to be applied:	
Proof:	Contracts.
Frequency:	Annually.
QA/QC procedures to be applied:	
Any comment:	

B.7.2. Description of the monitoring plan:

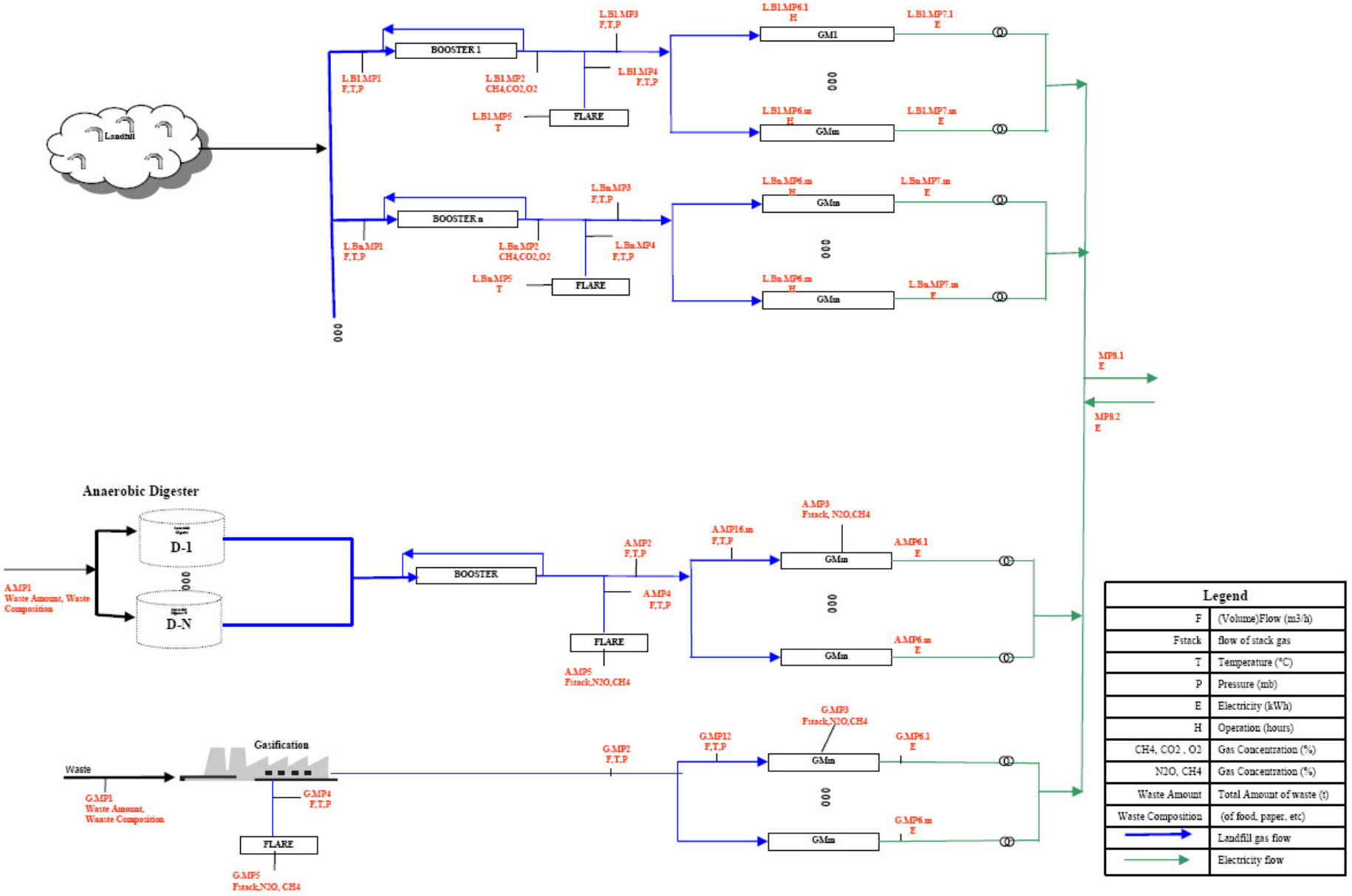
>>

Monitoring Plan

Monitoring will be carried out following the procedures set by the consolidated baseline methodology ACM0001 version 8.1 and AM0025 version 10, 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 out of the project boundary
- Operating hours of power generation units
- Total amount of the electricity imported from the grid
- Project emissions due from Anaerobic treatment
- Emissions from gasification of the fresh waste
- Amount of electricity generated from the gasifier power units exported to the grid
- The amount of fresh waste avoided from dumping waste at the solid waste disposal site

The following figure shows the position of the different measurement points:


Landfill
BOOSTER.1
L.B1.MP1
F,T,P
L.B1.MP2
CH4,CO2,O2
L.B1.MP3
F,T,P
L.B1.MP4
F,T,P
L.B1.MP5
T
FLARE
L.B1.MP6.1
H
GM1
L.B1.MP7.1
E
L.B1.MP6.m
H
GMm
L.B1.MP7.m
E
BOOSTER.n
L.Bn.MP1
F,T,P
L.Bn.MP2
CH4,CO2,O2
L.Bn.MP3
F,T,P
L.Bn.MP4
F,T,P
L.Bn.MP5
T
FLARE
L.Bn.MP6.m
H
GMm
L.Bn.MP7.m
E
MP8.1
E
MP8.2
E
Anaerobic Digester
D-1
D-N
A.MP1
Waste Amount, Waste Composition
BOOSTER
A.MP2
F,T,P
A.MP4
F,T,P
A.MP5
Fstack,N2O,CH4
FLARE
A.MP16.m
F,T,P
A.MP3
Fstack, N2O,CH4
GMm
A.MP6.1
E
A.MP6.m
E
Gasification
Waste
G.MP1
Waste Amount, Waste Composition
G.MP4
F,T,P
G.MP5
Fstack,N2O, CH4
FLARE
G.MP2
F,T,P
G.MP12
F,T,P
G.MP3
Fstack,N2O,CH4
GMm
G.MP6.1
E
G.MP6.m
E
Legend
F
(Volume)Flow (m3/h)
Fstack
flow of stack gas
T
Temperature (°C)
P
Pressure (mb)
E
Electricity (kWh)
H
Operation (hours)
CH4, CO2 , O2
Gas Concentration (%)
N2O, CH4
Gas Concentration (%)
Waste Amount
Total Amount of waste (t)
Waste Composition
(of food, paper, etc)
Landfill gas flow
Electricity flow

Measuring of exported electricity

The main meter for the monitoring of the electricity is at MP8.1. 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 once the gasifier starts operation, clarifying the fraction of electricity produced with LFG, biogas and syngas.

Flare efficiency

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

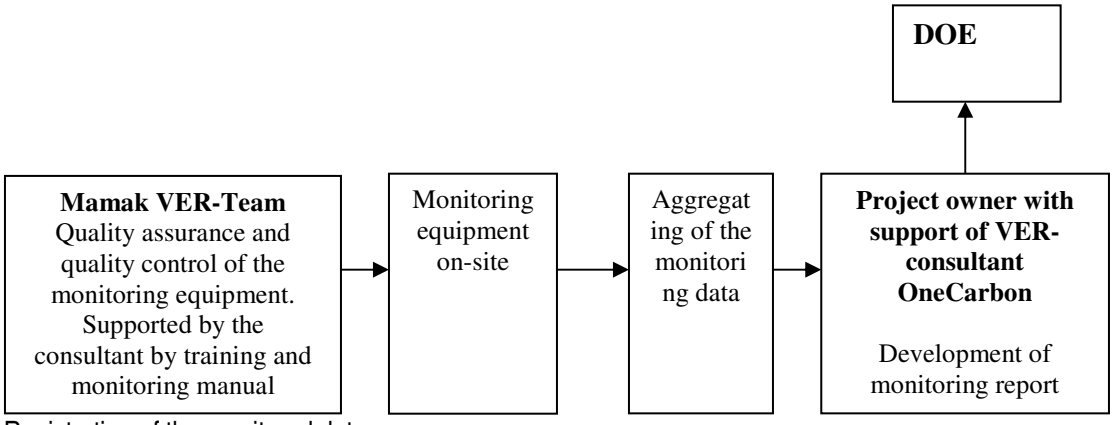
In case of enclosed flares and use of the default value for the flare efficiency, the efficiency in the hour h (n_{flare}, h) is:

- 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 landfill and the installed equipment. The project participant is also responsible for the administration of the data.
Therefore it will team up a VER team. This team will be responsible for monitoring all data required to estimate emission reductions.
OneCarbon will also provide a monitoring manual and train the VER-team with regards to the monitoring aspects of the project.

The monitoring manual will elaborately describe the monitoring procedures including the monitoring strategy, fixed parameters, monitored parameters, data gathering and storage, responsibilities, calibration and maintenance procedures.
In the diagram below the organisation of monitoring management and data application is presented.



Registration of the monitored data

The Mamak 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 with support of the VER-consultant OneCarbon to the DOE for verification. All the monitored data will be stored within the crediting period and for at least two years after the end of the crediting period.

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.

According to "Gold Standard" the parameters that have significant impact in the sustainability matrix should be monitored. In line with this requirement the parameters mentioned below will be monitored.

Biogas usage (utilisation of LFG > 65%) – calculation from available parameters possible (ID.50)

1. Water Quality (SDI.1)
2. Air Quality (SDI.2)
3. Soil condition (SDI.4)
4. Employment (Quality) (SDI.6)
5. Livelihood of the poor (SDI.7)
6. Human and institutional Capacity (SDI.9)
7. Employment (Quantity) (SDI.10)

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:
27/02/2009

Name of person/entity determining the baseline:
The baseline study and monitoring methodology has been prepared by Ecofys Netherlands BV in consultation with ITC Invest Trading & Consulting A.G. Turkish Branch by Mr. Ömer Akyürek and Mr. Edwin Dalenoord.

Company name: Ecofys Netherlands BV
Visiting Address: Kanaalweg 16-G
3526 KL Utrecht
The Netherlands
Contact Person: Mr. Ömer Akyürek
Telephone number: +90 212 3256780
Fax number: +90 212 2823480
e-mail: o.akyurek@ecofys.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:

>>
01/02/2006

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

>>
Life time of the project is 49 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:

>>
01/05/2007 or two years before the registration with Gold Standard –whatever is later.

C.2.1.2. Length of the first crediting period:

>>
7 years, 0 months

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

>>
N.A.

C.2.2.2. Length:

>>
N.A.

SECTION D. Environmental impacts

>>

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

>>

No Environmental Impact Assessment (EIA) has been performed for the proposed VER project activity, as Mamak Project is exempted from the necessity to conduct an Environmental Impact Assessment[82]. However all the necessary permits have been obtained from related departments/organizations including the Ministry of Environment and Forestry. Also there have been several articles, press releases, statements from different levels of authorities including on the positive affect of the project on environment and sustainable development.

Several studies have been conducted on the environmental impacts of Mamak Landfill area regarding the situation before the implementation of the project started, where significant negative affects on environment were attributed to the unmanaged landfill area. Most of the studies/reports were focusing on the leachate problem and the explosion danger of the unmanaged landfill area, which was the most significant and emphasized problem with regards to Mamak Landfill. The latest of these reports was the "Report on Characterization of Mamak Municipality Solid Waste Dump Site Leachate as Surface Seepage and Its Effect on Imrahor Creek"[83], which was published in 2004.

The result of the study suggested that:

"…the leachate has a capacity of 2.75 lt/sec, have neutral pH, contains high inorganic load (CO around 6000 mg/lt), but poor concerning biologically degradable substances (BOD around 300 mg/lt), high in TKN (around 1800 mg/lt) probably mainly due to ammonia and continuous increase in heavy metal content, which is a result of the uncontrolled activities. Imrahor Creek which is of a high quality water course becomes densely polluted after the discharge of leachate and acts as an open sewage, by receiving other effluents of the region as well."

The study proposed the derivation of leachate into sewer system of Ankara. The proposed project not only solves the leachate problem by connecting the leachate drainage system to the sewer system but also sends the leachate water to ASKI[84] waste water treatment centre, where the leachate is treated, enabling both the management of leachate and prevent its threat to surrounding environment and also preservation of the Imrahor Creek.

---

[82] Reference: Official document of Exemption for Environmental Impact Analyse for Mamak Project. Available for DOE.

[83] Reference: "Characterization of Mamak Municipal Solid Waste Dump Site Leachate as Surface Seepage and Its Effect on Imrahor Creek" Report / Chamber of Environmental Engineers, Environmental Science & Technology Magazine Volume 2, No1 p. 102-116 (year 2004).

[84] Reference: Ankara Water and Sewerage Administration / http://www.aski.gov.tr/m.asp?tid=15&pn=2

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:

>>

No Environmental Impact Assessment (EIA) has been performed for the proposed VER project activity, for the following reasons:

1. Executing an EIA for a project of this kind is not legally obliged in Turkey. The proposed project is exempted from an EIA.

2. The Sustainable Indicator Matrix, as can be found in section A.2 of this PDD, has a total score of +11 and does not contain any negative scores. According to the 'Gold Standard Voluntary Emission Reductions (VERs) Manual for Project Developers', indicators scoring -1 must be subject to the EIA pre-screen checklist to determine the necessity of an EIA. Since no indicator has a negative score it is not necessary to perform an EIA.

3. The outcomes of the preliminary consultation process did not result in any negative comments on significant impacts of the proposed project on the environment. In order to ensure adequate consideration of all relevant impacts, stakeholders have been asked to address the impacts and their significance based on the Social Impacts Checklist of the 'Gold Standard Voluntary Emission Reductions (VERs) Manual for Project Developers'. Detailed information regarding the preliminary consultation process can be found under section E, Stakeholders' comments.

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 has to be undertaken by the project participant in order to solicit stakeholders comment and increase their participation in the project. The preliminary consultation was organised in the Ankara Province, where the project is located.

Preliminary Consultation:

The preliminary consultation meeting was held on 26 November 2007 at the ITC management building located within the Mamak District Solid Waste Landfill Area during the meeting stakeholders were informed about the project and could share their views, opinions and recommendations. The meeting was held in Turkish, the local language.

Eighteen participants, including NGO representatives, academics, local and regional administrators, the Imrahor Village muhtar, local people and consultants from OneCarbon, attended the meeting[85].

The topic, date, place and hour of the public involvement and discussion meeting was announced in the local newspaper, Son Söz. Furthermore all the stakeholders were sent invitations via e-mail. The Imrahor Village Muhtar did not have e-mail access so he was invited orally by telephone and a written invitation was sent to his address. The copies of the invitation notice in the newspaper and the invitation sent to the muhtar are included in the preliminary consultation meeting report.

At the preliminary consultation, the participants were informed about the project by the representatives of ITC Invest Trading & Consulting AG Turkish Branch and project introduction documents in the local language were distributed to the participants. An introductory presentation of the project was performed by the General Manager Mr. Erdogan Gogen and Ms. Tugba Kırer and. In the appendix of the handouts, there was a questionnaire about the effects of the project on environmental, economical and sustainable development. The questionnaire was based on Appendix E of the GS VER project developers manual. Following the introduction of the project, the opinions and recommendations of the stakeholders were discussed.

The minutes of the meeting were signed by the Imrahor Village Muhtar Mr Irfan Yılmaz, the village headman who participated as an independent external supervisor. Additionally, the participants signed the attendance list. Both the minutes and the signed attendance list are provided in the preliminary consultation meeting report.

During the preliminary consultation meeting it was concluded that no negative effects regarding environmental and social aspects of the project were expected.

Second Round Consultation:

Between 14.02.2008 and 05.04.2008 a second round consultation process has been undertaken by the Project participant. However, due from the changes in the Project Design Document, Gold Standard

[85] For more detail please refer to the Preliminary Consultation Meeting Report.

requested the process to be repeated. Therefore, the second round consultation process has been repeated between 03.09.2008 and 03.11.2008.

List of stakeholders defined for the consultation process

National Level

Name / Surname	***Organization / Position***
Hayati Çetin	Ministry of Energy and National Resources, General Directorate of Energy Works / Head of Project Execution Department
Rüya Ataman	Energy Market Regulatory Authority
Dr. Volkan Ediger	Energy consultant to the Presidency of the Republic of Turkey
Mahir Erdem	Ministry of Environment and Forestry / Head of Waste Management Department

Regional Level

Name / Surname	***Organization / Position***
Fatih Hatipo•lu	Ankara Greater Municipality, Health & Sanitation Administration / Head of Health & Sanitation Administration
Vicdan Karakaya	Ankara Provincial Directorate of Environment / Department Manager of Environmental Impact Assessment and Planning

Local Level

Name / Surname	***Organization / Position***
Gazi Sahin	Mayor of Mamak District
Irfan Yılmaz	Headman of Imrahor Village

NGO

Name / Surname	***Organization / Position***
Ertu•rul Ünlütürk	Chamber of Environmental Engineers / Head of the Chamber
Özgür Sakı	CEVKO (Environmental Protection Association) / Representative of Ankara

Universities

Name / Surname	***Organization / Position***
Prof. Dr. Sencer Ayata	Middle East Technical University,
Doc. Dr. Yasemin Özkan	Ankara University / Project Manager of Development and Implementation of an Education Program on Consumption Habits of Families and Recycling of Domestic Wastes (a project of TÜBITAK[86]).
Ar. Gör. Nimet Uzal	Middle East Technical University

GS Supporters

Name / Surname	***Organization / Position***
Filiz Demirkaya	WWF Turkey
Hilal Atıcı	Greenpeace Turkey
Yunus Arıkan	REC Turkey[87]

[86] TÜBİTAK: The Scientefic and Technological Research Council of Turkey http://www.tubitak.gov.tr/home.do?ot=10&lang=en

[87] REC Turkey (Regional Environmental Center) has been commissioned as the focal point for education, training and public awareness under article 6 of UNFCCC on May 2005.

During the second round consultation period, full documentation was made publicelly available for two months starting from 03/09/2008 till 03/11/2008. These documents include:

a) Mamak Landfill, Waste Management Project PDD.
b) Preliminary Stakeholders Consultation Report including the non-technical summary of the project activity (in Turkish)
c) Questionnaire with regards to the project activity impact on environmental and sustainable development /Annex E of Gold Standard Manual version 1 (in Turkish)
d) Sustainable Development Matrix (in Turkish)

The second round consultation process begun with sending out the relevant documents, as listed above to the pre-defined stakeholders via e-mail and website of OneCarbon International BV. The documents were delivered by hand, where it is considered that access through internet might be a problem.

The documents were sent on 3rd, 4th and 5th of September 2008 via e-mail and were kindly invited to ask questions or provide comments and feedback on the project.

The muchtar, who is the official representative of the local community, was visited at the Imrahor Village and the documents including the SD Matrix has been delivered giving information and explanation on the documents invited to provide feedback. Also several hard copies of the documents were handed out to be delivered to the villagers. In general the locals are in favor of the project activity, specifically mentioning the employment opportunities and providing a solution to odour and leachate problems.

Furthermore, the mentioned documents have been made publicly available for download and comment by publishing on the web address http://www.onecarbon.com/index.php?option=com_content&task=blogsection&id=1&Itemid=58 , which is a link under OneCarbon International BV web page. The documents were available for download and comment between dates 03/09/2008 and 03/11/2008.

To ensure an efficient participation of the stakeholders to the process, they were called by phone by the project owner and encouraged to provide feedback with regards to the documents provided during the second round consultation process.

E.2. Summary of the comments received:

>>

Preliminary Consultation:

The general outcome of the preliminary consultation meeting was positive. The stakeholders stated that they are in favour of the project and underlined the significant contribution of the project to regions environment and stressed the importance of renewable and clean energy. The issues discussed/brought up by the stakeholders during the preliminary consultation meeting can be summarized as followed:

- The scope of the project and project activities
- Odour problem in the landfill area (please see section E.3 for details)
- The use of electricity generated by the project (please see section E.3 for details)
- Employment opportunities created by the proposed project
- The leachate management at the landfill
- Forestation activities
- The transportation of the wastes to the landfill (please see section E.3 for details)
- Further plans regarding the landfill and the project activities (please see section E.3 for details)
- Information on recycling centre.

Second Round Consultation:

In respond to the invitations Mr. Özgür Sakı on behalf of ÇEVKO (Environmental Protection Association) has provided feedback by filling out the questionnaire on 20.10.2008.
In general Mr. Özgür Sakı's feedback was positive. Important highlights of his feedback can be summarized as:

With regards to questions of the Gold Standard Annex E

No	Question	Respond
3	Will the project release pollutants or any hazardous, toxic or noxious substances to air?	The gases generated in the digester would cause no problem if proper control systems are applied
6	Are there any areas on or around the location which are protected under international or national or local legislation for their ecological value, which could be affected by the project?	Golba•ı private protection area
Other		Mr. Ozgur •akı has replied "no" in respond to all other questions

With regards to the comment from Mr. Özgür Sakı on the release of pollutants or or any hazardous, toxic or noxious substances to air, he has been informed on the anaerobic digester's features that ensure no leakage from the digester.
The gases generated due from the project activity will be managed mostly by combustion in the generators and electricity will be generated. Also to prevent gas leakage from the digester tanks, they will be constructed in such a way that they will be leakage proof. To prevent any gas leakage a leakage proof membrane has been chosen.
With regards to Gölbası private protection area, the project is not located in the mentioned protected area, however it is known that till 2006, Mamak wild landfilling area had an adverse effect to Eymir Lake located within the protected area. The un-managed leachate release had a polluting effect to the ground and

underground water that indirectly had impact to the basin which reaching Eymir Lake. An important part of the Mamak Waste Management Project activity, leachate is collected and managed through a drainage system constructed in the Mamak Landfill Area. The project has prevented the leakage problem of the solid waste landfill area by preventing the mixing of the leakage into the brook in Imrahor. The leakage water is collected through canals, directed to the ASKI water treatment system, and eliminated in a controlled way.

Through two consultation rounds conducted with regards to the proposed project's impact to environment and sustainable development, it can be concluded that the project is appraised as beneficial for the region. The stakeholders specifically emphasized the contribution of the project activity to the solution of odour and leachate problem.

Further details of the Second Round Consultation period is provided to the DOE.

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

>>

The general view about the project was positive at the meeting. The participants did not express any negative viewpoints about the effects of the project on environmental and social development; on the contrary, they stated that power generation technologies based on waste are supported.

One of the problems mentioned at the meeting was the odour problem around the landfill before the Project. The Mamak solid waste landfill, which had been used as an unmanaged landfill since 1980, was covered within the scope of the Project. As a result the odour problem has been greatly managed. Nonetheless, given the daily solid waste input, a certain degree of odour limited within the dump area can still be expected.

Another issue raised was where the generated electricity from the landfill will be used. The project participant stated that the electricity is delivered to the interconnected grid system of Turkey. It was emphasized that, with the project, the share of the power generated from renewable energy sources in Turkey's energy production would increase and the project sets an example.

Finally, questions about the future developments regarding the Mamak Solid Waste Landfill Facility were asked. The project participant explained that the solid waste landfill had a capacity large enough to feed an installed capacity of around 40 MW and that feasibility studies, including those for anaerobic digestion and gasification technologies, were being carried out to determine how the landfill could be utilized most efficiently at the highest level. It was additionally stressed that all the necessary efforts were made to rearrange the Mamak Solid Waste Landfill for the best of the capital Ankara.

As no negative comments have been received during the consultation process that will require a change in the project design, no amendments have been made. However, taken into account the major positive impact of the project to the environment and sustainable development of the region, critical indicators have been included to the monitoring plan[88].

[88] Please refer to section B.7.1 and B.7.2 for further information.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Organization:	ITC Invest Trading & Consulting A.G. Turkish Ankara Branch
Street/P.O.Box:	Nato Yolu Ege Mah. / Mamak
Building:	Mamak Katı Atık Alanı
City:	Ankara
State/Region:	
Postcode/ZIP:	
Country:	TURKEY
Telephone:	+90 312 390 87 01
FAX:	+90 312 390 96 73
E-Mail:	gogen@gpg.com.tr
URL:	
Represented by:	Mr. Erdoğan Göğen
Title:	General Manager
Salutation:	
Last name:	
Middle name:	
First name:	
Department:	
Mobile:	
Direct FAX:	
Direct tel:	
Personal e-mail:	

Annex 2

INFORMATION REGARDING PUBLIC FUNDING

The project does not obtain public funding.

Annex 3

BASELINE INFORMATION

List of Capacity additions for 2003-2006

Plant Name		Installed Capacity MW	Fuel Type	Generation Capacity GWh	Comissionary Date
2006					
EKOTEN TEKSTİL GR-I		1,9	*N.GAS*	14,0	16.02.2006
ERAK GİYİM GR-I		1,4	*N.GAS*	10,0	22.02.2006
ALARKO ALTEK GR-III		21,9	*N.GAS*	112,6	23.02.2006
AYDIN ÖRME GR-I		7,5	*N.GAS*	60,0	25.02.2006
NUH ENERJİ-2 GR II		26,1	*N.GAS*	180,0	02.03.2006
MARMARA ELEKTRİK (Çorlu) GR I		8,7	*N.GAS*	63,0	13.04.2006
MARMARA PAMUK (Çorlu) GR I		8,7	*N.GAS*	63,0	13.04.2006
ENTEK (Köseköy) GR IV		47,6	*N.GAS*	306,0	14.04.2006
ELSE TEKSTİL (Çorlu) GR I - II		3,2	*N.GAS*	25,0	15.04.2006
SÖNMEZ ELEKTRİK (Çorlu) GR I - II		17,5	*N.GAS*	126,0	03.05.2006
DENİZLİ ÇİMENTO(DÜZELTME)		0,4	*N.GAS*	0,0	04.05.2006
KASTAMONU ENTEGRE (Balıkesir) GR I		7,5	*N.GAS*	54,0	24.05.2006
BOZ ENERJİ GR I		8,7	*N.GAS*	70,0	09.06.2006
AMYLUM NİŞASTA (ADANA)		14,3	*N.GAS*	34,0	09.06.2006
ŞIK MAKAS (Çorlu) GR I		1,6	*N.GAS*	13,0	22.06.2006
ANTALYA ENERJİ GR I - II - III - IV		34,9	*N.GAS*	245,0	29.06.2006
HAYAT TEM. VE SAĞLIK GR I - II		15,0	*N.GAS*	108,0	30.06.2006
EROĞLU GİYİM (Çorlu) GR I		1,2	*N.GAS*	9,0	01.08.2006
CAM İŞ ELEKTRİK (Mersin) GR I		126,1	*N.GAS*	1.008,0	13.09.2006
YILDIZ ENT. AĞAÇ (Kocaeli) GR I		6,2	*N.GAS*	40,0	21.09.2006
ÇERKEZKÖY ENERJİ GR I		49,2	*N.GAS*	390,0	06.10.2006
ENTEK (Köseköy) GR V		37,0	*N.GAS*	237,9	03.11.2006
ÇIRAĞAN SARAYI GR I		1,3	*N.GAS*	11,0	01.12.2006
AKMAYA (Lüleburgaz) GR I		6,9	*N.GAS*	50,0	23.12.2006
BURGAZ (Lüleburgaz) GR I		6,9	*N.GAS*	54,0	23.12.2006
	Natural Gas (2006) Total	**461,7**		**3.283,5**	
ELBİSTAN B GR III		360,0	Lignite	2.340,0	23.06.2006
ELBİSTAN B GR II		360,0	Lignite	2.340,0	17.09.2006
ELBİSTAN B GR IV		360,0	Lignite	2.340,0	13.11.2006

	Lignite (2006) Total	**1.080,0**		**7.020,0**	
ŞANLIURFA GR I-II		51,8	*RUN OF RIVER*	124,0	01.03.2006
BEREKET ENERJİ GÖKYAR HES 3 Grup		11,6	*RUN OF RIVER*	43,3	05.05.2006
MOLU EN. Zamantı Bahçelik GR I - II		4,2	*RUN OF RIVER*	16,7	31.05.2006
SU ENERJİ (Balıkesir) GR I - II		4,6	*RUN OF RIVER*	20,7	27.06.2006
BEREKET EN.(Mentaş Reg) GR I - II		26,6	*RUN OF RIVER*	108,7	31.07.2006
EKİN (Başaran Hes) (Nazilli)		0,6	*RUN OF RIVER*	0,0	11.08.2006
ERE(Sugözü rg. Kızıldüz hes) GR I - II		15,4	*RUN OF RIVER*	31,6	08.09.2006
ERE(AKSU REG.ve ŞAHMALLAR HES) GR I-II		14,0	*RUN OF RIVER*	26,7	16.11.2006
TEKTUĞ(Kalealtı) GR I - II		15,0	*RUN OF RIVER*	52,0	30.11.2006
BEREKET EN.(Mentaş Reg) GR III		13,3	*RUN OF RIVER*	54,4	13.12.2006
SEYHAN I-II		0,3	*DAM*	0,0	20.02.2006
	Hydro (2006) Total	**157,5**		**478,1**	
BARES IX GRUP		0,0	*Wind*	0,0	20.04.2006
BARES X. ve XX. GRUPLAR		0,0	*Wind*	0,0	26.05.2006
MARE MANASTIR RÜZGAR (X GRUP)		0,0	*Wind*	0,0	08.12.2006
ERTÜRK ELEKTRİK Tepe RES GR I		0,9	*Wind*	2,0	22.12.2006
MENDERES ELEKTRİK GR I		8,0	*Geothermal*	56,0	10.05.2006
ADANA ATIK SU ARITMA TESİSİ		0,8	*Biogaz*	6,0	09.06.2006
EKOLOJİK EN. (Kemerburgaz) GR I		1,0	*LFG*	6,0	31.07.2006
ITC-KA EN. MAMAK TOP.M. GR I-II-III		4,2	*LFG*	30,0	03.11.2006
	Renewables (2006) Total	**14,8**		**100,0**	
2006 TOTAL		**1.714,0**		**10.881,6**	

2005

AKBAŞLAR GR-II(İZOLE)	8,8	*N.GAS*	73,0	2005
AKÇA ENERJİ GR-III	8,7	*N.GAS*	65,4	2005
AYKA TEKSTİL GR-I	5,5	*N.GAS*	40,0	2005
BAYDEMİRLER GR IV-V-VI	6,2	*N.GAS*	51,4	2005
BOSEN GR-III	50,0	*N.GAS*	350,0	2005
ÇUMRA ŞEKER	16,0	*N.GAS*	40,0	2005
EVYAP GR I-II	5,1	*N.GAS*	30,0	2005
GRANİSER GRANİT GR-I	5,5	*N.GAS*	42,0	2005
HABAŞ ALİAĞA GR III	47,7	*N.GAS*	381,6	2005

HABAŞ ALİAĞA GR IV		47,7	*N.GAS*	381,6	2005
HABAŞ ALİAĞA GR-V		24,6	*N.GAS*	196,8	2005
HABAŞ ALİAĞA (DÜZELTME)		6,2	*N.GAS*	49,3	2005
HAYAT KAĞIT GR-I		7,5	*N.GAS*	56,0	2005
KORUMA KLOR GR I-II-III		9,6	*N.GAS*	77,0	2005
KÜÇÜKÇALIK TEKSTİL GR I-II-III-IV		8,0	*N.GAS*	64,0	2005
MERCEDES BENZ TURK GR I-II-III-IV		8,3	*N.GAS*	68,0	2005
MODERN ENERJİ GR-III		8,4	*N.GAS*	62,9	2005
MOSB GR I-II-III-IV-V-VI-VII		84,8	*N.GAS*	434,0	2005
ORS RULMAN		12,4	*N.GAS*	99,4	2005
PAK GIDA(Kemalpaşa) GR-I		5,7	*N.GAS*	45,0	2005
TEZCAN GALVANİZ GR I-II		3,7	*N.GAS*	29,0	2005
YONGAPAN(KAST.ENTG) GR-II		5,2	*N.GAS*	32,7	2005
ZEYNEP GİYİM SAN. GR-I		1,2	*N.GAS*	9,0	2005
AK ENERJİ(K.paşa) GR- III		40,0	*N.GAS*	256,9	2005
AK ENERJİ(K.paşa) GR I-II		87,2	*N.GAS*	560,1	2005
ALTEK ALARKO GR I-II		60,1	*N.GAS*	420,0	2005
BİS ENERJİ GR VII		43,7	*N.GAS*	360,8	2005
CAN ENERJİ GR-I		3,9	*N.GAS*	28,0	2005
ÇEBİ ENERJİ BT		21,0	*N.GAS*	164,9	2005
ÇEBİ ENERJİ GT		43,4	*N.GAS*	340,1	2005
ENTEK ELK.A.Ş.KOÇ ÜNİ.GR I-II		2,3	*N.GAS*	19,0	2005
KAREGE GR IV-V		18,1	*N.GAS*	141,9	2005
METEM ENERJİ(Hacışıramat) GR I-II		7,8	*N.GAS*	58,0	2005
METEM ENERJİ(Peliklik) GR I-II-III		11,7	*N.GAS*	89,0	2005
NOREN ENERJİ GR-I		8,7	*N.GAS*	70,0	2005
NUH ENERJİ-2 GR I		47,0	*N.GAS*	319,7	2005
ZORLU ENERJİ KAYSERİ GR-I-II-III		149,9	*N.GAS*	1.144,1	2005
ZORLU ENERJİ KAYSERİ GR-IV		38,6	*N.GAS*	294,9	2005
ZORLU ENERJİ YALOVA GR I-II		15,9	*N.GAS*	122,0	2005
MODERN ENERJİ GR-II		6,7	*N.GAS*	50,4	2005
	Natural Gas (2005) Total	**992,8**		**7.117,8**	
ÇAN GR I		160,0	Lignite	1.040,0	2005
ÇAN GR II		160,0	Lignite	1.040,0	2005
ELBİSTAN-B GR I		360,0	Lignite	2.340,0	2005
OTOP DÜZELTME		0,1	Lignite	0,0	2005
	Lignite (2005) Total	**680,1**		**4.420,0**	
İÇDAŞ ÇELİK GR-I		135,0	*COAL*	1.080,0	2005
KAHRAMANMARAŞ KAĞIT GR-I		6,0	*COAL*	45,0	2005
	Coal (2005) Total	**141,0**		**1.125,0**	
OTOP DÜZELTME		0,6	FUEL-OİL	1,8	2005
KARKEY(SİLOPİ-4) GR-IV		6,2	FUEL-OİL	47,2	2005

KARKEY(SİLOPİ-4) GR-V		6,8	FUEL-OİL	51,9	2005
	Fuerl Oil (2005) Total	**13,5**		**100,9**	
TEKTUĞ(Kargılık) GR I-II		23,9	*RUN OF RIVER*	83,0	2005
İÇTAŞ ENERJİ(Yukarı Mercan) GR I-II		14,2	*RUN OF RIVER*	44,0	2005
MURATLI GR I-II		115,0	*DAM*	444,0	2005
BEREKET EN.(DALAMAN) GR XIII-XIV-XV		7,5	*RUN OF RIVER*	35,8	2005
YAMULA GRUP I-II		100,0	*DAM*	422,0	2005
	Hydro (2005) Total	**260,6**		**1.028,8**	
SUNJÜT(RES) GR I-II		1,2	*WIND*	2,4	2005
ETİ MAD.(BAN.ASİT)GR-I		11,5	Renewable	85,0	2005
	Renewables (2005) Total	**12,7**		**87,4**	
2005 TOTAL		**2.100,7**		**13.879,9**	

2004

ECZACIBAŞI BAXTER HAS.ÜRÜN.		1,0	*N.GAS*	5,8	2004
ÇIRAĞAN SARAYI İŞL.		1,4	*N.GAS*	11,0	2004
BAHARİYE MENSUCAT (İzole)		1,0	*N.GAS*	7,0	2004
ANKARA D.G.(BAYMİNA) GR-I-II-III		798,0	*N.GAS*	6.500,0	2004
ENTEK GR-IV		31,1	*N.GAS*	255,7	2004
ATATEKS 2 GM		5,6	*N.GAS*	45,0	2004
TANRIVERDİ 4 GM		4,7	*N.GAS*	38,7	2004
TEKBOY TEKSTİL 1 GM		2,2	*N.GAS*	16,0	2004
KOMBASSAN KAĞIT GIDA VE TEKS		5,5	*N.GAS*	38,1	2004
AYEN OSTİM ENERJİ ÜRETİM		31,1	*N.GAS*	264,1	2004
BİS ENERJİ 2 GT		73,0	*N.GAS*	602,7	2004
ŞAHİNLER ENERJİ 1 GM		3,2	*N.GAS*	22,2	2004
BESLER GR-2, BT (5,2+7,5)		12,7	*N.GAS*	97,7	2004
ÇELİK ENERJİ ÜR.ŞTİ. 2 GM		2,4	*N.GAS*	18,6	2004
OTOPRODÜKTÖR(DÜZELTME)		6,4	*N.GAS*	43,2	2004
KOMBASSAN KAĞ. MATBAA GIDA		5,5	*N.GAS*	35,7	2004
AYEN OSTİM ENERJİ ÜRETİM(BT)		9,9	*N.GAS*	84,0	2004
HABAŞ ALİAĞA GRUP I-II		89,2	*N.GAS*	713,9	2004
STANDART PROFİL 3 GM		6,7	*N.GAS*	49,2	2004
ALTINMARKA GIDA GR I-II-III		3,6	*N.GAS*	28,8	2004
	Natural Gas (2004) Total	**1.094,4**		**8.877,4**	
ÇOLAKOĞLU(KAPASİTE ARTIRIMI)		45,0	*COAL*	337,5	2004
	Coal (2004) Total	**45,0**		**337,5**	
TÜPRAŞ BATMAN GR V		1,5	FUEL-OİL	4,1	2004

GÜL ENERJİ GR-II		12,5	FUEL-OİL	96,5	2004
ENERJİ-SA ADANA 1 BT		49,8	FUEL-OİL	322,9	2004
KARKEY-II 3+3 DGM		54,3	FUEL-OİL	369,7	2004
	Fuel Oil (2004) Total	**118,1**		**793,3**	
ERE(BİR KAPILI HES) GRUP-I		48,5	*RUN OF RIVER*	170,6	2004
ELTA ELK(DODURGA) GR-I-II-III-IV		4,1	*RUN OF RIVER*	12,3	2004
İSKUR TEKSTİL(SÜLEYMANLI) GR I-II		4,6	*RUN OF RIVER*	17,9	2004
BEREKET EN.(Feslek Hes) Gr-1-2		9,5	*RUN OF RIVER*	41,0	2004
	Hydro (2004) Total	**66,7**		**241,8**	
2004 TOTAL		**1.324,2**		**10.249,9**	

2003

Yİ DÜZELTME-*REVISED*		83,1	*N.GAS*	692,3	31.12.2003
	Natural Gas (2003) Total	**83,1**		**692,3**	
2003 TOTAL		**83,1**		**692,3**	

Annex 4

MONITORING INFORMATION

- - - - -