CLEAN DEVELOPMENT MECHANISM
PROJECT DESIGN DOCUMENT FORM (CDM-SSC-PDD)
Version 03 - in effect as of: 22 December 2006

CONTENTS

Annexes

SECTION A. General description of project activity

A.1 Title of the project activity:

Kayseri Molu Landfill Gas to Electricity Project, Turkey

Version No	Date	Description and reason of revision
01	21 November 2011	Prepared PDD for DOE
02	22 May 2012	Updated to ACM0001 Version 13 from ACM0001 Version 11
03	21.09.2012	Revised for DOE
04	06.02.2013	Revised for DOE
05	09.06.2013	Revised for DOE
06	18.07.2013	Revised for DOE
07	10.12.2013	Revised for GS review

A.2. Description of the project activity:

Kayseri Molu landfill operates since 1996 and receives wastes from city of Kayseri and surrounding municipalities. Over the years from 1996 to 2010, 4 million tons of waste was collected in the landfill area, and this is increasing year by year. Kayseri Molu Landfill is unmanaged solid waste disposal sites where methane emission was not destroyed but realised to the atmosphere before implementation of Kayseri Molu landfill gas to electicity Project.

Her Enerji ve Çevre Teknolojileri Sanayi Ticaret A.Ş. (Her Enerji) plans to invest into a biogas power plant to generate electricity and feed it into the Turkish grid. The biogas power project is plant to be built close to Molu village of Koca Sinan district in the province of Kayseri in Turkey. The project aims at avoiding greenhouse gas (GHG) emissions from existing landfill area by collecting biogas to generate electricity. Thus, in addition to the direct avoidance of GHG emissions, further indirect emission reductions are achieved through the CO_2-neutral replacement of fossil fuels used for power generation.

The Gold Standard organization sets a framework – following the schemes defined by the Kyoto-Protocol for the international trading of emission reductions – for the generation and trading of certificates attesting emission reductions achieved by a project. The Gold Standard VER approach is applicable in countries that are not subject to a GHG emission target defined in the Kyoto-Protocol.

Construction work for project started at the end of June 2011. The activity includes installation of landfill gas extraction system, an enclosed flare as well as three biogas driven gensets for electricity production with capacity of 1560 kWe, 1305 kWe and 1357 kWe each. The total licenced installed capacity of the project is 4,222 MWe. The extraction system shall include a network of vertical gas extraction wells, de-watering units and gas transport pipelines connected to a main collector system. The gas will be driven to gas engine and the flare via an aspiration system.

Installation and commission of first electricity engine is done by end of October 2011. Second engine is planned to be commissioned by the mid of 2012. Thus, from December 2011 first engine is in operation and from end of 2012 on, Kayseri Molu Landfill project with three engines is planned to produce electricity by using landfill gas and transfer to the national grid.

Table 1: Time table of the project

	Installed capacity	Date
Commisioning of first Engine	**1.560 kWe**	**31.10.2011**
Commissioning of the second Engine	**1.305 kWe**	**01.08.2012**
Commissioning of the third Engine	**1.357 kWe**	**05.07.2013**

The responsibility of municipality is collection of waste from city and households and transfer of it to the project site. The responsinbility of Her Enerji is limited to the project site which is generation of electricity and arrangement of waste arrived inaccordance with higher electricity generation.

Contribution to sustainable development

Environmental, socio-economic and technological benefits of the project are described as follows:

- Reduction in fossil fuel use (imported or local) by using renewable energy resources,
- Reduction in greenhouse gas emissions from the landfill area by using biogas for electricity production,
- Reduction in energy production costs and imported energy amounts,
- Improvement of environmental conditions (GHG and odour) and safety in the landfill area.

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)	Her Enerji ve Çevre Teknolojileri Sanayi Ticaret A.Ş.	No

Her Enerji ve Çevre Teknolojileri Sanayi Ticaret A.Ş. is private project developer and owner of the project.

The Republic of Turkey is the host country. Turkey ratified the Kyoto Protocol (on 5th February of 2009) and put in effect on 13th May 2009[1]. Turkish National Focal Point to the UNFCCC is the Ministry of Environment and Forestry[2].

A.4. Technical description of project activity:

A.4.1. Location of project activity:

[1] See, Official Gazette: http://rega.basbakanlik.gov.tr/main.aspx?home=http://rega.basbakanlik.gov.tr/eskiler/2009/05/20090513.htm&main=http://rega.basbakanlik.gov.tr/eskiler/2009/05/20090513.htm (link in 'Milletlerarası Sözleşme' part)

[2] See, UNFCCC, list of the National Focal Points: http://maindb.unfccc.int/public/nfp.pl?mode=wim

A.4.1.1. **Host Party(ies):**

The host country is Republic of Turkey.

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

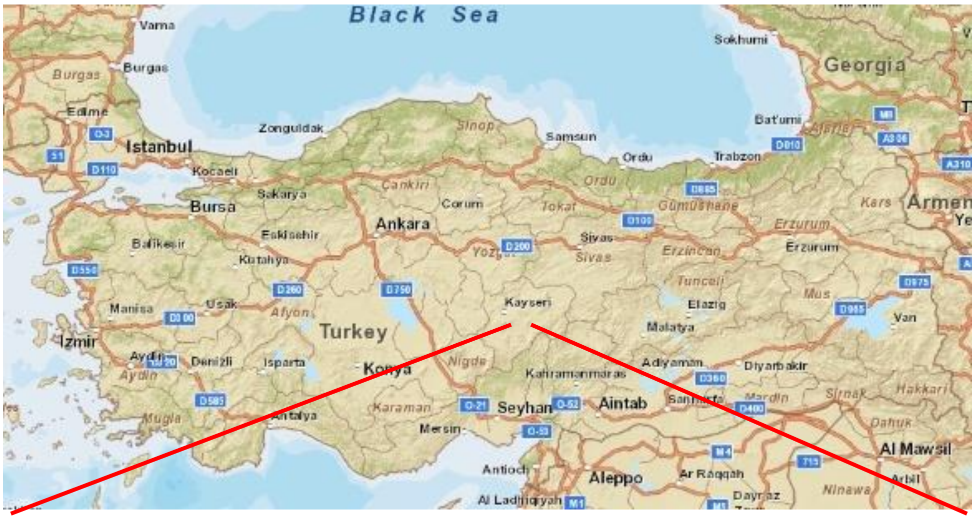
The project is located in Central Anatolia Region, Kayseri Province, Koca Sinan district, Turkey.

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

The project will be situated within the borders of Kayseri city, Koca Sinan district. Kayseri landfill area is located 4 km from the nearest residential area, Molu Village. The landfill area serves approximately 912,000 people.

A.4.1.4. Details of physical location, including information allowing the unique identification of this project activity :

The project site is located within the borders of Kayseri city- Koca Sinan district. Location of the project is given below in the Map 1.



Map 1: Location of the Project Area in Koca Sinan, Turkey

The geographical coordinates of the main bodies of the project activity are presented in the table below.

Table 2: Geographical coordinates of the two main project bodies

Bodies of the Project	Latitude (N)	Longitude (E)
Landfill gas plant	38º47'40.2"	35 º18'18.6"

A.4.2. Category(ies) project activity:

Sectoral Scope 13: **Waste Handling and Disposal**

The scope of the project activity is waste management, where the emission baseline is the amount of methane that would be emitted to the atmosphere during the crediting period in the absence of the project activity. The captured gas is used to produce energy.

Sectoral Scope 1: **Energy Industries**

Project activity includes electrical energy production from the collected landfill gas, which is to be used in a first instance to cover the electrical on-site demand. Excess electricity will be fed into the national grid.

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

The Molu Landfill Project aims at the reduction of methane gas generated at the Molu landfill by combusting the collected gas in an engine to generate electricity.

The landfill has started its operation in 1996. By the implementation of the project, a gas extraction and control system will be implemented. The control activities include periodic adjustment of the gas wells by means of measuring equipment - gas flow, methane content and oxygen content are very important parameters (landfill gas may form an explosive mixture when it combines with air in certain proportions; methane is explosive between its LEL[3] of 5% by volume and its UEL[3] of 15% by volume).

The gas extraction plant will be equipped with aspirators that create a suction vacuum in the system necessary for LFG extraction (aspiration system). Landfill gas will be used for electricity generation and excess gas will be flared in a high temperature flare (800-1200 °C, retention time 0.3 s). An emergency genset will be available for start-up of the biogas engine. The produced energy will be fed into the national grid.

The projected plant will be operated by an electrical control system equipped with a monitoring control system for methane, oxygen, flow, pressure and temperature. In the initial phase, the installed equipment is estimated to extract about 50% of the total produced LFG. The extraction efficiency may gradually increase.

The activity includes installation of landfill gas extraction system, an enclosed flare as well as three biogas driven gensets for electricity production with capacity of 1560 kWe, 1305 kWe and 1357 kWe each. The total licenced installed capacity of the project is 4,222 MWe. The extraction system includes a network of vertical gas extraction wells, de-watering units and gas transport pipelines connected to a main collector system. The system includes a Flare which has 500 m3/h capacit. The temprature is between 900-1200 C.

There is also an emergency diesel genset in the plant which was only used during construction period. The Standby power of the diesel generator is 101 kVA, / Continuous power 82 kVA.

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

The proposed project activity adopts a fixed crediting period, i.e. 10 years (01/01/2012-/31/12/2021); estimated emission reductions during each year are presented in the following table:

Table 3: Estimated amount of emission reductions over the crediting period

Years	Annual estimation of emission reductions [tCO_2e]
2012	45,959
2013	61,953
2014	63,332
2015	64,551
2016	61,911
2017	59,413
2018	57,049
2019	54,812
2020	52,695

[3] LEL= Lower explosive limits, UEL= Upper explosive limits

2021	50,691
Total emission reductions (tonnes of CO_2 e)	**572.367**
Total number of crediting years	**10**
Annual average over the crediting period of estimated reductions (tonnes of CO_2e)	**57,237**

A.4.5. Public funding of project activity:

The project activity does not receive any public funding or Official Development Assistance (ODA) funding.

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:

ACM0001 Version 13: ' Flaring or use of landfill gas [4]

Used tools:
Methodological tool: "Combined tool to identify the baseline scenario and demonstrate additionality" (Version 05.0.0)
Methodological tool: "Emissions from solid waste disposal sites" (version 6.0.0)
Methodological tool: "Tool to calculate baseline, project and/or leakage emissions from electricity consumption" version (01)
Methodological tool "Project emission from flaring" Version 02.0.0;
Methodological tool: "Tool to calculate the emission factor for an electricity system" (version 02.2.1)
Methodological tool: "Tool to determine the mass flow of a greenhouse gas in a gaseous stream"
(Version 02.0.0)

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

The baseline calculation for the Project follows the procedures for categories:

- Approved consolidated methodology ACM0001 / Version 13 - " Flaring or use of landfill gas" - for the methane recovery component of the project activity;

This methodology is applicable to Kayseri Molu landfill gas project activities, where the baseline scenario is the partial or total atmospheric release of the gas and the project activities include situations such as:

[4] See, http://cdm.unfccc.int/methodologies/SSCmethodologies/approved.html

(a) Install a new LFG capture system in a new or existing SWDS; or
(b)Make an investment into an existing LFG capture system to increase the recovery rate or change the use of the captured LFG, provided that:

(i) The captured LFG was vented or flared and not used prior to the implementation of the project activity; and

(ii) In the case of an existing active LFG capture system for which the amount of LFG can not be collected separately from the project system after the implementation of the project activity and its efficiency is not impacted on by the project system: historical data on the amount of LFG capture and flared is available.

c) Flare the LFG and/or use the captured LFG in any (combination) of the following ways:

(i) Generating electricity;
(ii) Generating heat in a boiler, air heater or kiln (brick firing only) or glass melting furnace; and/or
(iii) Supplying the LFG to consumers through a natural gas distribution network.

(d) Do not reduce the amount of organic waste that would be recycled in the absence of the project activity.

Since Kayseri Molu Landfill gas project instal a new LFG capture system in a new SWDS; and flare the LFG to generate electricity, both option of a and c(i) are satisfied.
Kayseri Molu landfill gas to energy project aims on capturing the landfill gas to produce electrical energy. If the power plant is out of order because of maintenance or a failure, the landfill gas will be burnt in an enclosed high temperature flare. This means that the project activity aims on (a and c) and during periods of maintenance on as described above. This justifies the choice for ACM0001, version 13.

This methodology is not applicable:

(a) In combination with other approved methodologies. For instance, ACM0001 cannot be used to claim emission reductions for the disp lacement of fossil fuels in a kiln or glass melting furnace, where the purpose of the CDM project activity is to implement energy efficiency measures at a kiln or glass melting furnace;
(b) If the management of the SWDS in the project activity is deliberately changed during the crediting in order to increase methane generate on compared to the situation prior to the implementation of the project activity.

Both options above which shows non-applicability of methodology does not apply in the case of Kayseri Molu Landfill gas project.
The applicability conditions in the relevant tools referred to are also satisfied by Kayseri Molu Landfill gas project.

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

According to the methodology, the project boundary is the site where the gas is captured and destroyed/used. For the proposed project activity, electricity will not be sourced from the grid or from power generation sources. Furthermore, it will not be sourced from a captive generation source or power plant.

The project boundary is the Molu landfill site where the landfill gas (LFG) is extracted and destroyed by flaring and partially used for electricity generation.

The boundary of the proposed project is defined shown in Figure 1. It describes basic layout of the project activities. The proposed project boundary considers GHG emissions from capture of biogas.

Table 4 Emissions within project boundaries

	Source	Gas	Included	Justification/Explanation
Baseline	Emissions from decomposition of waste at the SWDS site	CO_2	No	CO2 emissions from decomposition of organic waste are not accounted since the CO2 is also released under the project activity
		CH_4	Yes	Major source of emissions in the baseline.
		N_2O	No	N_2O emissions are small compared to CH_4 emissions from SWDS. This is conservative
	Emissions from electricity generation	CO_2	Yes	Major emission source if power generation is included in the project activity
		CH_4	No	Excluded for simplification. This is conservative
		N_2O	No	excluded for simplification. This is conservative
Project Activity	Emissions from electricity consumption due to the Project activity	CO_2	Yes	May be an important emission source.
		CH_4	No	excluded for simplification. This emission source is assumed to be very small
		N_2O	No	excluded for simplification. This emission source is assumed to be very small

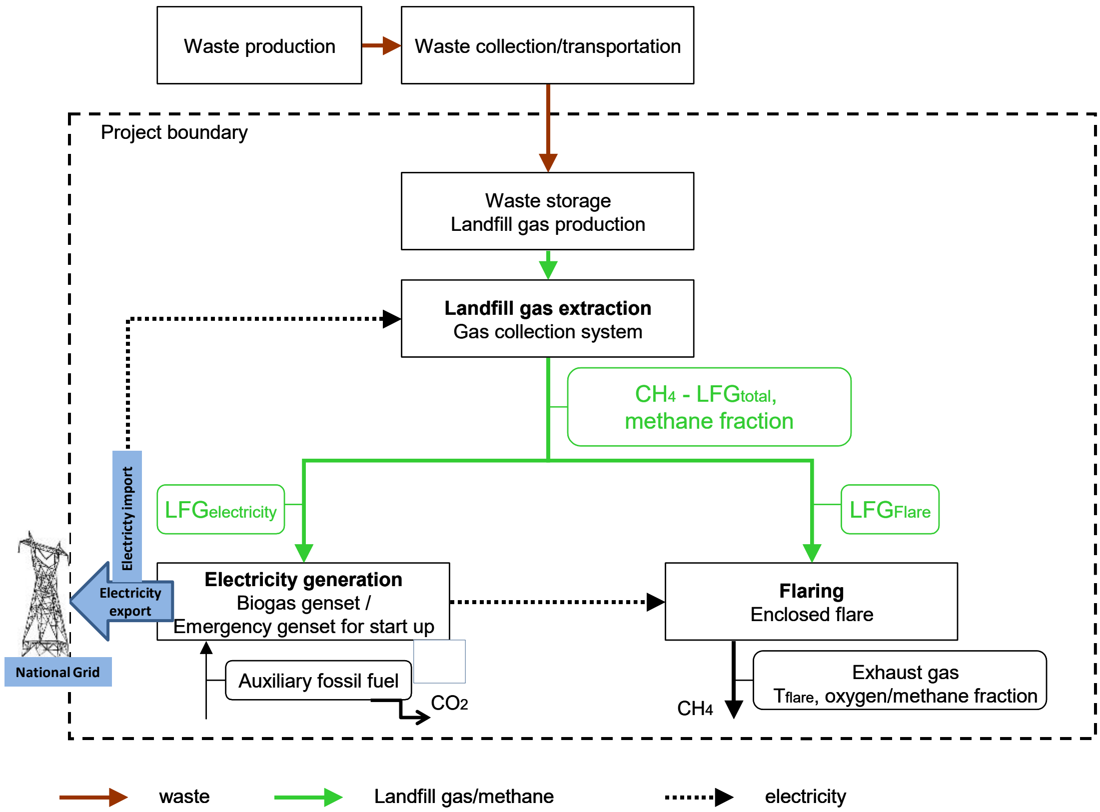


Figure 1 Flow diagram of project boundary

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

In accordance with ACM0001 (Version 13), the baseline scenario is the situation where, in the absence of the project activity, biomass and other organic matter are left to decay within the project boundary and methane is emitted to the atmosphere. Baseline emissions shall exclude methane emissions that would have to be removed to comply with national or local safety requirement or legal regulations.

Besides, the recovered methane from landfill gas is used for electricity generation, the baseline emissions are the electricity produced by the renewable generating unit multiplied by the grid emission factor. Since the electricity produced by the proposed project will be exported to Turkish National Grid which is mainly based on thermal power plants using fossil fuels, the baseline scenario for electricity replacement is product of electricity energy baseline expressed in kWh of electricity produced by the renewable generating unit multiplied by an emission factor. Combined margin (CM) is adopted for emission factor.

Therefore as explained above, baseline emission for the Landfill Gas Project is:

A. Landfill Gas: In the absence of the project activity, biomass and other organic matter are left to decay within the project boundary and methane is emitted to the atmosphere

B. Electricity: Product of electricity energy baseline expressed in kWh of electricity produced by the renewable generating unit multiplied by an emission factor. Combined margin (CM) is adopted for emission factor

Procedure for the selection of the most plausible baseline scenario

The following steps describe the approach used to assess the project's additionality, approach given in methodology ACM0001 / Version 13.0.0, and in the "Combined tool to identify the baseline scenario and demonstrate additionality" (Version 05.0.0)
All realistic and credible baseline alternatives for estimating baseline methane emissions are identified based on the procedures given in the "Combined tool to identify the baseline scenario and demonstrate additionality" (Version 05.0.0)

Step 1: Identification of alternative scenarios

<u>Step 1a: Define alternative scenarios to the proposed CDM project activity</u>
According to the methodology and applied tool, the following baseline alternatives for the destruction of LFG shall be taken into consideration:

Scenario	**Scenario description**	**Justification**	**Baseline**
LFG1	The proposed project activity undertaken without being registerred as a CDM project activity	It is a plausible scenario that the proposed project activity undertaken without being registered as a CDM project Activity.	YES
LFG2	Atmospheric release of the LFG or partial capture of LFG and destruction to comply with regulations or contractual requirements, or to address safety and odour concerns;	The pre-project scenario is total release of the LFG to the atmosphere and hence continuation of prevailing practice is a plausible scenario.	YES
LFG3	LFG is partially not generated because part of the organic fraction of the solid waste is recycled and not disposed in the SWDS;	There was no recycle of organic waste prior to the project implementation, thus; **this scenario is not plausible**	NO
LFG4	LFG is partially not generated because part of the organic fraction of the solid waste is treated aerobically and not disposed in the SWDS	The organic fraction of the solid waste has not been treated aerobically prior to the project implementation, thus; **this scenario is not**	NO

		Plausible.	
LFG5	LFG is partially not generated because part of the organic fraction of the solid waste is incinerated and not disposed in the SWDS.	There was no incineration organic fraction of the solid prior to the project implementation, thus; **this scenario is Not Plausible.**	NO
S1	It is same with LFG1		
S2	Where applicable, no investment is undertaken by the project participants but third party(ies) undertake(s) investments or actions which provide the same output to users of the project activity, for example: (i) In the case of a Greenfield power project, an alternative scenario may be that the project participants would not invest in another power plant but that power would be generated in existing and/or new power plants in the electricity grid.	It is a plausible scenario while other investors could act to invest to generate electricty	YES
S3	Similar with LFG2		
S4	Where applicable, the continuation of the current situation, requiring an investment or expenses to maintain the current situation, such as, inter alia: (i) The continued use of an existing boiler involving expenses for operation and maintenance; (ii) The continued use of a specific fuel mix for power generation in an existing power plant.	That is not applicable in case of proposed project activity, **thus scenario is not plausible**	NO
S5	Other plausible and credible alternative scenarios to the project activity scenario, including the common practices in the relevant sector, which deliver the same output, taking into account, where relevant, examples of scenarios identified in the underlying methodology;	There is no other plausible alternatives than stated as above, thus it is not plausible	NO
S6	Where applicable, the "proposed project	There is no reason that	NO

	activity undertaken without being registered as a CDM project activity" to be implemented at a later point in time (e.g. due to existing regulations, end -of-life of existing equipment, financing aspects)	may cause the proposed project to be implemented in a later point of time, thus the scenario is not plausible.	

In concerns of alternatives of **LFG3, LFG4 and LFG5**, and S4,S5 and S6 alternatives are not plausible and could not be considered as a baseline scenario. Thus, According to the Methodology applied and "Combined tool to identify the baseline scenario and demonstrate additionality" (Version 05.0.0) , there are three alternatives for the disposal/treatment of the waste which are realistic:

LFG1: The project activity implemented without being registered as a CDM project activity;
This alternative is realistic and credible as Her Enerji may undertake project activity if he sees no risk for project and/or if the project turns out to be financially attractive without GS VER credit income. However, investments analyze shows that the project is not economically feasible without GS VER credit income

LFG2: Atmospheric release of the LFG or partial capture of LFG and destruction to comply with regulations or contractual requirements, or to address safety and odour concerns.
This alternative is realistic too as this scenario corresponds to the continuation of the current situation which is the atmospheric release of the LFG

S3: Where applicable, no investment is undertaken by the project participants but third party(ies) undertake(s) investments or actions which provide the same output to users of the project activity,

In addition to the alternative baseline scenarios identified for the destruction of LFG, alternative scenarios for the use of LFG shall also be identified (if this is an aspect of the project activity):

(a) For electricity generation, alternative(s) shall include, inter alia:
    E1: Electricity generation from LFG, undertaken without being registered as CDM project activity;
    E2: Electricity generation in existing or new renewable or fossil fuel based captive power plant(s);
    E3: Electricity generation in existing and/or new grid-connected power plants.

As grid connection already exists near the project site so the construction of new on site fossil fuel fired captive power plant is not a plausible option as purchasing electricity from the grid. In addition, renewable energy and fossil fuel-based sources are not considered as alternatives in this case as th project participant's core business and expertise is in LFG destruction and power generation from landfills. Hence, alternative E2 has not been taken into consideration.

As the project activity does not aim at producing heat for nearby industry or on-site use, existing or construction of a co-generation plant is not a part of the baseline scenario

Outcome of Step 1a: The combination of the project activity composes the following scenarios:

There are 3 realistic alternative scenarios for the identified project activity which are the combination of LFG1, LFG2, S3, E1 and E3:
Option 1: The proposed project activity is undertaken without being registered as a CDM project activity (LFG1 + E1)
Option 2: It continues to release LFG to the atmosphere and use the electricity from the grid which is business as usual (LFG2 + E3)
Option 3: Where applicable, no investment is undertaken by the project participants but third party(ies) undertake(s) investments or actions which provide the same output to users of the project activity (S3 +E3)

The decision in favour or against a project investment depends on the expected revenues and risks, like for every other private investment.

Sub-step 1b: Consistency with mandatory applicable laws and regulations

In Turkey, no specific legal strategy for abatement of emissions of greenhouse gases has been adopted. Therefore all the alternatives comply with applicable laws and regulatory requirements in the country, which are detailed below:

Legal and regulatory aspects of waste management and electricity generation in Turkey

The most common means of waste management in Turkey is unmanaged landfilling. Most of the existing landfill sites are uncontrolled, exceeding the maximal volumes of waste allowed to be disposed.

Since Turkey seeks to join European Union, the Government has started to create strategic development plans for the waste sector. A national programme on waste management concept was adopted in 2008[5]. The programme defines basic principles and legal framework for waste management and gives action plans for each province.

Laws and regulations regarding waste management and electricity generation are given below. The regulations on waste management require precautions to prevent explosion of landfill gas but does not require recovery or destruction of it.

Legal aspects of air protection in Turkey	Comment
"Law on the Environment" dated 26.04.2006 numbered 2872 and	This law addresses the ecological security of the population, the rational use of natural resources, nature conservation and environmental protection. Additional Article 6 says that clean air policies should be applied in provinces and districts and air quality should be monitored. Methodologies for determination, monitoring and measurement of air quality, air quality limit values, precautions to prevent air pollution and public awareness are responsibilities of

5 http://www.cygm.gov.tr/CYGM/Files/EylemPlan/atikeylemplani.pdf

	the Ministry of Environment and Forestry. No regulatory requirement for destruction of landfill gas.
"Regulation on general principles of waste management[6]" dated 05.07.2008 and numbered 26927	The regulation aims to determine general principles of waste management in order to protect the environment and human health from generation to disposal of waste. No regulatory requirement for destruction of landfill gas.
"Regulation on landfilling[7]" dated 26.03.2010 and numbered 27533	The regulation aims to protect of the environment by minimizing negative impacts of leachate and landfill gas on soil, air, underground and surface water No regulatory requirement destruction of landfill gas.
"Regulation on Control of Solid Waste[8]" dated 14.03.1991 and numbered 20814	The regulation aims to determine policies and programmes to prevent disposal, storage and transportation of waste in a way to harm biological and human environment. No regulatory requirement destruction of landfill gas.
Electricity Market Law[9] dated 20.02.2001 and numbered 03.03.2001	The Law aims to ensure the development of a financially sound and transparent electricity market operating in a competitive environment under provisions of civil law and the delivery of sufficient, good quality, low cost and environment-friendly electricity to consumers and to ensure the autonomous regulation and supervision of this market. No regulatory requirement for destruction of landfill gas.
Law on Utilization of Renewable Energy Resources for the Purpose of Generating Electricity Energy[10] dated 10.05.2005 and numbered 5346	The purpose of this Law is to expand the utilization of renewable energy resources for generating electrical energy, to benefit from these resources in secure, economic and qualified manner, to increase the diversification of energy resources, to reduce greenhouse gas emissions, to assess waste products, to protect the environment and to develop the related manufacturing sector for realizing these objectives. The law brings an incentive of 13.3 $ cent/kWh for the electricity production from biomass. It also brings incentives for local local equipment purchase such as turbines, enginees, cogeneration systems etc. No regulatory requirement for destruction of landfill gas.

[6] See: http://www.mevzuat.adalet.gov.tr/html/27906.html
[7] See: http://www.mevzuat.gov.tr/Metin.Aspx?MevzuatKod=7.5.13887&MevzuatIliski=0&sourceXmlSearch=
[8] See: http://www.mevzuat.adalet.gov.tr/html/20743.html
[9] See: http://www.epdk.gov.tr/mevzuat/kanun/elektrik/elektrik_piyasalari_kanunu.pdf
[10] See: http://www.epdk.gov.tr/documents/10157/4b360128-53aa-4174-8104-a6c10434ac9c

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):

Project Implementation Schedule and Early Consideration of VER

Table 5: Project Implementation Schedule and Early Consideration of VER

Date (DD/MM/YYYY)	Activity
27/09/2010	Contract with the Municipality
04/03/2011	Date of Board Decision on Carbon income
08/02/2011	First Proposal Request from VER Consultants
29/04/2011	Turnkey agreement with İltekno which is date of decision making
05/05/2011	Signature with FutureCamp Turkey for VER Development
01/07/2011	Starting Construction Activities with Roads and Site Preparation
01/08/2011	Issuance of the License
14/10/2011	The date of contract with the DOE
31/10/2011	Operation date for first gas engine
21/11/2011	Date of Submission of Initial PDD to DOE
01/08/2012	Operation date for second gas engine
01/05/2013	Planned Operation date for third gas engine

According to Turkish regulations, to get necessary permits for further project implementation, granting generation license from Authority is required. Hence, issuance of license or municipality contract cannot be considered as 'investment decision date for the project' but a prerequisite to proceed for further project development activities. Date of Turnkey agreement with İltekno shall be set as project investment decision date, since after this agreement 'Her Enerji' committed to make considerable amount of investment for this project.

Above Implementation Schedule clearly shows that before starting to the project activity and investment decision date, 'Her Enerji' started to analysis of revenue from VER credit sale decided to get consultancy for VER development based on the decision of the board dated 04/03/2011 and later made agreement with FutureCamp Turkey for carbon development.

In the following, the investment analysis is applied to clearly demonstrate that the project activity is unlikely to be financially/economically attractive without the revenue from the sale of VERs.

STEP 2 : Barrier analysis

Step 2a: Identify barriers that would prevent the implementation of alternative scenarios

There are no barriers that prevent alternatives to be implemented.

Step 2b: Eliminate alternative scenarios which are prevented by the identified barriers

The alternatives are not eliminated by any barriers.

Outcome of Step 2: While none of alternatives are eliminated by barriers and that includes project without CDM, the next step is application of investment analysis.

STEP 3 : Investment analysis

This step will determine whether the proposed project activity is not the most economically or financially attractive or economically or financially feasible, without the revenue from the sale of certified emission reductions (CERs).

Sub-step 3a: Determine appropriate analysis method

There are three options that can be applied in investment analysis: simple cost anaylsis, simple cost analysis, investment comparison analysis or benchmark analysis. As the propose project has financial benefits (electricity sale) other than CDM related income, simple cost analysis cannot be applied. The investment comparison analysis is not applicable either, as the baseline scenario, providing the same electricity output is not a project with comparable investment data.

Benchmark analysis will be used to determine if financial indicators of the proposed project is better than the benchmark value or not.

Sub-step 3b: Apply benchmark analysis

As a common means to evaluate the attractiveness of investment projects and compare them with possible alternatives, the IRR (Internal Rate of Return) shall be used.

According to the "Tool for the demonstration and assessment of additionality", benchmark for investment analysis can be driven from '*Estimates of the cost of financing and* ***required return on capital based on bankers views*** *and private equity investors/funds*'. As a banker view, according to Worldbank loan appraisal document[11], threshold equity IRR for biomass investments (i.e. required returns of equity for biomass power investors) in Turkey is 20%.

Sub-step 3c: Calculation and comparison of the IRR

In the paragraph 11 of the 'Guidance on the Assessment of Investment Analysis'[12], it is stated that: 'Required/expected returns on equity are appropriate benchmarks for equity IRR'. Since, benchmark identified in the Sub-step 2b is required/expected returns on equity, equity IRR (after tax) of the project activity shall be calculated for comparison.

The IRR is calculated on the basis of expected cash flows (investment, operating costs and revenues from electricity sale), as used in the financial analysis for the feasibility assessment of the project. Main parameters for the calculation of IRR are:

- Installed Capacity: 4.222 MWe
- Annual net power generation: 24,699 MWh

---

[11] Worldbank - Project Appraisal Document on a IBRD Loan and a Proposed Loan from Clean Technology Fund to TSKB and TKB with the Guarantee of Turkey, May 2009 (http://www-wds.worldbank.org/external/default/WDSContentServer/WDSP/IB/2009/05/11/000333037_20090511030724/Rendered/PDF/468080PAD0P112101Official0Use0Only1.pdf page 80, paragraph 29 and page 81, Table 11.5)

[12] See, http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-01-v5.2.pdf (page 14)

- Electricity tariff: 133 $/MWh

Electricity tariff of Law on Utilization of Renewable Energy Resources for the Purpose of Generating Electricity Energy[13] is used in the IRR calculations. As the equipment in the project is imported, the incentive of the Law for local equipment purchase is not applicable.

Other parameters and values used for the IRR calculation are available to DOE during validation. The resulting equity IRR for 10 years is stated in below table:

Table 6: Equity IRR values (after tax) for project activity for Base Case Scenario*

Period	IRR
10 years	13.32%

Without adding any risk premium to the benchmark, which is 20%, it does clearly exceed the resulting equity IRR, thus rendering the project activity economically unattractive.

Sub-step 3d: Sensitivity analysis

While the main parameter determining the income of the project is the electricity sales price, a variation of the accordant value shall demonstrate the reliability of the IRR calculation. Electricity price (EP) is varied with +/-10% from the max. feed-in-tariff, which is 133 $/MWh.

For Sensitivity Analysis, the investment amount, annual energy yield amount and construction cost parameters are varied with +/- 10%. The worst, base and best-case results for each parameter variation are given below, in Table 7. The sensitivity analysis confirms that the proposed project activity is unlikely to be economically attractive without the revenues from VERs as even the maximum IRR result for the best case scenario (16.25%) is below the benchmark, which is 20%. Best case scenario is not possible as the feed-in-tariff prices are fixed and determined by law.

Table 7: Equity IRR (before tax) results according to different parameters*

Parameter	Investment Cost @ 133 $/MWh			Energy Yield @133 $/MWh			Operation Cost @ 133 $/MWh		
Variance	-10%	0%	10%	-10%	0%	10%	-10%	0%	10%
Equity IRR - 10y	**15.46%**	13.32%	11.46%	10.18%	13.32%	**16.25%**	**14.56%**	13.32%	12.06%

* For other parameters than electricity price (EP), 133 $/MWh EP is applied.

Key variables are analysed in a way to reach the benchmark, however the result for these key variables have been so high which cannot be realized. To be able to reach benchmark, energy sales varied with 26 % increase which is not realistic. The power price for wind power plant are recently revised in Feed in tariff as 13.3 USD Cent/kWh, which is not expected to be revise soon. Even when there is a revision this cannot be increased by 20 %. Variation in Investment cost is done with -30% to reach the benchmark, however such a discount with equipment provider cannot be reasonable, that is why 10 percent discount is already considered in the first step of the sensitivity analysis. Variation with 60% in operation cost to reach the

[13] See: http://www.epdk.gov.tr/documents/10157/4b360128-53aa-4174-8104-a6c10434ac9c

benchmark is so high that cannot be expected. As it can be clearly seen from table below, the variations to reach the benchmark is above to be realized.

Parameter	**Investment Cost @ 133 $/MWh**			**Energy Yield @133 $/MWh**			**Operation Cost @ 133 $/MWh**		
Variance	**-30%**	0%	10%	-10%	0%	**26%**	**-60%**	0%	10%
Equity IRR - 10y	**20,95%**	13,32%	11,46%	10,18%	13,32%	**20,52%**	**20,24%**	13,32%	12,06%

STEP 4: Common practice analysis.

Stepwise Approach for Common Practice

The section below provides the analysis as per step 4 of the "Combined tool to identify the baseline scenario and demonstrate additionality" (Version 05.0.0) and according to the Guidelines on Common Practice version 02.0

Step 1. Output Range: The proposed project has a capacity of 4.222 MW. Per the guideline of +/-50%, the applicable output range for the project is 2.111 MW to 6.333 MW.

Step 2. Applicable Geographical Area: The applicable geographical area for the proposed project covers the entire host country as the default area specified in the guideline. The projects within the host country and the output range that have started commercial operation and are connected to the national grid system are shown in the excile file Named Common Practice_Kayseri Molu.xlsx.

Step 3: identified projects that are neither registered CDM project activities, project activities submitted for registration, nor project activities undergoing validation is 1 Nall.

Step 4: Identified projects that apply technologies that are different to the technology applied in the proposed project activity are 0 as Ndiff.

Step 5. Calculation of factor F:

Diff = 1

Since factor Diff is 1 and lower than 3, the proposed project is not a common practice as per the guidelines. The proposed project activity is therefore additional under common practice analysis. An Excel sheet is provided for the calculation.

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

<u>Baseline emissions</u>

Baseline emissions are calculated as per the consolidated Methodology ACM0001 version 13 and determined according to equation 1 and comprise the following sources:
(A) Methane emissions from the SWDS in the absence of the project activity;
(B) Electricity generation using fossil fuels or supplied by the grid in the absence of the project activity;

$$BE_y = BE_{CH4,y} + BE_{EC,y} \quad \textbf{(1)}$$

where

BE_y	Baseline emissions in year y (t CO_2e)
$BE_{CH4,y}$	Baseline emissions of methane from the SWDS in year *y* (t CO2e/yr)
$BE_{CE,}$ y	Baseline emissions associated with electricity generation in year *y* (t CO2/yr)

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

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

$$BE_{CH4,y} = (1 - OX_{top-layer})(F_{CH4,PJ,y} - F_{CH4,BL,y})GWP_{CH4} \quad \textbf{(2)}$$

Where:

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

There is neither regulatory nor contractual requirements for methane destruction/combustion. There is also no LFG flared without the project activity, therefore $F_{CH4,BL,y}$ is equal zero.

Step A.1: Ex post determination of $F_{CH4, PJ,y}$

During the crediting period, $\mathbf{F_{CH4, PJ,y}}$ is determined as the sum of the quantities of methane flared and used in power plant(s), boiler(s), air heater(s), kiln(s) and natural gas distribution network, as follows:

$$F_{CH4,PJ,y} = F_{CH4\,flared,y} + F_{CH4,EL,y} + F_{CH4,HG,y} + F_{CH4,NG,y} \quad \textbf{(3)}$$

Where:

$F_{CH4,PJ,y}$	Amount of methane in the LFG which is flared and/or used in the project activity in year *y* (t CH4/yr)
$F_{CH4,flared,y}$	Amount of methane in the LFG which is destroyed by flaring in year *y* (t CH4/yr)
$F_{CH4,EL,y}$	Amount of methane in the LFG which is used for electricity generation in year *y* (t CH4/yr)
$F_{CH4,HG,y}$	Amount of methane in the LFG which is used for heat generation in year *y* (t CH4/yr)
$F_{CH4,NG,y}$	Amount of methane in the LFG which is sent to the natural gas distribution network in year *y* (t CH4/yr)

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

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

$$F_{CH4,PJ,y} = F_{CH4\,flared,y} + F_{CH4,EL,y} \quad (4)$$

Determination of $F_{CH4,flared,y}$ and $F_{CH4,EL,y}$

The sum of the quantities fed to the flares ($F_{CH4,flared,y}$) and to the power plant ($F_{CH4,EL,y}$)will be summed up annually be adopted as $F_{CH4,PJ,y}$

$F_{CH4,PJ,y}$ is determined using the "Methodological Tool to determine the mass flow of a greenhouse gas in a gaseous stream" Version 02.0.0. The following requirements apply:

• The gaseous stream the tool shall be applied to is the LFG delivery pipeline to electricity. $F_{CH4,PJ,y}$ is then calculated as the sum of mass flows to electricity generation.

• CH4 is the greenhouse gases for which the mass flow should be determined;

• The flow of the gaseous stream should be measured on continuous basis;

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

• The mass flow should be summed to a yearly unit basis (t CH4/yr).

According to the "Tool to determine the mass flow of a greenhouse gas in a gaseous stream" (Version 02.0.0) the mass flow of greenhouse gas *I (CH4)* in the gaseous stream in time interval *t* (F_{CH4}, t) is calculated based on measurements of

a) the total volume flow or mass flow of the gas stream and

b) the volumetric fraction of the gas in the gaseous stream and

c) the water content and gas composition.

The tool covers possible measurement options, providing six different calculation options to determine the volume or mass flow of a particular greenhouse gas (A-F). Furthermore, the tool provides several options for the determination of the moisture content of the gaseous stream. Option A is applied for determination of mass flow of the gas stream. In order to apply this option, it shall be demonstrated that the gaseous stream is

dry. As described in part (b) of Option A, the temperature (T_t) of the gaseous stream will be measured and it shall be demonstrated that it is less than 60°C (333.15 K) at the flow measurement point.
If it cannot be demonstrated that the gaseous stream is dry, then the flow measurement should be assumed to be on a wet basis and the corresponding option which is Option B should be applied instead.

The mass flow of greenhouse gas *i* ($F_{i,t}$) is determined as follows:

$$F_{i,t} = V_{t,db} * V_{i,db,t} * \rho_{i,t} \quad \textbf{(5)}$$

With

$$\rho_{i,t} = \frac{P_t * MM_i}{R_u * T_t} \quad \textbf{(6)}$$

Where:

$F_{i,t}$ Mass flow of greenhouse gas *i* in the gaseous stream in time interval *t* (kg gas/h)
$V_{t,db}$ Volumetric flow of the gaseous stream in time interval *t* on a dry basis (m^3 dry gas/h)
$V_{i,t,db}$ Volumetric fraction of greenhouse gas *i* in the gaseous stream in a time interval *t* on a dry basis (m^3 gas *i*/m^3 dry gas)
$\rho_{i,t}$ Density of greenhouse gas *i* in the gaseous stream in time interval *t* (kg gas *i*/m^3 gas *i*)
P_t Absolute pressure of the gaseous stream in time interval *t* (Pa)
MM_i Molecular mass of greenhouse gas *i* (kg/kmol)
R_u Universal ideal gases constant (Pa.m3/kmol.K)
T_t = Temperature of the gaseous stream in time interval *t* (K)

The hourly values are then aggregated for the duration of the monitoring period n, as follows:

$$F_{CH4,El,n} = \sum_{h=1}^{h=hn} F_{CH4,t} \quad \textbf{(7)}$$

Amount of methane destroyed by flaring ($F_{CH4,flared,y}$)

$F_{CH4,\ flared,\ y}$ is determined as the difference between the amount of methane supplied to the flare(s) and any methane emissions from the flare(s), as follows:

$$F_{CH4,flared,y} = F_{CH4,sent\_flare,y} - (PE_{flare,y} / GWP_{CH4}) \quad \textbf{(8)}$$

Where:

$F_{CH4,flared,y}$ Amount of methane in the LFG which is destroyed by flaring in year *y* (t CH4/yr)
$F_{CH4,\ sent\_flare,y}$ Amount of methane in the LFG which is sent to the flare in year *y* (t CH4/yr)
$PE_{flare,y}$ Project emissions from flaring of the residual gas stream in year *y* (t CO2e/yr)
GWP_{CH4} Global warming potential of CH4 (t CO2e/t CH4)

$F_{CH4,\ sent\_flare,n}$ and $F_{CH4,EL,y}$ are determined directly using the "Tool to determine the mass flow of a greenhouse gas in a gaseous stream", applying the requirements described above where the gaseous stream the tool will be applied to is the LFG delivery pipeline to the flares. Thus as in formula below.

$$F_{CH4,sent\_flared,y} = FV_{RG,y} * w_{CH4} * D_{CH4} \quad (9)$$

$$F_{CH4,EL,y} = LFG_{electricity,y} * w_{CH4} * D_{CH4} \quad (10)$$

$PE_{flare,n}$ will be determined using the "Tool to determine project emissions from flaring gases containing methane".

Application of "Tool to determine project emissions from flaring"

According to "Project emission from flaring" Version 02.0.0", the project emissions from flaring of the residual gas stream $PE_{flare,y}$ are determined considering the following steps:

STEP 1: Determination of the mass flow rate of the residual gas
STEP 2: Determination of the hourly flare efficiency
STEP 3: Calculation of project emissions from flaring

The calculation procedure in this tool determines the flow rate of methane before and after the destruction in the flare, taking into account the amount of air supplied to the combustion reaction and the exhaust gas composition (oxygen and methane).

The calculation procedure in this tool determines the project emissions from flaring the residual gas ($PE_{flare,y}$) based on the flare efficiency ($\eta_{flare,m}$) and the mass flow of methane to the flare ($F_{CH4,RG,m}$). The flare efficiency is determined for each minute m of year y based either on monitored data or default values.

The project activity applies an enclosed flare. The temperature in the exhaust gas of the flare is measured to determine whether the flare is operating or not.
For the determination of flare efficiency, option A of the tool is chosen which states:
To use a 90% default value. Continuous monitoring of compliance with manufacturer's specification of flare (temperature, flow rate of residual gas at the inlet of the flare) must be performed. If in a specific hour any of the parameters are out of the limit of manufacturer's specifications, a 50% default value for the flare efficiency should be used for the calculations for this specific hour.
If there is no record of the temperature of the flare or if the recorded temperature is less than 500 °C for any particular hour, it shall be assumed that during that hour the flare efficiency is zero. According to the Tool, the steps 3 and 4 are only applicable in case of enclosed flares and continuous monitoring of the flare efficiency, thus it is not applicable in option a and will not be applied here.

STEP 1. Determination of the mass flow rate of the residual gas

This step calculates the residual gas mass flow rate in each hour h, based on the volumetric flow rate and the density of the residual gas. The density of the residual gas is determined based on the volumetric fraction of all components in the gas.

The following requirements apply:
• The gaseous stream tool shall be applied to the residual gas;
• The flow of the gaseous stream shall be measured continuously;
• CH4 is the greenhouse gas i for which the mass flow should be determined;
• The simplification offered for calculating the molecular mass of the gaseous stream is valid (equation 3 and 17 in the tool); and
• The time interval t for which mass flow should be calculated is every minute m $F_{CH4,m}$ which is measured as the mass flow during minute m,shall then be used to determine the mass of methane in kilograms fed to the flare in minute m ($F_{CH4, RG, m}$). $F_{CH4, m}$ shall be determined on a dry basis.

The calculation follows the procedure as described by the "Tool to determine the mass flow of a greenhouse gas in a gaseous stream". Option A is applied: Same basis (dry basis) is considered for the measurement of the volumetric flow rate of the residual gas and the measurement of the volumetric fraction of methane in the residual gas.

In order to determine the mass flow of CH4, the equations (5) to (6) mentioned above in the present document shall be used.

STEP 2. Determination of flare efficiency

The determination of the hourly flare efficiency depends on the operation of flare (e.g. temperature), the type of flare used (open or enclosed) and, in case of enclosed flares, the approach selected by project participants to determine the flare efficiency (default value or continuous monitoring).

In the case of Molu Landfill Project, an enclosed flare is used and the flare efficiency is determined by default value, **thus Option A**. For enclosed flares that are defined as low height flares, the flare efficiency in the minute m ($\eta_{flare,m}$) shall be adjusted, as a conservative approach, by subtracting 0.1 from the efficiency as determined in Options A or B

Option A: Default value
In case of **enclosed flares and use of the default value** for the flare efficiency, the flare efficiency in the minute m ($\eta_{flare,m}$) is 90% when the following two conditions are met to demonstrate that the flare is operating:

- • the temperature of the flare ($T_{EG, m}$) and the flow rate of the residual gas to the flare ($F_{RG,m}$) is with in the manufacturer's specifications fort he flare ($SPEC_{flare}$) in minute m; and
- • the flame is detected in minute m ($Flame_m$)

Otherwise, ($\eta_{flare,m}$) is 0 %

STEP 3. Calculation of project emissions from flaring

Project emission from flaring are calculated as the sum of emission from each minute m, based on the methane mass flow in the residual gas ($F_{CH4,RG,m}$) and the flare efficiency ($\eta_{flare,m}$), as follows:

$$PE_{flare,y} = GWP_{CH4} x \sum_{m=1}^{525600} F_{CH4,RG,m} \times (1 - \eta_{flare,m}) \times 10^{-3} \quad (11)$$

Where:

$PE_{flare,y}$	Project emissions from flaring of the residual gas in year y (tCO_2 e)
$F_{CH4,RG,m}$	Mass flow of methane in the residual gas in the minute m (kg)
$\eta_{flare,m}$	Flare efficiency in minute m

Step A.1.1: Ex ante estimation of $F_{CH4,PJ,y}$

An *ex ante* estimate of $F_{CH4,PJ,y}$ is required to estimate baseline emission of methane from the SWDS (according to equation 2) in order to estimate the emission reductions of the proposed project activity in the PDD. It is determined as follows:

$$F_{CH4,PJ,y} = \eta_{PJ} * BE_{CH4,SWDS,y} / GWP_{CH4} \quad \textbf{(12)}$$

Where:

$F_{CH4,PJ,y}$	Amount of methane in the LFG which is flared and/or used in the project activity in year *y* (t CH4/yr)
$BE_{CH4,SWDS,y}$	Amount of methane in the LFG that is generated from the SWDS in the baseline scenario in year *y* (t CO2e/yr)
η_{PJ}	Efficiency of the LFG capture system that will be installed in the project activity (%)
GWP_{CH4}	Global warming potential of CH4 (t CO2e/t CH4)

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

• *fy* in the tool shall be assigned a value of 0 because the amount of LFG that would have been captured and destroyed is already accounted for in equation 2 of this methodology;
• In the tool, x begins with the year that the SWDS started receiving wastes (e.g. the first year of SWDS operation); and
• Sampling to determine the fractions of different waste types is not necessary because the waste composition can be obtained from previous studies.

The project will capture only a fraction of the whole LFG due to following reasons:

- The degassing system has its own efficiency
- The enclosed flares have their destruction efficiency

Molu Kayseri Landfill has different efficiencies for gas collection, thus a 50% of default value is applied for calculation.
According the methodological tool "Emissions from solid waste disposal sites" version 06.0.1, ex-ante calculation of $BE_{CH4,SWDS,y}$ based on the formulation below:

$$BE_{CH4,SWDS,y} = \varphi \cdot (1-f) \cdot GWP_{CH4} \cdot (1-OX) \cdot \frac{16}{12} \cdot F \cdot DOC_f \cdot MCF \cdot \sum_{x=1}^{y} \sum_{j} W_{j,x} \cdot DOC_j \cdot e^{-k_j(y-x)} \cdot \left(1-e^{-k_j}\right) \quad \textbf{(13)}$$

where

φ	model correction factor to account for model uncertainties (0.9)
f	fraction of methane captured at SWDS and flared, combusted or used in another manner (default value as per ACM 0001 is zero)
OX	oxidation factor (reflecting the amount of methane from SWDS that is oxidized in the soil or another material covering 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 [t]
DOC_j	fraction of degradable organic carbon (by weight) in the waste type j
k_j	decay rate for waste type j
j	waste type category (index)
x	year of receiving wastes at the landfill site: x runs from the first year of landfill operation x=1 to the year for which avoided emissions are calculated (x = y)
y	year for which methane emissions are calculated

In application of the Tool "Emissions from solid waste disposal sites" version 06.0.1, option A is applied. The calculation is provided for validation as Molu_Landfill_calculation file.

Step A.2: Determination of $F_{CH4,BL,y}$

This steps provides a procedure to determine the amount of methane that would have been captured and destroyed (by flaring) in the baseline due to regulatory or contractual requirements, or to address safety and odour concerns (collectively referred to as *requirement* in this step). The motholdogy ACM0001 version 13 provide for cases to determine the amount, while there is "*no requirement to destroy methane exists and no existing LFG capture system" for Molu Kayseri Landfill,* as in the case 1,

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

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

The baseline emissions associated with electricity generation in year *y* ($BE_{EC,y}$) is calculated using the "Tool to calculate baseline, project and/or leakage emissions from electricity consumption" version 01.

When applying the tool:
• The electricity sources *k* in the tool correspond to the sources of electricity generated identified in the selection of the most plausible baseline scenario; and
• $EC_{BL,k,y}$ in the tool is equivalent to the net amount of electricity generated using LFG in year *y*.

According to the methodological tool "Tool to calculate baseline, project and/or leakage emissions from electricity consumption" (Version 01) baseline emission for electricity generation is calculated by multiplying the amount of electricity generated using LFG with carbon emission factor of the electricity source, which is the Turkish national grid. Calculation of CO_2 emission intensity of the baseline source of electricity is given in Annex 4.

$$BE_{EC,y} = \sum_k EC_{BL,k,y} x EF_{EL,k,y} x (1 + TDL_{k,y}) \quad \textbf{(14)}$$

Where:

$BE_{EC,y}$	Baseline emissions for electricity generation in year y (tCO2/yr)
$EC_{BL,k,y}$	Quantity of electricity that would be generated using LFG in year y (MWh/yr)
$FE_{EL,k,,y}$	Emission factor for electricity generation for source k in year y (tCO2/MWh)
$TDL_{k,y}$	Average technical transmission and distribution losses for providing electricity to source k in year y
K	Sources of electricity consumption in the baseline

Step B.1 Determination of the emission factor for electricity generation ($EF_{EL,k,y}$)

The methodological tool "Tool to calculate baseline, project and/or leakage emissions from electricity consumption" (Version 01) provides option and scenario for determination of the emission factors for electricity generation ($EF_{EL,k,y}$). The option A1 of the tool is applicable for Molu Kayseri Landfill gas to electricty project:
Option A1: Calculate the combined margin emission factor of the applicable electricity system, using the procedures in the latest approved version of the .Tool to calculate the emission factor for an electricity system. ($EF_{EL,k,y} = EF_{grid,CM,y}$).

Calculation of $EF_{grid,CM,y}$

Stepwise approach of 'Tool to calculate the emission factor for an electricity system' version 02.2.1 [14] is used to find this combined margin (emission coefficient) as described below:

<u>Step 1</u>: Identify the relevant electric power system

There are 21 regional distribution regions in Turkey but no regional transmission system is defined. In Article 20 of License Regulation it is stated that '*TEİAŞ shall be in charge of all transmission activities to be performed over the existing transmission facilities and those to be constructed as well as the activities*

[14] See, http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-07-v2.pdf

pertaining to the operation of ***national transmission system*** *via the National Load Dispatch Centre and the regional load dispatch centres connected to this centre and the operation of Market Financial Reconciliation Centre*[15]'. As it can be understood from this phrase, only one transmission system which is national transmission system is defined and only TEİAŞ is in charge of all transmission system related activities. Moreover, a communication with representative of TEİAŞ which indicates that: "There are not significant transmission constraints in the national grid system which is preventing dispatch of already connected power plants" is submitted to the DOE. Therefore, the national grid is used as electric power system for project activity. The national grid of Turkey is connected to the electricity systems of neighbouring countries. Complying with the rules of the tool, the emission factor for imports from neighbouring countries is considered 0 (zero) tCO_2/MWh for determining the OM.

There is no information about interconnected transmission capacity investments, as TEİAŞ, who operates the grid, also didn't take into account imports-exports for electricity capacity projections.[16] Because of that, for BM calculation transmission capacity is not considered.

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

According to Tool project participants may choose between the following two options to calculate the operating margin and build margin emission factor:

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

Option II: Both grid power plants and off-grid power plants are included

For this project, **Option I** is chosen.

Step 3: Select an operating margin (OM) method

The Turkish electricity mix does not comprise nuclear energy. Also there is no obvious indication that coal is used as must run resources. Therefore, the only low cost resources in Turkey, which are considered as must-run, are Hydro, Renewables and Waste, Geothermal and Wind (according to statistics of TEİAŞ).

*Table 8***: *Share of Low Cost Resource (LCR) Production 2006-2010 (Production in GWh)***[17]

	2006	2007	2008	2009	2010
Gross production	176,299.8	191,558.1	198,418.0	194,812.9	211,207.7
TOTAL LCR Production	44,618,7	36,575.6	34,498.6	38,229.6	55,837.6
Hydro	44,244,2	35,850.8	33,269.8	35,958.4	51,795.5

[15] See: http://www.epdk.org.tr/english/regulations/electric/license/licensing.doc (page 21)

[16] See: http://www.epdk.gov.tr/documents/10157/d03e6570-d4c8-461c-9e78-9cfe38f71be1 (page 39)

[17] See: http://www.teias.gov.tr/istatistik2010/front%20page%202010-%C3%A7i%C3%A7ek%20kitap/uretim%20tuketim(22-45)/35(75-10).xls

Renewables and Waste	154.0	213.7	219.9	340.1	457.5
Geothermal and Wind	220.5	511.1	1,008.9	1,931.1	3,584.6
Share of LCRs	*25.31%*	*19.09%*	*17.39%*	*19.62%*	*26.44%*
Average of last five years	**21.57%**				

As average share of low cost resources for the last five years is far below 50% (21.57%), the Simple OM method is applicable to calculate the operating margin emission factor ($EF_{grid,OM,y}$)

For the Simple OM method, the emissions factor can be calculated using either of the two following data vintages:

- Ex-ante option: A 3-year generation-weighted average, based on the most recent data available at the time of submission of the CDM-PDD to the DOE for validation, or
- Ex-post option: The year, in which the project activity displaces grid electricity, requiring the emissions factor to be updated annually during monitoring.

The ex-ante option is selected for Simple OM method, with the most recent data for the baseline calculation stemming from the years 2007 to 2009.

Step 4: Calculate 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. The calculation of the simple OM emission factor can be based on:

- net electricity generation and corresponding CO_2 emission factor of each power unit (Option A), or
- total net electricity generation of all power plants serving the system and the fuel types and total fuel consumption of the project electricity system (Option B).

Option B is chosen to calculate the Simple OM, as there is no power plant specific data available. Renewable power generation is considered as low-cost power source and amount of electricity supplied to the grid by these sources is known.

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

$$EF_{grid,OMsimple,y} = \frac{\sum_i FC_{i,y} x NCV_{i,y} x EF_{CO2,i,y}}{EG_y} \quad \textbf{(15)}$$

Where:

$EF_{grid,Omsimple,y}$	=	Simple operating margin CO_2 emission factor in year y (tCO_2/MWh)
$FC_{i,y}$	=	Amount of fossil fuel type i consumed in the project electricity system in year y (mass or volume unit)
$NCV_{i,y}$	=	Net calorific value (of fossil fuel type i in year y (GJ / mass or volume unit)
$EF_{CO2,i,y}$	=	CO_2 emission factor of fossil fuel type i in year y (tCO_2/GJ)
EG_y	=	Net electricity generated and delivered to the grid by all power sources serving the system, not including low-cost / must-run power plants / units, in year y (MWh)
i	=	All fossil fuel types combusted in power sources in the project electricity system in year y
y	=	three most recent years for which data is available at the time of submission of the PDD to the DOE for validation

For the calculation of the OM the consumption amount and heating values of the fuels for each sources used for the years 2008, 2009 and 2010, is taken from the TEİAŞ annual statistics, which holds data on annual fuel consumption by fuel types as well as electricity generation amounts by sources and electricity imports. All the data needed for the calculation, including the emission factors and net calorific values (NCVs), are provided in part B of this Annex. Total CO_2 emission due to electricity generation in Turkey for the years of 2008, 2009 and 2010 are given in Table 9.

*Table 9**: CO2 emissions from electricity production 2008-2010 (ktCO$_{2}$e)***[18]

	2008	2009	2010
CO_2-Emmissions [ktCO_2]	103,352	97,863	98,478

Table 10 below presents the gross electricity production data by all the relevant energy sources. Low-cost/must run resources like hydro, wind, geothermal and biomass do not emit fossil CO_2 and thus are not taken into account in calculations.

*Table 10**: Gross electricity production by fossil energy sources 2008-2010 (GWh)***[19]

Energy Source	2008	2009	2010
Natural Gas	98,685.3	96,094.7	98,143.7
Lignite	41,858.1	39,089.5	35,942.1
Coal	15,857.5	16,595.6	19,104.3
Fuel Oil	7,208.6	4,439.8	2,143.8

[18] For detail calculation see Annex 3.

[19] http://www.teias.gov.tr/istatistik2010/front%20page%202010-%C3%A7i%C3%A7ek%20kitap/uretim%20tuketim(22-45)/35(75-10).xls

Motor Oil	266.3	345.8	4.3
Naphtha	43.6	17.6	31.9
LPG	0.0	0.4	0.0
Total fossil fuels	**163,919.4**	**156,583.4**	**155,370.1**

Table 11 shows gross data, but EG_y in the above described formula means electricity delivered to the grid, i.e. net generation. Therefore following table shall help to derive net data by calculating the net/gross proportion on the basis of overall gross and net production numbers.

*Table 11: **Net/gross electricity production 2008-2010 (GWh)**[20]*

	2008	2009	2010
Gross Production	198,418.00	194,812.90	211,207.70
Net Production	189,761.90	186,619.30	203,046.10
Relation	**95.64%**	**95.79%**	**96.14%**

Multiplying these overall gross/net relation percentages with the fossil fuels generation amount does in fact mean an approximation. However this is a conservative approximation as the consumption of plant auxiliaries of fossil power plants is higher than for the plants that are not included in the baseline calculation. In the end this would lead to a lower net electricity generation and therefore to a higher OM emission factor and higher emission reductions.

Table 12 shows the resulting net data for fossil fuel generation and adds electricity imports.

*Table 12: **Electricity supplied to the grid, relevant for OM (GWh)**[21]*

	2008	2009	2010
Net El. Prod. by fossil fuels	156,768.3	149,997.7	149,366.2
Electricity Import	789.4	812.0	1,143.8
Electricity supplied to grid by relevant sources	**157,557.7**	**150,809.7**	**150,510.0**

Electricity import is added to the domestic supply in order to fulfil the Baseline Methodology requirements. Imports from connected electricity systems located in other countries are weighted with an emission factor of 0 (zero) tCO_2/MWh.

The last step is to calculate $EF_{grid,OMsimple,y}$:

[20] For Net Production See, http://www.teias.gov.tr/istatistik2009/32(75-09).xls (column L)

[21] http://www.teias.gov.tr/istatistik2010/front%20page%202010-%C3%A7i%C3%A7ek%20kitap/ithalat-ihracat(50-54)/52.xls

Table 13: ***Calculation of Weighted Efgrid, OMsimple,y (ktCO2/GWh)***

	2008	2009	2010
CO_2-Emmissions ($ktCO_2$)	103,352	97,863	98,478
Net Electricity Supplied to Grid by relevant sources (GWh)	157,557.7	150,809.7	148,269.2
$EF_{grid,OMsimple,y}$ ($ktCO_2$/GWh)	0.6560	0.6489	0.6642
3-year Generation Weighted Average $EF_{grid,Omsimple,y}$ ($ktCO_2$/GWh)	**0.6531**		

<u>Step 5</u>: Identify the group of power units to be included in the build margin

Build Margin calculations are performed with the sample group of power units *m* consisting 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

Option (b) is used to identify the sample group, as this option comprises the larger annual generation in Turkey. In 2010, gross electricity generation amount was 211,207 GWh and 20% of this is 42,241 GWh.

The last plant of the sample group is built in 2006 and until the end of the 2010 (which is the latest year for official statistics published for plants put in operation) there were 52 VER projects. Because of the last plant of the sample group was built 4 years ago (not more than 10 years ago), VER plants are excluded from sample group.

While identifying the sample group dismantled, revised, retrofits are not included. Only new capacity additions (power plants / units) are taken into account.

Sample group for BM emission factor is given below Table 14. The derivation of the values presented in Table 14 is contained in a separate excel file which is available for validation.

Table 14: ***Sample group generation for BM emission factor calculation (GWh)***

Energy Source	2008	2009	2010	Sample Group Total Generation (GWh)
Natural Gas	1.050,0	10.164,3	12.864,4	24.078,6
Lignite	0,0	0,0	184,0	184,0
Coal	0,0	1.923,3	9.080,0	11.003,3
Fuel Oil	103,2	1.260,0	0,0	1.363,2
Hydro	0,0	1.960,5	3.336,8	5.297,2

Renewables	50,0	313,0	2,4	365,4
TOTAL	**1.203,1**	15.621,1	25.467,6	**42.291,77**

Again, the project proponents can chose between two options according to the calculation tool: calculate the BM ex-ante based on the latest available data or update the BM each year ex post. Option 1, the ex-ante approach, is again chosen.

<u>Step 6:</u>. Calculate the build margin emission factor

The build margin emissions factor is the generation-weighted average emission factor (tCO_2/MWh) of all power units *m* during the most recent year *y* for which power generation data is available, calculated as per formula in the tool:

$$EF_{grid,BM,y} = \frac{\sum_m EG_{m,y} x EF_{EL,m,y}}{\sum_m EG_{m,y}} \quad \textbf{(16)}$$

Where:

$EF_{grid,BM,y}$	=	Build margin CO_2 emission factor in year y (tCO_2/MWh)
$EG_{m,y}$	=	Net quantity of electricity generated and delivered to the grid by power unit m in year y (MWh)
$EF_{EL,m,y}$	=	CO_2 emission factor of power unit m in year y (tCO_2/MWh)
m	=	Power units included in the build margin
y	=	Most recent historical year for which power generation data is available

Because of only fuel types and electricity generation data are available for the sample group, *Option B2* of Simple OM method is used to calculate emission factor. The formula of the tool is below:

$$EF_{EL,m,y} = \frac{EF_{CO2,m,i,y} x 3.6}{\eta_{m,y}} \quad \textbf{(17)}$$

Where:

$EF_{EL,m,y}$	=	CO_2 emission factor of power unit m in year y (tCO_2/MWh)
$EF_{CO2,m,i,y}$	=	Average CO_2 emission factor of fuel type i used in power unit m in year y (tCO_2/GJ)
$\eta_{m,y}$	=	Average net energy conversion efficiency of power unit m in year y (%)
y	=	Three most recent years for which data is available at the time of submission of the PDD to the DOE for validation

BM emission factor calculation and resulted BM factor is given in the Table 15. For BM factor calculation, since no official emission factors for different fuel types are available, lower confidence default values of IPCC Guidelines are applied. Explanation of emission factor selection for each energy sources and references are given in section 3.3 of the PDD.

*Table 15**: BM emission factor calculation as per tool equations 13/3***

Energy Source	Sample Group Total Generation (GWh)	Effective CO_2 emission factor (tCO_2/TJ)	Average Efficiency ($\eta_{m,y}$)	CO_2 Emission ($ktCO_2$)
Natural Gas	24,078.6	54.3	60.00%	7,844.8
Lignite	184.0	90.9	38.00%	158.5
Coal	11,003.3	89.5	41.50%	8,542.8
Fuel Oil	1,363.2	72.6	46.00%	774.5
Hydro	5,297.2	0.0	0.00%	0.0
Renewables	365.4	0.0	0.00%	0.0
Total	**42,291.77**			**17,320.6**
$EF_{grid,BM,y}$ (tCO_2/MWh)	**0.4096**			

<u>Step 7:</u> *Calculate the combined margin emission factor*

The combined margin emission factor is calculated as per tool formula below:

$$EF_{grid,CM,y} = EF_{grid,OM,y} * w_{OM} + EF_{grid,BM,y} * w_{BM} \quad \textbf{(18)}$$

Where:

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

According to the Tool for landfill power generation project activities Combined margine: $w_{OM} = 0.5$ and $w_{BM} = 0.5$. Then:

$EF_{grid,CM,y}$ = 0.6513 tCO2/MWh * 0.5 + 0.4096 tCO2/MWh * 0.5 = 0.5313 tCO2/MWh

xxx

Project emissions

$$PE_y = PE_{EC,y} + PE_{FC,y} \quad \textbf{(19)}$$

Where:

PE_y Project emissions in year *y* (t CO2/yr)

$PE_{EC,y}$ Emissions from consumption of electricity due to the project activity in year *y* (t CO2/yr)

$PE_{FC,y}$ Emissions from consumption of fossil fuels due to the project activity, for purpose other than electricity generation, in year *y* (t CO2/yr)

The project emissions from consumption of electricity by the project activity ($PE_{EC,y}$) is calculated using the "Tool to calculate baseline, project and/or leakage emissions from electricity consumption". When applying the tool:

- Electricity sources *j* in the tool corresponds to the sources of electricity consumed due to the project activity. This includes, where applicable, electricity consumed for the operation of the LFG capture system,

$$PE_{EC,y} = \sum_k EC_{PJ,j,y} xEF_{EL,j,y} x\left(1 + TDL_{j,y}\right) \quad \textbf{(20)}$$

Where:

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

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

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

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

j Sources of electricity consumption in the project

For the simplicity of emission reduction calculation, project emission from electricity consumption is assumed to be "0". For ex-post calculation, this emission sources will be taken into account.

The project emissions from fossil fuel combustion (PE $_{FC,j,y}$) will be calculated following the "Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion". For this purpose, the processes j in the tool corresponds to all fossil fuel combustion in the landfill, as well as any other on-site fuel combustion needed for the project activity.

$$PE_{FC,j,y} = \sum_i FC_{i,j,y} \times COEF_{i,y}$$ **(21)**

Where

$FC_{i,j,y}$	quantity of fuel type i combusted in process j during the year y
$COEF_{i,y}$	CO_2 emission coefficient of fuel type i in year y

The CO_2 emission coefficient is calculated following Option B as fuel combust chemical composition of the fuel.

The CO_2 emission coefficient is calculated following Option B based on net calorific value and CO_2 emission factor of the fuel type I as follows:

$$COEF_{i,y} = NCV_{i,y} \times EF_{CO2,i,y}$$ **(22)**

where

$COEF_{i,y}$	CO_2 emission coefficient of fuel type i in year y
$NCV_{i,y}$	the weighted average net calorific value of the fuel type I in year y
$EF_{CO2,y}$	the weighted average CO_2 emission factor of fuel type I in year y
i	are the fuel types combusted in process j during the year y

For the simplicity of emission reduction calculation, project emission from fossil fuel combustion is assumed to be "0". For ex-post calculation, this emission sources will be taken into account.

Leakage

No leakage effects need to be accounted under the approved consolidated methodology ACM0001, version 13.

Emission Reduction

The emission reductions are calculated as the difference between baseline and project emissions as follows:

$ER_y = BE_y - PE_y$ **(23)**

Where:

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

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

Data and Parameters not Monitored

Data / Parameter:	Wx
Data unit:	Ton
Description:	Quantity of MSW land filled during 1996~2012
Source of data:	Landfill gas power generation report of Kayseri Molu Landfill gas project
Value to be Applied:	See section B.6.3 and Molu Calculation sheet
Justification of the choice of data or description of measurement methods and procedures actually applied :	The data is provided in the report of landfill gas power generation report and this data is used to for calculation of energy generation. The date of waste is also confirmed by representative of waste department in Municipality.
Any comment:	

Data / Parameter:	GWP_{CH4}
Data unit:	tCO_2e/tCH_4
Description:	Global warming potential of CH4
Source of data:	IPCC
Value to be Applied:	21 of the first commitment period. Shall be updated according to any future COP/MOP decisions
Justification of the choice of data or description of measurement methods and procedures actually applied :	
Any comment:	

Data / Parameter:	D_{CH4}
Data unit:	tCH_4/ m^3tCH_4
Description:	Methane Density
Source of data:	
Data Applied	At standard temperature and pressure (0 degree Celsius and 1,013 bar) the density of methane is 0.0007168 tCH_4/ m^3tCH_4
Justification of the choice of data or description of measurement methods	

and procedures actually applied :	
Any comment:	

Data / Parameter:	**Φ**
Data unit:	-
Description:	Default value for the model correction factor to account for model uncertainties
Source of Data	"Methodological Tool: Emissions from solid waste disposal sites" (Version 06.0.0)
Value to be applied:	0.75 For baseline emissions: refer to Table 3 to identify the appropriate factor based on the application of the tool (A or B) and the climate where the SWDS is located
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 the model results.
Any comment:	

Default values for the model correction factor	**Humid/wet conditions**	**Dry conditions**
Application A	**0.75**	**0.75**
Application B	**0.85**	**0.80**

Data / Parameter:	**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:	2006 IPCC Guidelines for National Greenhouse Gas Inventories, Vol. 5 Waste, Table 3.2.
Value to be applied:	0.1
Justification of the choice of data or description of measurement methods and procedures actually	As the landfill was covered by soil, the default value for oxidation could be applied.

applied :	
Any comment:	-

Data / Parameter:	**F**
Data unit:	-
Description:	Fraction of methane in the SWDS gas (volume fraction)
Source of data used:	2006 IPCC Guidelines for National Greenhouse Gas Inventories, Vol. 5 Waste,
Value applied:	0.5
Justification of the choice of data or description of measurement methods and procedures actually applied :	
Any comment:	

Data / Parameter:	**DOC_f**
Data unit:	Weight fraction
Description:	Default value for the fraction of degradable organic carbon (DOC) in MSW that decomposes in the SWDS.
Source of data used:	2006 IPCC Guidelines for National Greenhouse Gas Inventories, Vol. 5 Waste,
Value applied:	0.5
Justification of the choice of data or description of measurement methods and procedures actually applied :	Based on the methodological tool "Emissions from solid waste disposal sites" version 06.0.0", this factor reflects the fact that some degradable organic carbon degrades very slowly, under anaerobic conditions in the SWDS. A default value of 0.5 is recommended by IPCC.
Any comment:	-

Data / Parameter:	**MCF**
Data unit:	-
Description:	Methane correction factor
Source of data used:	2006 IPCC Guidelines for National Greenhouse Gas Inventories, Vol. 5 Waste, Table 3.1
Value applied:	0.8

Justification of the choice of data or description of measurement methods and procedures actually applied :	The methane correction factor (MCF) accounts for the fact that unmanaged SWDS produce less methane from a given amount of waste than managed SWDS, because a larger fraction of waste decomposes aerobically in the top layers of unmanaged SWDS. Based on the "Tool: Emissions from solid waste disposal sites", IPPC default value for **unmanaged solid waste disposal sites . deep.** This comprises all SWDS not meeting the criteria of managed SWDS and which have depths of greater than or equal to 5 meters.[22]
Any comment:	

Data / Parameter:	DOC_j
Data unit:	-
Description:	Fraction of degradable organic carbon (by weight) in the waste type j
Source of data used:	2006 IPCC Guidelines for National Greenhouse Gas Inventories, Vol. 5 Waste, Tables 2.4 and 2.5.
Value applied:	(see table below)
Justification of the choice of data or description of measurement methods and procedures actually applied :	MAP/PET < 1 for province of Kayseri, thus **dry** values are used in accordance to "the tool Emissions from solid waste disposal sites" version 6.0.0 and 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Vol. 5 Waste, Tables 2.4 and 2.5.

Value applied:

Waste type j	DOC_j (% wet waste)	DOC_j (% dry waste)
Wood and wood products	43	50
Pulp, paper and cardboard (other than sludge)	40	44
Food, food waste, bevarages and tobacco (other than sludge)	15	38
Textiles	24	30
Garden, yard and park waste	20	49
Glass, plastic, metal, other inert waste	0	0

[22] Landfill gas power generation report of Kayseri Molu Landfill.

Any comment:	0.40 (kitchen waste), 0.03 (paper & carton), 0.08 (textiles), 0.03 (wood), 0.10 (garden/fruits), 0.36 (glass, plastic, metal, other inert waste)[23]

Data / Parameter:	**k_j**
Data unit:	-
Description:	Decay rate for the waste type j
Source of data used:	2006 IPCC Guidelines for National Greenhouse Gas Inventories, Vol. 5 Waste, Table 3.3.
Value applied:	0.04 (paper & carton), 0.04 (textiles), 0.02 (wood), 0.05 (garden & park wastes), 0.06 (food)
Justification of the	For Kayseri region:

Waste type j		**Boreal and Temperate (MAT ≤ 20 ºC)**		**Tropical (MAT ≥ 20 ºC)**	
		Dry MAP/PET < 1)	Wet (MAP/PET > 1)	Dry (MAP < 1000 mm)	Wet MAP > 1000)
Slowly Degrading	Pulp, paper, cardboard (other than sludge, textiles)	0.04	0.06	0.045	0.07
Slowly Degrading	Wood, wood products and straw	0.02	0.03	0.025	0.035
Moderately Degrading	Other (non-food) organic putrescible garden and park waste	0.05	0.10	0.065	0.17
Rapidly Degrading	Food, food waste, sewage sludge, beverages and tobacco	0.06	0.185	0.085	0.40

[23] Kayseri-Ergebnisbericht-Deponie und Gasprognos.page: 18.

choice of data or description of measurement methods and procedures actually applied :	Medium Average temperature MAT [°C]: 10.5 Medium Average Precipitation MAP [mm/y]: 393 Potential Evapotraspiration PET [mm/y]:438 Thus, MAP/PET<1 Source for MAP : http://www.mgm.gov.tr/veridegerlendirme/yillik-toplam-yagis-verileri.aspx?m=KAYSERI#sfB Source for PET: http://www.mgm.gov.tr/veridegerlendirme/acik-yuzey-buharlasma.aspx
Any comment:	

Data / Parameter:	η_{PJ}
Data unit:	Dimensionless
Description:	Efficiency of the LFG capture system that will be installed in the project activity
Source of data used:	The methodology ACM0001 Version 13.
Value applied:	50%
Justification of the choice of data or description of measurement methods and procedures actually applied :	While there are different values in regards of efficiency of LFG capture system due to difference in disposal sites. The default value of 50% is applied fort he Project.
Any comment:	

Data / Parameter:	fy
Data unit:	-
Description:	Fraction of methane captured at the SWDS and flared, combusted or used in another manner that prevents the emissions of methane to the atmosphere in year *y*
Source of data:	Methodology ACM0001 Version 13
Value applied	0
Monitoring frequency:	N.a
Justification of the choice of data or description of measurement methods and procedures actually applied :	According Methodology ACM0001 Version 13, “0” is applied.
Any comment:	While Molu Kayseri landfill does not have a water table above the bottom of the

	SWDS, then this parameter is used to determine the MCF

Data / Parameter:	**Gross electricity generation**
Data unit:	**MWh**
Description:	Gross Electricity supplied to the grid by relevant sources (2008-2010)
Source of data used:	Turkish Electricity Transmission Company (TEIAS), Annual Development of Turkey's Gross Electricity Generation of Primary Energy Resources (1975-2010) TEIAS, see: http://www.teias.gov.tr/istatistik2010/front%20page%202010-%C3%A7i%C3%A7ek%20kitap/uretim%20tuketim(22-45)/35(75-10).xls
Value applied:	See table 11
Justification of the choice of data or description of measurement methods and procedures actually applied :	TEIAS is the national electricity transmission company, which makes available the official data of all power plants in Turkey.
Any comment:	

Data / Parameter:	**Net electricity generation**
Data unit:	**MWh**
Description:	Net electricity fed into the grid. Used for the calculation of the net/gross relation (Including Import and Export figures)
Source of data used:	Turkish Electricity Transmission Company (TEIAS), Annual Development of Electricity Generation-Consumption and Losses in Turkey (1984-2010) TEIAS, http://www.teias.gov.tr/istatistik2010/front%20page%202010-%C3%A7i%C3%A7ek%20kitap/uretim%20tuketim(22-45)/33(84-10).xls
Value applied:	See table 12
Justification of the choice of data or description of measurement methods and procedures actually applied :	This data is used to find relation between the gross and net electricity delivered to the grid by fossil fuel fired power plants (Table 12). Import and Export data is used to find total net electricity fed into the grid in the years of 2008, 2009 and 2010 (table 12) TEIAS is the national electricity transmission company, which makes available the official data of all power plants in Turkey.
Any comment:	

Data / Parameter:	$HV_{i,y}$
Data unit:	Mass or volume unit
Description:	Heating Values of fuels consumed for electricity generation in the years of 2007, 2008, 2009 and 2010
Source of data used:	Heating Values Of Fuels Consumed In Thermal Power Plants In Turkey By The Electric Utilities, TEİAŞ. See: http://www.teias.gov.tr/istatistik2010/front%20page%202010-%C3%A7i%C3%A7ek%20kitap/yak%C4%B1t46-49/49.xls
Value applied:	See table 20
Justification of the choice of data or description of measurement methods and procedures actually applied :	TEİAŞ is the national electricity transmission company, which makes available the official data of all power plants in Turkey. There is no national NVC data in Turkey. However, TEİAŞ announces Heating values of fuels. This data is used to calculate annual NCVs for each fuel type.
Any comment:	

Data / Parameter:	$FC_{i,y}$
Data unit:	Mass or volume unit
Description:	Fuels consumed for electricity generation in the years of 2008, 2009 and 2010
Source of data used:	Annual Development of Fuels Consumed In Thermal Power Plants In Turkey By The Electric Utilities, TEİAŞ. See: http://www.teias.gov.tr/istatistik2010/front%20page%202010-%C3%A7i%C3%A7ek%20kitap/yak%C4%B1t46-49/47.xls
Value applied:	See table 21
Justification of the choice of data or description of measurement methods and procedures actually applied :	TEİAŞ is the national electricity transmission company, which makes available the official data of all power plants in Turkey.
Any comment:	

Data / Parameter:	$NCV_{i,y}$
Data unit:	TJ/kton, TJ/million m^3
Description:	Net Calorific Value of fuel types in the years of 2008, 2009 and 2010

Source of data used:	Calculated by using HVi,y to FCi,y as Net Calorific Values of fuel types are not directly available in Turkey.
Value applied:	See table 22
Justification of the choice of data or description of measurement methods and procedures actually applied :	TEİAŞ is the national electricity transmission company, which makes available the official data of power plants in Turkey. Calculation of NCVs from national $HV_{i,y}$ and $FC_{i,y}$ data, Table 22and **Table 23**, is preferred to default IPCC data as these are more reliable.
Any comment:	

Data / Parameter:	**Sample Group for BM emission factor**
Data unit:	Name of the plants, MW capacities, fuel types, annual electricity generations and dates of commissioning.
Description:	Most recent power plants which compromise 20% of total generation
Source of data used:	Annual Development of Fuels Consumed in Thermal Power Plants in Turkey by the Electric Utilities, TEIAS: For plants in 2006: http://www.epdk.gov.tr/documents/10157/70d5f8ce-9da8-44c4-bef8-84b7505dccc3 (page 76 and 77 for installed power of new plants, page 67-75 for generation amounts. For capacity additions, interpolation method is used for generation amounts) For plants in 2007: www.teias.gov.tr/projeksiyon/KAPASITEPROJEKSIYONU2008.pdf (page 121 and 122 for installed power of new plants, page 111-120 for generation amounts. For capacity additions, interpolation method is used for generation amounts) For plants in 2008: http://www.teias.gov.tr/projeksiyon/KAPASITEPROJEKSIYONU2009.pdf (page 95 for plants and pages 82-94 for generation amounts. For capacity additions, interpolation method is used for generation amounts) For Plants in 2009: http://www.teias.gov.tr/projeksiyon/KAPASITE%20PROJEKSIYONU%202010.pdf (page 98-100 for plants and pages 85-97 for generation amounts. For capacity additions, interpolation method is used for generation amounts) For Plants in 2010: http://www.epdk.org.tr/documents/10157/8edb1470-7667-4ce1-8ce5-21d1ce4e4761 (Page 101-106 for 2010 Plants and Pages 88-101 for Fuel Types and Generation Amounts)
Value applied:	See table 24
Justification of the choice of data or description of measurement methods	TEIAS is the national electricity transmission company, which makes available the official data of all power plants in Turkey.

and procedures actually applied :	
Any comment:	

Data / Parameter:	**EF_i**
Data unit:	tCO_2/GJ
Description:	Emission factor for fuel type *I*
Source of data used:	IPCC default values at the lower limit of the uncertainty at a 95% confidence interval as provided in table 1.4 of Chapter1 of Vol. 2 (Energy) of the IPCC Guidelines on National GHG Inventories. http://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/2_Volume2/V2_1_Ch1_Introduction.pdf
Value applied:	See table 22
Justification of the choice of data or description of measurement methods and procedures actually applied :	No plant specific and national emission factor data is available in Turkey. So, IPCC default data is used. For Fuel Oil Power Plants: 'Gas/Diesel Oil' data is used for conservativeness. For Coal Power Plants: In the 205th page of official document given in the link below, it is stated that Çolakoğlu and İçdaş utilizes 'Taşkömürü' (Hardcoal). And at the Table-2 in page 157 of the same document, Taşkömürü is dived in two groups: Bituminous and Antharcite. Since Sub-Bituminous Coal is under Brown Coal in the same table and since Other Bituminous Coal has lower EF than Anthracite in 1.4 of IPCC Guidelines, EF for 'Other Bituminous Coal' is used. See: http://www.dpt.gov.tr/DocObjects/Icerik/4225/Enerji_Hammaddeleri_(Linyit_Taskömuru-Jeotermal)
Any comment:	

Data / Parameter:	$\eta_{i,y}$
Data unit:	-
Description:	Average energy conversion efficiency of power unit m in year y
Source of data used:	TEİAŞ and Annex I of the "Tool to calculate the emission factor for an electricity system"
Value applied:	See Table 16
Justification of the choice of data or description of measurement methods and procedures actually applied :	For Lignite and Coal power plants, plants specific values are applied. There are two lignite power plant in Sample Group. These are Çan and Elbistan PPs. For efficiency factor of Çan PP is taken form presentation of Mr. Sefer Bütün (General Manager of EUAS, state production company), which is 'Thermal Power Plants and Environment'. This presentation is submitted to DOE. In the page 18 of the presentation, it is stated that for pulverized lignite power plants the highest achieved electrical efficiency rate is 38%. So this rate is applied also for Elbistan-B PP.

	Weighted average of these efficiency rates, which turns to be 38.63% is used for lignite power plants. For coal power plants, the highest efficiency rate for 'fluidized bed' technology which is 41.5% for PFBS is applied as coal PPs in the sample group (Çolakoğlu (Capacity Increment) and Çan Gr I-II) are utilizing fluidized bed type technology. For reference see: http://www.mimag-samko.com.tr/akiskan_yatakli_kazanlar.pdf (last paragraph of page 6) For Natural Gas and Oil plants efficiencies, default value given in the tool is applied: http://cdm.unfccc.int/methodologies/Tools/EB35_repan12_Tool_grid_emission.pdf
Any comment:	

Data / Parameter:	R_u
Data unit:	Pa.m^3/kmol.K
Description:	Universal ideal gas constant
Source of data used:	Methodological Tool "Tool to determine the mass flow of a greenhouse gas in a gaseous stream" Version 02.0.0
Value applied:	8,314
Justification of the choice of data or description of measurement methods and procedures actually applied :	
Any comment:	

Data / Parameter:	MM_{CH4}
Data unit:	kg/kmol
Description:	Molecular mass of greenhouse gas (CH4)
Source of data used:	Methodological Tool "Tool to determine the mass flow of a greenhouse gas in a gaseous stream" Version 02.0.0
Value applied:	16.04
Justification of the choice of data or description of measurement methods and procedures	

actually applied :	
Any comment:	

Data / Parameter:	P_n
Data unit:	Pa
Description:	Total pressure at normal conditions
Source of data used:	Methodological Tool "Tool to determine the mass flow of a greenhouse gas in a gaseous stream" Version 02.0.0
Value applied:	101,325 Pa
Justification of the choice of data or description of measurement methods and procedures actually applied :	
Any comment:	

Data / Parameter:	T_n
Data unit:	K
Description:	Tempearture at normal conditions
Source of data used:	Methodological Tool "Tool to determine the mass flow of a greenhouse gas in a gaseous stream" Version 02.0.0
Value applied:	273.15 K
Justification of the choice of data or description of measurement methods and procedures actually applied :	
Any comment:	

In addition the following constants - as provided in the "Tool to determine project emissions from flaring gases containing methane" (EB 28, Meeting report Annex 13, page 11/12) - are used in the equations 5-19.

Table 16: Constants and default values used in equations to determine project emissions from flaring gases

Parameter	**Unit**	**Description**	**Value**
MM_{CH4}	kg/kmol	Molecular mass of methane	16.04
MM_{CO}	kg/kmol	Molecular mass of carbon monoxide	28.01

MM_{CO2}	kg/kmol	Molecular mass of carbon dioxide	44.01
MM_{O2}	kg/kmol	Molecular mass of oxygen	32.00
MM_{H2}	kg/kmol	Molecular mass of hydrogen	2.02
MM_{N2}	kg/kmol	Molecular mass of nitrogen	28.02
AM_c	kg/kmol (g/mol)	Atomic mass of carbon	12.00
AM_H	kg/kmol (g/mol)	Atomic mass of hydrogen	1.01
AM_O	kg/kmol (g/mol)	Atomic mass of oxygen	16.00
AM_N	kg/kmol (g/mol)	Atomic mass of nitrogen	14.01
P_n	Pa	Atmospheric pressure at normal conditions	101,325
Ru	Pa m3/kmol K	Universal ideal gas constant	0.008314472
Tn	K	Temperature at normal conditions	273.15
MF_{O2}	Dimensionless	O_2 volumetric fraction of air	0.21
MV_n	m^3/kmol	Volume of one mole of any ideal gas at normal temperature and pressure	22.414
$\rho_{CH4,n}$	kg/m^3	Density of methane gas at normal conditions	0.716

B.6.3 Ex-ante calculation of emission reductions:

The quantity of emission reductions projected to be generated during a given year are represented by the emissions of methane captured and destroyed due to the project activity:

$$ER_y = BE_y - PE_y \quad \textbf{(24)}$$

Where:

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

Baseline emissions from existing waste and electricity generation

Baseline emissions associated with the project activity results from SWDS and electricity generation as described under B.6.1 formula 1 as below:

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

where

BE_y Baseline emissions in year y (t CO_2e)
$BE_{CH4,y}$ Baseline emissions of methane from the SWDS in year *y* (t CO2e/yr)
$BE_{CE,}$ y Baseline emissions associated with electricity generation in year *y* (t CO2/yr)

Baseline emission due to the release of methane from SWDS to the atmosphere ($BE_{CH4,y}$):

Baseline emissions of methane from the SWDS are determined as formula 12 and 13, estimated result is as below:

Table 17: Ex-ante calculation of emission reductions from waste management:

Years	Disposed MSW [t/a]	Methane generation potential $BE_{CH4,SWDS,y}$ [CO_2e]	Estimation of avoided GHG during the crediting period $F_{CH4,PJ,y}$ [t CO_2e]
2012	387,229	77,201	38,600
2013	398,845	96,399	48,199
2014	410,811	99,156	49,578
2015	0	101,594	50,797
2016	0	96,314	48,157
2017	0	91,318	45,659
2018	0	86,590	43,295
2019	0	82,116	41,058
2020	0	77,882	38,941
2021	0	73,874	36,937
Total	**1,196,885**	**882,444**	**441,222**

Baseline emission due to the electricity replacement ($BE_{EC,y}$):

Baseline emission due to the electricity replacement is calculated as formula 16

Table 18 Emission reductions from electricity production

Year	Electricity Generation of the Plant (MWh)	Estimation of baseline emissions (tonnes of CO2e)

2012	13,850	7,359
2013	25,886	13,754
2014	25,886	13,754
2015	25,886	13,754
2016	25,886	13,754
2017	25,886	13,754
2018	25,886	13,754
2019	25,886	13,754
2020	25,886	13,754
2021	25,886	13,754
Total (tonnes of CO2e)	**246,824**	**131,145**

Project Emissions

It is expected that project has emissions due to electricity consumption and fossil fuel consumption in the emergency gensetas it is explained in the formulas 22, 21 and 22.

However, at the stage of PDD design and for simplicity of calculation of emission reduction, project emissions are assumed to be zero. During ex-post calculation project emission will be considered.

PEy=0

Table 19 Ex-ante calculation of emission reductions from waste management:

Years	Disposed MSW [t/a]	Methane generation potential $BE_{CH4,SWDS,y}$ [CO_2e]	Estimation of avoided GHG during the crediting period $F_{CH4,PJ,y}$ [t CO_2e]	Project emissions from flaring PEy [t CO2e]	Emission reductions from electricity generation	Emission reductions ER [t CO2e]
2012	387,229	77,201	38,600	0	7,359	45,959
2013	398,845	96,399	48,199	0	13,123	61,323
2014	410,811	99,156	49,578	0	13,123	62,701
2015	0	101,594	50,797	0	13,123	63,920
2016	0	96,314	48,157	0	13,123	61,280

2017	0	91,318	45,659	0	13,123	58,782
2018	0	86,590	43,295	0	13,123	56,419
2019	0	82,116	41,058	0	13,123	54,182
2020	0	77,882	38,941	0	13,123	52,064
2021	0	73,874	36,937	0	13,123	50,060
Total	**1,196,885**	**882,444**	**441,222**	**0**	**125,469**	**566,691**
Ave p.a.	**119,689**	**88,244**	**44,122**	**0**	**12,547**	**56,669**

* Efficiency of degassing system is considered as 50 per cent.

For detailed information see the document Molu_Calculation_Tool.xls.

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

Years	Estimation of avoided GHG during the crediting period $F_{CH4,PJ,y}$ [t CO_2e]	Project emissions from flaring PEy [t CO2e]	Emission reductions from electricity generation	Emission reductions ER [t CO2e]
2012	38,600	0	7,359	45,959
2013	48,199	0	13,123	61,323
2014	49,578	0	13,123	62,701
2015	50,797	0	13,123	63,920
2016	48,157	0	13,123	61,280
2017	45,659	0	13,123	58,782
2018	43,295	0	13,123	56,419
2019	41,058	0	13,123	54,182
2020	38,941	0	13,123	52,064
2021	36,937	0	13,123	50,060
Total	**441,222**	**0**	**125,469**	**566,691**
Ave p.a.	**44,122**	**0**	**12,547**	**56,669**

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

B.7.1 Data and parameters monitored:

Data / Parameter:	Management of SWDS
Data unit:	-

Description:	Management of SWDS
Source of data:	Use different sources of data: • Original design of the landfill; • Technical specifications for the management of the SWDS; • Local or national regulations
Measurement procedures (if any):	Project participants should refer to the original design of the landfill to ensure that any practice to increase methane generation have been occurring prior to the implementation of the project activity. Any change in the management of the SWDS after the implementation of the project activity should be justified by referring to technical or regulatory specifications
Monitoring frequency:	Annually
QA/QC procedures:	
Any comment:	

Data / Parameter:	**$F_{CH4,sent\ flare,y}$ (= LFG flare)**
Data unit:	t_{CH4} /y
Description:	Amount of methane in LFG which is sent to the flare in year y
Source of data:	Calculated based on the flow of LFG and the concentration of methane in the LFG that will be sent to the flare(s)
Measurement procedures (if any):	Measured by a flow meter and a gas analyzer. Data to be aggregated monthly and yearly
Monitoring frequency:	Continously
QA/QC procedures:	Flow meter will be subject to regular (in accordance to the manufacturer) maintenance and testing to ensure accuracy.
Any comment:	-

Data / Parameter:	**$F_{CH4,EL,y}$ ($LFG_{electricity,y}$)**
Data unit:	t_{CH4} /year
Description:	Amount of methane in LFG which is sent to the genset for electricity generation in year y
Source of data:	Calculated based on the flow of LFG and the concentration of methane in the LFG that will be sent to the genset
Measurement procedures (if any):	Measured by a flow meter and a gas analyzer. Data to be aggregated monthly and yearly
Monitoring frequency:	Continously
QA/QC procedures:	Flow meter will be subject to regular (in accordance to the manufacturer) maintenance and testing to ensure accuracy.
Any comment:	Amount of methane in LFG which is sent to the flare in year y

Data / Parameter:	**$V_{t,db}$**

Data unit:	m^3 dry gas/h
Description:	Volumetric flow of the gaseous stream in the hour *h* on a dry basis
Source of data:	Continuous measurement by flow meter by Her Enerji
Measurement procedures (if any):	Measured by a flow meter. Data will be aggregated monthly and yearly. Volumetric flow measurement should always refer to the actual pressure and temperature.
Monitoring frequency:	Continuous. The measurement interval will be equal to or more than one sampling each hour. (average value in a time interval not greater than an hour will be used in the calculations of emission reductions) Measured by a flow meter, which is a turbine system, with a special internal shell for biogas, completed with a volume checker and a fiscal converter of frequency. Meter will provide a minimum accuracy of +/- 1% by volume.
QA/QC procedures:	Periodic calibration against a primary device provided by an independent accredited laboratory is mandatory. Calibration and frequency of calibration is according to manufacturerís specifications
Any comment:	Temperature and pressure will be automatically measured and LFG volumes will be expressed in normalised cubic meters.

Data / Parameter:	$V_{CH4, t,db}$
Data unit:	m^3 CH4/ m^3 dry gas
Description:	Volumetric flow of CH4 in time interval on a dry basis
Source of data:	Continuous measurement by flow meter by Her Enerji
Measurement procedures (if any):	Continuous gas analyser operating in dry-basis. Volumetric flow measurement refers to the actual pressure and temperature. Data will be aggregated monthly and yearly.
Monitoring frequency:	Continuous. The measurement interval will be equal to or more than one sampling each hour (average value in a time interval not greater than an hour will be used in the calculations of emission reductions) Measured by a flow meter, which is a turbine system, with a special internal shell for biogas, completed with a volume checker and a fiscal converter of frequency. Meter will provide a minimum accuracy of +/- 1% by volume.
QA/QC procedures:	Periodic calibration against a primary device provided by an independent accredited laboratory is mandatory. Calibration and frequency of calibration is according to manufacturerís specifications
Any comment:	Temperature and pressure will be automatically measured and LFG volumes will be expressed in normalised cubic meters.

Data / Parameter:	T_t
Data unit:	K
Description:	Temperature of the landfill gas
Source of data:	Thermometer
Measurement procedures (if any):	Continuous in dry-basis.
Monitoring frequency:	Continuous. The measurement interval will be equal to or more than one sampling each hour (average value in a time interval not greater than an hour will be used in the calculations of emission reductions) All the data will be aggregated hourly, daily, monthly and yearly.
QA/QC procedures:	The device is subject to regular maintenance and testing regime to ensure accuracy. They will be periodically calibrated according to the manufacturer's recommendation by project participants.
Any comment:	

Data / Parameter:	**Pt**
Data unit:	Pa or mbar
Description:	Pressure of the gaseous stream in the hour *h*
Source of data:	Manometer
Measurement procedures (if any):	Continuous on dry-basis. Instruments with recordable electronic signal (analogical or digital) are required. Examples include pressure transducers, etc
Monitoring frequency:	Continuous.
QA/QC procedures:	The device is subject to regular maintenance and testing regime to ensure accuracy. They will be periodically calibrated according to the manufacturer's recommendation by project participants.
Any comment:	

Data / Parameter:	$TDL_{k,y}$
Data unit:	
Description:	Average technical transmission and distribution losses for providing electricty to source k in year y
Source of data:	Default value per "Tool to calculate baseline, project and or leakage emission from electricity consumption" version 01. In case of scenario A, • Use recent, accurate and reliable data available within the host country;
Measurement procedures (if any):	Na.
Monitoring frequency:	Annually

QA/QC procedures:	
Any comment:	

Data / Parameter:	**$PE_{flare,y}$**
Data unit:	t CO_2e
Description:	Project emissions from flaring of the residual gas stream in year y
Source of data:	Calculated as per the "Tool to determine project emissions from flaring gases containing methane" (EB 28, Report Annex 13)
Measurement procedures (if any):	0. Project emissions from flaring of the biogas are estimated to be zero, as a high efficiency flare is used and no significant methane contents in the exhaust gas of the flare are expected.
Monitoring frequency:	Calculated as per the "Tool to determine project emissions from flaring gases containing methane" (EB 28, Report Annex 13)
QA/QC procedures:	-
Any comment:	-

Data / Parameter:	**$FC_{i,j,y}$**
Data unit:	t/year
Description:	Quantity of diesel combusted for auxiliary purposes
Source of data:	Measurements by Her Enerji.
Measurement procedures (if any):	
Monitoring frequency:	Fuel consumption is calculated using a mass balance approach based on the quantity of fuel purchased and the difference in the quantity held in stock.
QA/QC procedures:	Cross-check with operation hours of the emergency genset.
Any comment:	Fuel usage for auxiliary combustion, only. Related project emissions are expected to remain below 0,1% of total emission reduction.

Data / Parameter:	**w_{CH4}**
Data unit:	m^3CH4/m^3LFG
Description:	Methane fraction in the landfill gas
Source of data:	Gas quality analyser
Measurement procedures (if any):	The gas analysing system is a modular construction and designed for stationary operation for measuring directly the fraction of methane in the landfill gas. The gas analyser provides three analogue signals, CH_4, CO_2 and O_2. The values are measured continuously. The proportion of the data to be monitored is 100%.

Monitoring frequency:	Continuously.
QA/QC procedures:	The gas analyser will be subject to a regular maintenance and testing regime to ensure accuracy. The gas analyser will be calibrated according to manufacturer's specifications.
Any comment:	Methane fraction of the landfill gas and LFG flow has to be measured on the same basis (either wet or dry).

Data / Parameter:	T_{flare} / $T_{EG,m}$
Data unit:	°C
Description:	Temperature in the exhaust gas of the enclosed flare in minute m
Source of data:	Project Participants by Thermocouple
Measurement procedures (if any):	Measure the temperature of the exhaust gas in the flare by an appropriate temperature measurement equipment. Measurements outside the operational temperature specified by the manufacturer may indicate that the flare is not functioning correctly and may require maintenance. Flare manufacturers must provide suitable monitoring ports for the monitoring of the temperature of the flare. These would normally be expected to be in the middle third of the flare.Where more than one temperature port is fitted to the flare, the flare manufacturer must provide written instructions detailing the conditions under which each location shall be used and the port most suitable for monitoring the operation of the flare according to manufacturers specifications for temperatur
Monitoring frequency:	Once per minute
QA/QC procedures:	Thermocouples should be replaced and periodically calibrated according to the manufacturer's recommendation
Any comment:	Unexpected changes such as a sudden increase/drop in temperature can occur for different reasons. These events should be noted in the site records along with any corrective action that was implemented to correct the issue. Monitoring of this parameter is applicable in case of enclosed flares.

Data / Parameter:	Opj,h
Data unit:	-
Description:	Operation of the equipment that consumes the LFG
Source of data:	Recording by Her Enerji.
Measurement procedures (if any):	For each equipment unit j using the LFG monitor that the plant is operating in hour h by the monitoring any one or more of the following three parameters: · Temperature. Determine the location for temperature measurements and minimum operational temperature based on manufacturer´s specifications of the burning equipment. Document and justify the location and minimum threshold in

	the PDD; · Flame. Flame detection system is used to ensure that the equipment is in operation; · Products generated. Monitor the generation of steam for the case of boilers and air-heaters and glass for the case of glass melting furnaces. This option is not applicable to brick kilns. Opj,h = 0 when: · One of more temperature measurements are missing or below the minimum threshold in hour h (instantaneous measurements are made at least every minute); · Flame is not detected continuously in hour h (instantaneous measurements are made at least every minute); · No products are generated in the hour h Otherwise Opj,h = 1
Monitoring frequency:	hourly
QA/QC procedures:	
Any comment:	This is monitored to ensure methane destruction is claimed for methane used in electricity plant when its operational.

Data / Parameter:	**$EC_{BL,y}$**
Data unit:	MWh
Description:	Net electricity delivered to the grid
Source of data:	The data from the Electricity Meters are the basis for the settlement notification of PMUM. Data are gathered electronically from the meters by TEIAS and stored in secured website of PMUM, which is accessible to project developer with a private password. For monitoring, the monthly settlement notification of PMUM shall be used as source of data.
Measurement procedures (if any):	• Regarding the electricity meters: two meters will be placed (one main and one reserve). at the TEIAS substation. These meters are sealed by TEIAS and intervention by project proponent is not possible. The fact that two meters are installed in a redundant manner keeps the uncertainty level of the only parameter for baseline calculation low. High data quality of this parameter is not only in the interest of the emission reduction monitoring, but paramount for the business relation between the plant operator and the electricity buyer. • Measured hourly and readings monthly: Monthly settlement notifications of PMUM consist hourly electricity production and withdrawn from the grid • Since the meters are reading electricity supplied to the system and withdrawn from the system separately, the net electricity amount supplied to the grid will be calculated by electricity supplied minus electricity withdrawn which will be taken from monthly settlement notifications. Thus with this procedure is monitored sufficient and no extra Monitoring has to be implemented.

	The above described measurement method follows Article 81 of the official regulation "Electricity Market Balancing And Settlement Regulation"[26]
Monitoring frequency:	Continously
QA/QC procedures to be applied:	According to the Article 2 of the 'Communiqué Regarding the Meters to be used in the Electricity Market '[27] (Communiqué): '*The meters to be used in the electricity market shall be compliant with the standards of Turkish Standards Institute or IEC and have obtained* ***"Type and System Approval" certificate from the Ministry of Trade and Industry.*'** Therefore, Ministry of Science, Industry and Technology (Ministry) is responsible from control and calibration of the meters. Paragraph b) of the Article 9 of the 'Regulation of Metering and Testing of Metering Systems'[28] (Regulation) of Ministry states that: ' *b) Periodic tests of meters of electricity, water, coal gas, natural gas and current and voltage transformers are done* ***every 10 years****.'* Therefore periodic calibration of the meters will be done every 10 years. Also according to Article 67 (page 20) of this regulation, the calibration shall be done in calibration stations which have been tested and approved by Ministry of Trade and Industry. Article 10-d) of Communiqué requires the meters shall be three phase four wire and Article 64 of Regulation clearly states how calibration shall be performed for this kind of meters. According to Article 3 of System Usage Agreement[29] done by Her Enerji and TEIAS; other than periodic tests, if a party alleges the meters are not working appropriately tests of the meters will be done by presence of both parties. If, after controls, it is seen that the meter is not working appropriately, the measurements of reserve meters are taken into account beginning from date both meters are reading the same (page 3, 2-c) As above mentioned, the data acquisition and management and quality assurance procedures that are anyway in place, no additional procedures have to be established for the monitoring plan.
Any comment:	
Data / Parameter:	**$EC_{PJ,y}$**
Data unit:	MWh
Description:	Quantity of electricity consumed by the project activity during the year y
Source of data:	Onsite measurement
Measurement procedures (if any):	By authorized electricity meters
Monitoring frequency:	Continously, aggregated manually via on site meter checking
QA/QC procedures to be applied:	According to the Article 2 of the 'Communiqué Regarding the Meters to be used in the Electricity Market '[30] (Communiqué): '*The meters to be used in the electricity market shall be compliant with the standards of Turkish Standards*

[26] See, http://www.epdk.org.tr/mevzuat/yonetmelik/elektrik/dengeleme/yeni/degisiklik06112010.docpage13
[27] See, http://www.epdk.org.tr/english/regulations/electric/meters.doc, (page 6)
[28] See, http://www.sanayi.gov.tr/download/osgm/olcu_aletleri_muayene_yonetmelik.zip (page 2)
[29] See, http://www.teias.gov.tr/sistemkullanim1.doc , (page 3, 2-b)
[30] See, http://www.epdk.org.tr/english/regulations/electric/meters.doc, (page 6)

	Institute or IEC and have obtained ***"Type and System Approval" certificate from the Ministry of Trade and Industry.'*** Therefore, Ministry of Science, Industry and Technology (Ministry) is responsible from control and calibration of the meters. Paragraph b) of the Article 9 of the 'Regulation of Metering and Testing of Metering Systems'[31] (Regulation) of Ministry states that: ' *b) Periodic tests of meters of electricity, water, coal gas, natural gas and current and voltage transformers are done* ***every 10 years****.'* Therefore periodic calibration of the meters will be done every 10 years. Also according to Article 67 (page 20) of this regulation, the calibration shall be done in calibration stations which have been tested and approved by Ministry of Trade and Industry. Article 10-d) of Communiqué requires the meters shall be three phase four wire and Article 64 of Regulation clearly states how calibration shall be performed for this kind of meters. According to Article 3 of System Usage Agreement[32] done by Her Enerji and TEIAS; other than periodic tests, if a party alleges the meters are not working appropriately tests of the meters will be done by presence of both parties. If, after controls, it is seen that the meter is not working appropriately, the measurements of reserve meters are taken into account beginning from date both meters are reading the same (page 3, 2-c) As above mentioned, the data acquisition and management and quality assurance procedures that are anyway in place, no additional procedures have to be established for the monitoring plan.
Any comment:	

Data / Parameter:	NCV i,y
Data unit:	GJ/t
Description:	Net calorific value of diesel combusted for auxiliary purposes
Source of data:	IPPC default value at the upper limit of the uncertainty at a 95 % confidence interval as provided in Table 1.2. of chapter 1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines.
Measurement procedures (if any):	43.3 GJ/t (IPCC)
Monitoring frequency:	In case of applying IPCC values any future revision of the IPPC guidelines will be taken into account..
Any comment:	Fuel usage for auxiliary combustion, only. Related project emissions are expected to remain below 0,1% of total emission reduction.

[31] See, http://www.sanayi.gov.tr/download/osgm/olcu_aletleri_muayene_yonetmelik.zip (page 2)
[32] See, http://www.teias.gov.tr/sistemkullanim1.doc , (page 3, 2-b)

Data / Parameter:	**$EF_{CO2,i,y}$**
Data unit:	t CO_2/GJ
Description:	CO_2 emission factor of diesel in year y
Source of data:	IPPC default value at the upper limit of the uncertainty at a 95 % confidence interval as provided in Table 1.4. of chapter 1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines.
Measurement procedures (if any):	0.0748 t/GJ (IPCC)
Monitoring frequency:	In case of applying IPCC values any future revision of the guidelines will be taken into account.
Any comment:	In case data will be available from fuel supplier the NCV will be obtained for each fuel delivery. Fuel usage for auxiliary combustion, only. Related project emissions are expected to remain below 0,1% of total emission reduction.

B.7.2 Description of the monitoring plan:

The monitoring methodology is based on direct measurement of the amount of landfill gas captured and destroyed at the flare platform(s) and the electricity generating unit(s) to determine the quantities as shown in Figure 3. The monitoring plan provides for continuous measurement of the quantity and quality of LFG flared. The main variables that need to be determined are the quantity of Volumetric flow of the gaseous stream in the hour *h* on a dry basis (**$V_{t,db}$**) *and* the quantity of methane used to generate electricity ($LFG_{electricity,y}$). The methodology also measures the energy generated by use of LFG ($EC_{BL,y}$,).

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

Table 20: Summary of Monitoring Plan

Number	Parameter	Description
1	$V_{t,db}$	Volumetric flow of the gaseous stream in the hour *h* on a dry basis
2	$F_{CH4,sent flare,y}$	Amount of methane in LFG which is sent to the flare in year y
3	$F_{CH4,EL,y}$	Amount of methane in LFG which is sent to the genset for electricity generation in year y
4	$V_{CH4, t,db}$	Volumetric flow of CH4 in time interval on a dry basis
5	T	Temperature of the landfill gas
6	P	Pressure of the gaseous stream in the hour *h*
7	w_{CH4}	Methane fraction in the landfill gas
8	$EC_{BL,y}$	Net electricity delivered to the grid

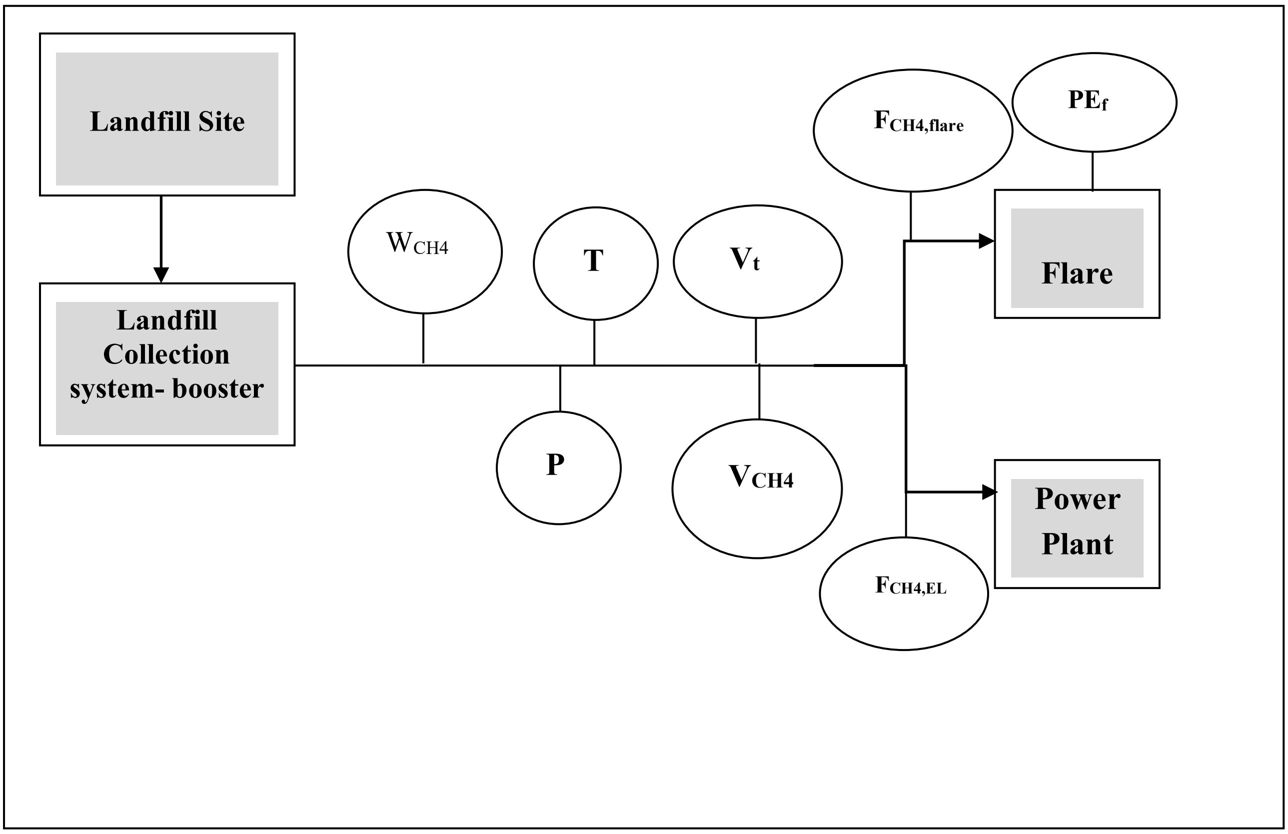


Figure 2 Monitoring Plan

Responsibilities for the data processing and management lie with Her Enerji. Therefore, it will team up a VER team. This team will be responsible for monitoring all data required to estimate emission reductions.FutureCamp Turkey will also assist VER Team with regards to the monitoring aspects of the project. Plant manager will have main responsibility to collect and archive the data. The data will be monitored and recorded by qualified technicians according to the monitoring plan. All the technicians will receive proper training to ensure that they understand their specific tasks and handling of equipment. The records will be double checked by the General Manager of the Proposed Project who will be responsible for accuracy and frequency of the measurements.

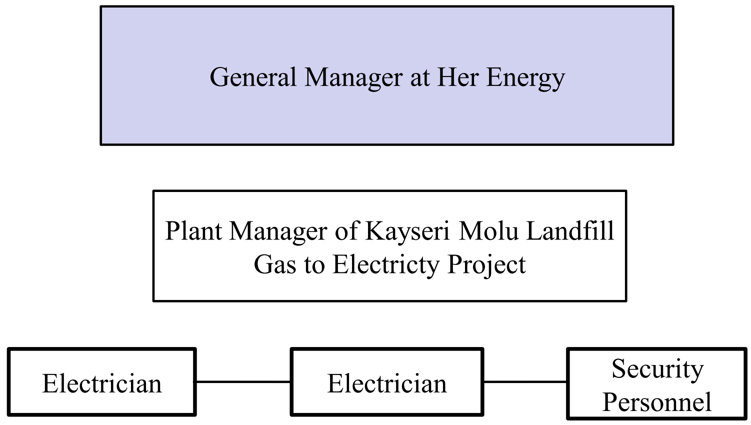


Figure 4 Organizational chart

Data collection

The projected plant is to be operated by an automatically electrical control system measuring actual LFG flow and its composition to avoid the interference of ambient air into the extraction wells and thereby optimize the gas extraction.

1) Flow measurements

Flow of landfill gas (collected by the system and subsequently combusted) is measured by flow measuring device suitable for measuring the velocity and volumetric flow of a gas. The flow measurements are taken within the piping itself, and the flow sensors are connected to a transmitter that is capable of collecting and sending continuous data to a recording device such as a data logger.

Calibration: The flow sensors are calibrated according to specified temperature, pressure and composition of the gas as per the manufacturer’s recommendation. The equipment selected will allow dynamic compensation for these parameters, normalized to standard temperature, pressure, and gas composition. There will be a periodic verification according to the requirement of equipment specifications.

2) Gas Quality and efficiency of the flare

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

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

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

Calibration: Analysers are periodically calibrated according to the manufacturer's and regulation on "Metering and Testing of Metering Systems'[33] of Ministry of Science, Industry and Technology recommendation. Calibration equipment will provide an accuracy of +/- 1% by volume.

3) Auxiliary fossil fuel consumption

Auxiliary fossil fuel consumption in the emergency genset will be recorded daily manually by the operators in cases the emergency genset is running (emergency genset log book). Data will be included in the electronic database. It is anticipated that the related project emissions are expected to remain below 0,1% of total emission reduction.

Data records and storage

The most important parameters (Gas quantities, methane/Oxygen concentrations, Temperatures) will be monitored on-line and all data will be stored in the monitoring station on the landfill site.

All process parameters will be stored in the data-logger of the degassing installation. Once a day the data will be transferred to the monitoring station on the landfill site. The monitoring station is a PC containing a

- modem for connection with the data-logger of the degassing installation,
- visualization system of the process for operating purposes,
- database to archive the received process data,
- system to provide alarm signals to the operators.

Electronically backup of the data will be conducted on a daily basis. A hard copy backup of all relevant data will be printed out monthly. Calibration records for all instrumentation will be constantly collected and archived. All data and records required for verification will be kept for two years after the end of the project crediting period or the last issuance of VERs, whichever is later.

Data assessment and reporting

Her Enerji will, if technically possible, execute remote monitoring of the installation. All relevant data will be analysed on a daily basis and registered, in both versions - electronical and paper. Based on the recorded data in the electronic database, emission reduction calculations will be carried out monthly by the monitoring

[33] See, http://www.sanayi.gov.tr/download/osgm/olcu_aletleri_muayene_yonetmelik.zip (page 2)

manager. The annual monitoring report will contain the data required for the validation of the emission reductions and additionally may contain operational data from the collection system and flaring/gas engine system to illustrate that the system is well maintained and operating at peak efficiency. Records of regular maintenance performed will also be a component of the annual report.

Maintenance

Regular maintenance consists of the control of subsiding/distortion of the gas wells and the pipeline system. Local companies are in charge of those activities. In addition experts provided by the equipment supplier shall execute regularly the maintenance works at their equipments as foreseen in the maintenance plan.

Training

Training will be performed at commissioning stage by instruction and an accompanying guidebook, in order to ensure that the personnel on site perform their designated tasks at high standards.

The technology supplier will deliver a guidebook in English which is to be translated into Russian and Romanian. It will provide a short training of the local technical personnel for maintenance and calibration works. Chosen trainees shall have a good understanding the processes and technology of the installation of landfill gas extraction.

The guidebook will include an information about the following aspects:

- operation manual of the gas extraction system, flares and gas engines
- technical drawings of the installation
- maintenance instructions
- description of parts of the equipment
- telephone of a person who will be available in case of technical failures (a help desk shall be available for 24 hours per day in case of technical failures.)

Using the telephone helpdesk of supplier, the trained operators can however always inquire any technical support.

Monitoring personnel will be trained internally or externally at regular intervals during the crediting period. This will include training for landfill gas collection system balancing, monitoring equipment and calibration as well as impact of the monitoring on the CDM activity.

Detailed standard operation procedures will be developed and detailed after commissioning in October.

Emergency cases

VERs will not be claimed for periods in which the requirements of the monitoring methodology are not complied. Any failure of relevant equipment and monitoring equipment will be recorded including the time where respective equipment was out of order.In case of failure at the degassing installation the following procedures should be performed:

No electrical power

If no electrical power is available, the blower of the degassing installation cannot operate, therefore no LFG stream is available and flow-meter cannot detect anything. In such situations no emission reductions are accounted for.

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

Name of entity determining the baseline:
Dr. Farız Taşdan
FutureCamp İklim ve Enerji Ltd. Şti (FutureCamp Turkey - project consultant)
Tel : +90 312 481 21 42
Fax : +90 312 480 88 10
e-mail : info@futurecamp.com.tr
Contributor: Her Enerji Üretim Sanayi ve Ticaret A.Ş.

FutureCamp Turkey is not a project participant.

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:

Starting date of the project activity is29/04/2011, which is the date of electromechanical contract signature.

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

According to the Methodological tool to determine the remaining lifetime of equipment v.1, the equipment lifetime is 150,000/8,000= 18.75 years. However, the Project is designed for an operation lifetime of 10 years, according to the contract with the Kayseri Municipality, which is from 01/01/2012 to 31.12.2021. Becasue of that, in the IRR calculation a fair value is considered at the end of contract date.

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

C.2.1. Renewable crediting period

N.A

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

N.A

C.2.1.2. Length of the first crediting period:

N.A

C.2.2. Fixed crediting period:

A single 10-year crediting period is chosen.

C.2.2.1. Starting date:

The crediting period starts on 01/01/2012.

C.2.2.2. Length:

10 years

SECTION D. Environmental impacts

D.1. If required by the host Party, documentation on the analysis of the environmental impacts of the project activity:

Detailed information regarding the environmental impacts is provided in the Gold Standard Passport, which is also available to DOE.

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:

There have not been identified any significant environmental impacts of the project.

SECTION E. Stakeholders' comments

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

A stakeholder consultation meeting has not been carried out for the proposed retroactive project.

E.2. Summary of the comments received:

A stakeholder consultation meeting has not been carried out for the proposed retroactive project.

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

A stakeholder consultation meeting has not been carried out for the proposed retroactive project.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Organization:	Her Enerji Üretim Sanayi ve Ticaret A.Ş. (Her Enerji)
Street/P.O.Box:	Kayseri Asfaltı 8.km.
Building:	
City:	Koca Sinan / Kayseri
State/Region:	
Postfix/ZIP:	
Country:	TURKEY
Telephone:	+90 (276) 266 79 79
FAX:	
E-Mail:	info@sesli.com.tr
URL:	http://www.sesli.com.tr/tr_index.aspx
Represented by:	Hakkı Azizlerlioğlu
Title:	Project Manager
Salutation:	Mr.
Last Name:	Azizlerlioğlu
Middle Name:	
First Name:	Hakkı
Department:	
Mobile:	
Direct FAX:	
Direct tel:	
Personal E-Mail:	hakkia@sesli.com.tr

Annex 2

INFORMATION REGARDING PUBLIC FUNDING

- - - - -

Annex 3

BASELINE INFORMATION FOR LANDFILL SITE

Waste types

The Molu landfill site has started its operation in 1997. Currently approx. 1000 tonnes of waste is received by the site.

Composition of waste at Molu landfill site:

Paper and carton	3%
Kitchen waste	40%
Garden waste/ fruits	10%
Textiles	8%
Wood	3 %
Total organic	64%
Glass/metal	6%
Plastics	15%
Non-recyclable construction waste (stones, mortar)	3%
Ash/minerals	4%
Fine fractions	2%
Bones/ rubber	4%
Bulky waste	2%
Total inorganic	36 %
Total	100 %

Annex 4

BASELINE INFORMATION FOR ELECTRICITY PRODUCTION

Calculation of Total CO_2 from OM Power Plants:

Table 21: $HV_{i,y}$ (Heating Values for Fossil Fuels for Electricity Generation (TCal)

Energy Sources	2008	2009	2010
Hard Coal+Imported Coal	33,310	35,130	39,546
Lignite	108,227	97,652	96,551
Fuel Oil	20,607	15,160	8,569
Diesel Oil	1,328	1,830	209
LPG	0	1	0
Naphta	113	84	105
Natural Gas	189,057	186,266	194,487

Table 22 $FC_{i,y}$ (Fuel Consumptions for Fossil Fuels for Electricity Generation (million m^3 for Natural Gas and ton for others)

Energy Sources	2008	2009	2010
Hard Coal+Imported Coal	6,270,008	6,621,177	7,419,703
Lignite	66,374,120	63,620,518	56,689,392
Fuel Oil	2,173,371	1,594,321	891,782
Diesel Oil	131,206	180,857	20,354
LPG	0	111	0
Naphta	10,606	8,077	13,140
Natural Gas	21,607,635	20,978,040	925,276

1	**Tcal**	**=**	**4.1868**	**TJ**

Table 23: $NCV_{i,y}$ (Average Net Calorific Values for Fossil Fuels for Electricity Generation (TJ/million m^3 for Natural Gas and TJ/kton for others) and EF_i (Emission Factor of Fossil Fuels)

Energy Sources	NCV_i 2008	NCV_i 2009	NCV_i 2010	EF_i
Hard Coal+Imported Coal	22.24	22.21	22.32	*89.50*
Lignite	6.83	6.43	7.13	*90.90*
Fuel Oil	39.70	39.81	40.23	*72.60*
Diesel Oil	42.38	42.37	42.99	*72.60*
LPG	0.00	37.72	0.00	*61.60*

Naphta	44.61	43.54	33.46	*69.30*
Natural Gas	36.63	37.17	880.04	*54.30*

Table 24: CO_2 Emission by each Fossil Fuels Types ($ktCO_2e$)

Energy Sources	**2008**	**2009**	**2010**
Hard Coal+Imported Coal	12,482	13,164	14,819
Lignite	41,189	37,164	36,745
Fuel Oil	6,264	4,608	2,605
Diesel Oil	404	556	64
Lpg	0	0	0
Naphta	33	24	30
Natural Gas	42,981	42,346	44,215
TOTAL	**103,352**	**97,863**	**98,478**

Identification of Sample Group

Table 25: Sample Group PPs for BM Emission Factor Calculation

Information to clearly identify the Plant (Name of the Plant)	Date of Commissioning	Capacity in MW	Fuel Type	Annual Generation (GWh)
EKOTEN TEKSTİL GR-I	16.02.2006	1,9	N. Gas	14
ERAK GİYİM GR-I	22.02.2006	1,4	N. Gas	10,0
ALARKO ALTEK GR-III	23.02.2006	21,9	Steam	173,0
AYDIN ÖRME GR-I	25.02.2006	7,5	N. Gas	60,0
NUH ENERJİ-2 GR-II	02.03.2006	26,1	Steam	180,1
MARMARA ELEKTRİK (Çorlu) GR-I	13.04.2006	8,7	N. Gas	63,0
MARMARA PAMUK(Çorlu) GR-I	13.04.2006	8,7	N. Gas	63,0
ENTEK (Köseköy) GR-IV	14.04.2006	47,6	N. Gas	378,2
ELSE TEKSTİL (Çorlu) GRI-II	15.04.2006	3,2	N. Gas	25,0
SÖNMEZ ELEKTRİK (Çorlu) GRI-II	03.05.2006	17,5	N. Gas	126,0
MENDERES ELEKTRİK GR-I	10.05.2006	8,0	Geothermal	56,0
KASTAMONU ENTEGRE (Balıkesir) GR-I	24.05.2006	7,5	N. Gas	54,0
BOZ ENERJİ GR-I	09.06.2006	8,7	N. Gas	70,0
ADANA ATIK SU ARITMA TESİSİ	09.06.2006	0,8	Biogas	6,0
AMYLUM NİŞASTA (ADANA)	09.06.2006	14,3	N. Gas	34,0
ŞIKMAKAS (Çorlu) GR-I	22.06.2006	1,6	N. Gas	13,0
ELBİSTAN B GR-III	23.06.2006	360,0	Lignite	2.340,0

ANTALYA ENERJİ GR I-II-III-IV	29.06.2006	34,9	N. Gas	245,0
HAYAT TEM. VE SAĞLIK GR I-II	30.06.2006	15,0	N. Gas	108,0
EKOLOJİK EN. (Kemerburgaz) GR-I	31.07.2006	1,0	Waste Heat	6,0
EROĞLU GİYİM (Çorlu) GR-I	01.08.2006	1,2	N. Gas	9,0
CAM İŞ ELEKTRİK (Mersin) GR-I	13.09.2006	126,1	N. Gas	1.008,0
ELBİSTAN B GR-II	17.09.2006	360,0	Lignite	2.340,0
YILDIZ ENT. AĞAÇ (Kocaeli) GR-I	21.09.2006	6,2	N. Gas	40,0
ÇERKEZKÖY ENERJİ GR-I	06.10.2006	49,2	N. Gas	390,0
ENTEK (Köseköy) GR-V	03.11.2006	37,0	N. Gas	293,9
ELBİSTAN B GR-IV	13.11.2006	360,0	Lignite	2.340,0
ÇIRAĞAN SARAYI GR-I	01.12.2006	1,3	N. Gas	11,0
ERTÜRK ELEKTRİK Tepe RES GR-I	22.12.2006	0,9	Wind	2,0
AKMAYA (Lüleburgaz) GR-I	23.12.2006	6,9	N. Gas	50,0
BURGAZ (Lüleburgaz) GR-I	23.12.2006	6,9	N. Gas	54,0
ŞANLIURFA GR I-II	01.03.2006	51,8	Hydro (Run of River)	124,0
BEREKET ENERJİ GÖKYAR HES 3 Grup	05.05.2006	11,6	Hydro (Run of River)	43,3
MOLU EN. Zamantı Bahçelik GR I-II	31.05.2006	4,2	Hydro (Run of River)	16,7
SU ENERJİ (Balıkesir) GR I-II	27.06.2006	4,6	Hydro (Run of River)	20,7
BEREKET EN. (Mentaş Reg) GR I-II	31.07.2006	26,6	Hydro (Run of River)	108,7
EKİN (Başaran Hes) (Nazilli)	11.08.2006	0,6	Hydro (Run of River)	4,5
ERE (Sugözü rg. Kızıldüz hes) GR I-II	08.09.2006	15,4	Hydro (Run of River)	31,6
ERE (AKSU REG. Ve ŞAHMALLAR HES) GR I-II	16.11.2006	14,0	Hydro (Run of River)	26,7
TEKTUĞ (Kalealtı) GR I-II	30.11.2006	15,0	Hydro (Run of River)	52,0
BEREKET EN. (Mentaş Reg) GR III	13.12.2006	13,3	Hydro (Run of River)	54,4
HABAŞ (ALİAĞA-ADDITION)	02.05.2007	9,1	N. Gas	35,3
MODERN ENERJİ	2007	5,2	N. Gas	38,0
Acıbadem Sağlık Hiz.ve Tic.A.Ş(Kadıköy Hast.)(İstanbul/Kadıköy)	19.06.2007	0,5	N. Gas	4,0
Acıbadem Sağlık Hiz.ve Tic.A.Ş(Kozyatağı Hast.)(İstanbul/Kadıköy)	23.10.2007	0,6	N. Gas	5,0
Acıbadem Sağlık Hiz.ve Tic.A.Ş(Nilüfer/BURSA)	28.08.2007	1,3	N. Gas	11,0
AKATEKS Tekstil Sanayi ve Ticaret A.Ş.	30.07.2007	1,8	N. Gas	14,0
FLOKSER TEKSTİL	03.12.2007	2,1	N. Gas	17,0

SAN.AŞ.(Çatalça/istanbul)(SüetserTesisi)				
FLOKSER TEKSTİL SAN.AŞ.(Çatalça/istanbul)(Poliser Tesisi)	03.12.2007	2,1	N. Gas	17,0
FRİTOLAY GIDA SAN.VE TİC. AŞ.	23.01.2007	0,5	N. Gas	4,0
KIVANÇ TEKSTİL SAN.ve TİC.A.Ş.	20.03.2007	3,9	N. Gas	33,0
KİL-SAN KİL SAN.VE TİC. A.Ş	19.02.2007	3,2	N. Gas	25,0
SÜPERBOY BOYA SAN.ve Tic.Ltd.Şti.(Büyükçekmece/İstanbul)	05.12.2007	1,0	N. Gas	8,0
SWİSS OTEL(Anadolu Japan Turizm A.Ş (İstanbul)	01.08.2007	1,6	N. Gas	11,0
TAV Esenboğa Yatırım Yapım ve İşetme AŞ./ANKARA	19.09.2007	3,9	N. Gas	33,0
KARTONSAN	2007	5,0	Liqued Fuel + N.Gas	40,0
ESKİŞEHİR END.ENERJİ	2007	3,5	Liqued Fuel + N.Gas	26,8
İGSAŞ	2007	2,2	Liqued Fuel + N.Gas	15,2
BİS Enerji Üretim AŞ.(Bursa)(Addition)	30.05.2007	43,0	N. Gas	354,8
Aliağa Çakmaktepe Enerji A.Ş.(Aliağa/İZMİR)	13.09.2007	34,8	N. Gas	278,0
BİS Enerji Üretim AŞ.(Bursa)(Addition)	30.08.2007	48,0	N. Gas	396,1
BOSEN ENERJİ ELEKTRİK AŞ.	18.01.2007	142,8	N. Gas	1.071,0
SAYENERJİ ELEKTRİK ÜRETİM AŞ. (Kayseri/OSB)	03.07.2007	5,9	N. Gas	47,0
T ENERJİ ÜRETİM AŞ.(İSTANBUL)	04.04.2007	1,6	N. Gas	13,0
ZORLU EN.Kayseri (1 GT Addition)	17.01.2007	7,2	N. Gas	55,0
SİİRT	2007	25,6	Fuel Oil	190,0
Mardin Kızıltepe	2007	34,1	Fuel Oil	250,0
KAREN	2007	24,3	Fuel Oil	180,0
İDİL 2 (PS3 A- 2)	2007	24,4	Fuel Oil	180,0
BORÇKA HES	27.02.2007	300,6	Hydro (With Dam)	1.039,0
TEKTUĞ(Keban River)	08.05.2007	5,0	Hydro (run of river)	32,0
YPM Ener.Yat.AŞ.(Altıntepe Hydro)(Sivas/Suşehir)	06.06.2007	4,0	Hydro (run of river)	18,0
YPM Ener.Yat.AŞ.(Beypınar Hydro)(Sivas/Suşehir)	06.06.2007	3,6	Hydro (run of river)	18,0
YPM Ener.Yat.AŞ.(Konak Hydro)(Sivas/Suşehir)	19.07.2007	4,0	Hydro (run of river)	19,0
KURTEKS Tekstil A.Ş./Kahramanmaraş(KARASU HES-Andırın)	28.11.2007	2,4	Hydro (run of river)	19,0
İSKUR TEKSTİL (SÜLEYMANLI HES)	30.12.2007	4,6	Hydro (run of river)	18,0
ÖZGÜR ELK.AŞ.(K.MARAŞ)(Tahta)	03.05.2007	6,3	Hydro (run of river)	27,0

ÖZGÜR ELK.AŞ.(K.MARAŞ)(Tahta)(Addition)	24.05.2007	6,3	Hydro (run of river)	27,0
AKKÖY ENERJİ (AKKÖY I HES)	2008	101,9	Hydro (with Dam)	408,0
ALP ELEKTRİK (TINAZTEPE) ANTALYA	2008	7,7	Hydro (run of river)	29,0
CANSU ELEKTRİK (MURGUL/ARTVİN)	2008	9,2	Hydro (run of river)	47,0
DAREN HES ELKT. (SEYRANTEPE BARAJI VE HES)	2008	49,7	Hydro (With Dam)	182,0
DEĞİRMENÜSTÜ EN. (KAHRAMANMARAŞ)	2008	25,7	Hydro (With Dam)	69,0
GÖZEDE HES (TEMSA ELEKTRİK) BURSA	2008	2,4	Hydro (run of river)	10,0
H.G.M ENERJİ (KEKLİCEK HES) (Yeşilyurt)	2008	8,7	Hydro (run of river)	18,0
HİDRO KNT. (YUKARI MANAHOZ REG. VE HES)	2008	22,4	Hydro (run of river)	79,0
İÇ-EN ELK. (ÇALKIŞLA REGÜLATÖRÜ VE HES)	2008	7,7	Hydro (run of river)	18,0
KALEN ENERJİ (KALEN II REGÜLAT. VE HES)	2008	15,7	Hydro (run of river)	50,0
MARAŞ ENERJİ (FIRNIS REGÜLATÖRÜ VE HES)	2008	7,2	Hydro (run of river)	36,0
SARMAŞIK I HES (FETAŞ FETHİYE ENERJİ)	2008	21,0	Hydro (run of river)	96,0
SARMAŞIK II HES (FETAŞ FETHİYE ENERJİ)	2008	21,6	Hydro (run of river)	108,0
TORUL	2008	105,6	Hydro (With Dam)	322,0
YEŞİL ENERJİ ELEKTRİK (TAYFUN HES)	2008	0,8	Hydro (run of river)	5,0
MB ŞEKER NİŞASTA SAN.A.Ş. (Sultanhanı)	2008	8,8	Natural Gas	60,0
AKSA ENERJİ (Antalya)	2008	183,8	Natural Gas	1.290,0
AKSA ENERJİ (Manisa)	2008	52,4	Natural Gas	370,0
ANTALYA ENERJİ (Addition)	2008	17,5	Natural Gas	122,3
ATAÇ İNŞAAT SAN. A.S.B. (ANTALYA)	2008	5,4	Natural Gas	37,0
BAHÇIVAN GIDA (LÜLEBURGAZ)	2008	1,2	Natural Gas	8,0
CAN ENERJİ (Çorlu - Tekirdağ) (Addition)	2008	52,4	Natural Gas	304,2
FOUR SEASONS OTEL (ATİK PASHA TUR. A.Ş.)	2008	1,2	Natural Gas	7,0
FRİTOLAY GIDA SAN.VE TİC. AŞ. (Addition)	2008	0,1	Natural Gas	4,0
KARKEY (SİLOPİ-5) (154 kV) (Addition)	2008	14,8	Fuel Oil	103,2
MELİKE TEKSTİL (GAZİANTEP)	2008	1,6	Natural Gas	11,0
MİSİS APRE TEKSTİL BOYA EN. SAN.	2008	2,0	Natural Gas	14,0

MODERN ENERJİ (LÜLEBURGAZ)	2008	13,4	Natural Gas	94,1
POLAT TURZ. (POLAT RENAISSANCE İST. OT.)	2008	1,6	Natural Gas	11,0
SARAYKÖY JEOTERMAL (Denizli)	2008	6,9	Geothermal	50,0
SÖNMEZ Elektrik (Addition)	2008	8,7	Natural Gas	67,3
TÜPRAŞ RAFİNERİ(Aliağa/İzmir)	2009	24,7	Natural Gas	170
ERDEMİR(Ereğli-Zonguldak)	2009	36,1	Natural Gas	217,95
ARENKO ELEKTRİK ÜRETİM A.Ş. (Denizli)	2009	12	Natural Gas	84
TAV İSTANBUL TERMİNAL İŞLETME. A.Ş.	2009	6,52	Natural Gas	54,56
AKSA AKRİLİK KİMYA SN. A.Ş. (YALOVA)	2009	70	Natural Gas	539
KASAR DUAL TEKSTİL SAN. A.Ş. (Çorlu)	2009	5,67	Natural Gas	38
SÖNMEZ ELEKTRİK(Uşak) (Addition)	2009	8,73	Natural Gas	67,29
GÜRMAT ELEKT. (GÜRMAT JEOTERMAL)	2009	47,4	Geothermal	313
DELTA ENERJİ ÜRETİM VE TİC.A.Ş.	2009	60	Natural Gas	467
KEN KİPAŞ ELKT. ÜR.(KAREN) (K.Maraş)	2009	17,46	Natural Gas	73,36
TESKO KİPA KİTLE PAZ. TİC. VE GIDA A.Ş.	2009	2,33	Natural Gas	18
NUH ÇİMENTO SAN. TİC. A.Ş.(Nuh Çim.) (Addition)	2009	46,95	Natural Gas	328,65
SİLOPİ ELEKTRİK ÜRETİM A.Ş.	2009	135,000	Asphaltit	945,00
MAURİ MAYA SAN. A.Ş.	2009	2,000	Natural Gas	16,52
AKSA ENERJİ (Antalya) (Addition)	2009	300,000	Natural Gas	2310,00
ANTALYA ENERJİ (Addition)	2009	41,820	Natural Gas	302,24
MARMARA PAMUKLU MENS. SN.TİC.A.Ş.	2009	34,920	Natural Gas	271,68
AKSA ENERJİ (Antalya) (Addition)	2009	300,000	Natural Gas	2310,00
ZORLU ENERJİ (B.Karıştıran) (Addition)	2009	49,530	Natural Gas	395,21
İÇDAŞ ÇELİK (Addition)	2009	135,000	Imported coal	961,67
GLOBAL ENERJİ (PELİTLİK)	2009	8,553	Natural Gas	65,31
RASA ENERJİ (VAN)	2009	78,570	Natural Gas	500,00
DELTA ENERJİ ÜRETİM VE TİC.A.Ş. (Addition)	2009	13,000	Natural Gas	101,18
İÇDAŞ ÇELİK (Addition)	2009	135,000	Imported coal	961,67
DALSAN ALÇI SAN. VE TİC. A.Ş.	2009	1,165	Natural Gas	9,00
AK GIDA SAN. VE TİC. A.Ş. (Pamukova)	2009	7,500	Natural Gas	61,00
CAM İŞ ELEKTRİK (Mersin) (Addition)	2009	126,100	Natural Gas	1008,00
SELKASAN KAĞIT PAKETLEME MALZ. İM.	2009	9,900	Natural Gas	73,00
TAV İSTANBUL TERMİNAL İŞLETME. A.Ş.	2009	3,260	Natural Gas	27,28
DESA ENERJİ ELEKTRİK ÜRETİM A.Ş.	2009	9,800	Natural Gas	70,00
FALEZ ELEKTRİK ÜRETİMİ A.Ş.	2009	11,748	Natural Gas	88,00
AKSA ENERJİ (MANİSA) (Addition)	2009	62,900	Natural Gas	498,07
SİLOPİ ELEKTRİK ÜRETİM A.Ş.(ESENBOĞA)	2009	44,784	Fuel Oil	315,00

TAŞOVA YENİDEREKÖY HES (HAMEKA A.Ş.)	2009	1,980	Hydro (run of river)	10,00
TEKTUĞ (Erkenek)	2009	6,000	Hydro (run of river)	24,00
BAĞIŞLI REG. VE HES (CEYKAR ELEKT.)	2009	9,857	Hydro (run of river)	32,96
DEĞİRMENÜSTÜ EN. (KAHRAMANMARAŞ)	2009	12,850	Hydro (run of river)	35,28
BAĞIŞLI REG. VE HES (CEYKAR ELEKT.)	2009	19,714	Hydro (run of river)	66,04
TOCAK I HES (YURT ENERJİ ÜRETİM SN.)	2009	4,760	Hydro (run of river)	13,00
BEYOBASI EN. ÜR. A.Ş. (SIRMA HES)	2009	5,880	Hydro (run of river)	23,00
ÖZYAKUT ELEK. ÜR.A.Ş. (GÜNEŞLİ HES)	2009	1,800	Hydro (run of river)	8,00
LAMAS III - IV HES (TGT ENERJİ ÜRETİM)	2009	35,674	Hydro (run of river)	150,00
YPM SEVİNDİK HES (Suşehri/SİVAS)	2009	5,714	Hydro (run of river)	36,00
BEREKET ENERJİ (KOYULHİSAR HES)	2009	42,000	Hydro (run of river)	329,00
KALEN ENERJİ (KALEN I - II HES)	2009	15,650	Hydro (run of river)	52,17
CİNDERE HES (Denizli)	2009	19,146	Hydro (With Dam)	58,00
ŞİRİKÇİOĞLU EL.(KOZAK BENDİ VE HES)	2009	4,400	Hydro (run of river)	15,00
AKUA ENERJİ (KAYALIK REG. VE HES)	2009	5,800	Hydro (run of river)	39,00
KAYEN ALFA ENERJİ (KALETEPE HES)	2009	10,200	Hydro (run of river)	37,00
OBRUK HES	2009	212,400	Hydro (With Dam)	473,00
ANADOLU ELEKTRİK (ÇAKIRLAR HES)	2009	16,158	Hydro (run of river)	60,00
AKÇAY HES ELEKTRİK ÜR. (AKÇAY HES)	2009	28,780	Hydro (run of river)	95,00
ELESTAŞ ELEKTRİK (YAYLABEL HES)	2009	5,100	Hydro (run of river)	20,00
ERVA ENERJİ (KABACA REG. VE HES)	2009	4,240	Hydro (run of river)	16,50
ELESTAŞ ELEKTRİK (YAZI HES)	2009	1,109	Hydro (run of river)	6,00
ERVA ENERJİ (KABACA REG. VE HES)	2009	4,240	Hydro (run of river)	16,50
TÜM ENERJİ (PINAR REG. VE HES)	2009	30,090	Hydro (run	138,00

			of river)	
TEKTUĞ (Erkenek) (Additon)	2009	6,514	Hydro (run of river)	26,00
SARITEPE HES (GENEL DİNAMİK SİS.EL.)	2009	2,450	Hydro (run of river)	10,00
UZUNÇAYIR HES (Tunceli)	2009	27,330	Hydro (With Dam)	105,00
YEŞİLBAŞ ENERJİ (YEŞİLBAŞ HES)	2009	14,000	Hydro (run of river)	56,00
SARITEPE HES (GENEL DİNAMİK SİS.EL.)	2009	2,450	Hydro (run of river)	10,00
Eti Soda	2010	24,000	Lignite	144,00
Can Tekstil	2010	7,832	Natural Gas	86,75
ALTINMARKA GIDA	2010	4,600	Natural Gas	33,00
Akbaşlar (Addition)	2010	1,540	Natural Gas	12,08
GLOBAL ENERJİ (PELİTLİK)	2010	3,544	Natural Gas	27,06
Konya Şeker	2010	6,000	Lignite	40,00
RASA ENERJİ (VAN)	2010	26,190	Natural Gas	166,60
Aksa Enerji (Antalya)	2010	25,000	Natural Gas	175,46
Yıldız Entegre Ağaç (kocaeli)	2010	12,368	Natural Gas	80,10
ATAER ENERJİ	2010	49,000	Liqued Fuel + N.Gas	278,00
Cengiz Enerji	2010	101,950	Natural Gas	802,00
Uğur Enerji	2010	48,200	Natural Gas	406,00
Aksa Enerji (Antalya)	2010	25,000	Natural Gas	175,46
ALTEK ALARKO Elektrik Santralleri	2010	60,100	Natural Gas	420,00
Eren Enerji	2010	160,000	Imported coal	1068,00
Flokser Tekstil (Çerkezköy/Tekirdağ)	2010	5,172	Natural Gas	42,00
RB Karesi İthalat İhracat Tekstil	2010	8,600	Natural Gas	65,00
Cengiz Enerji	2010	101,950	Natural Gas	802,00
Keskinoğlu Tavukçuluk ve Dam. İşl.	2010	3,495	Natural Gas	25,00
Binatom Elektrik Üretim A.Ş.	2010	2,000	Natural Gas	13,00
CAN ENERJİ (Çorlu - Tekirdağ)	2010	29,100	Natural Gas	203,00
Kurtoğlu Bakır Kurşun San.A.Ş.	2010	1,585	Natural Gas	12,00
Sönmez Enerji Üretim (Uşak)	2010	32,242	Natural Gas	272,55
Kırka Boraks	2010	10,000	Liqued Fuel + N.Gas	65,00
Enerji-SA (Bandırma)	2010	930,800	Natural Gas	7540,00
Uğur Enerji (Addition)	2010	12,000	Natural Gas	100,00
Eren Enerji (Addition)	2010	600,000	Imported coal	4006,00

Eren Enerji (Addition)	2010	600,000	Imported coal	4006,00
MARMARA PAMUKLU MENS. SN.TİC.A.Ş. (Addition)	2010	26,190	Natural Gas	203,76
Aliağa Çakmaktepe Enerji A.Ş.(Aliağa/İZMİR) (Addition)	2010	69,840	Natural Gas	556,00
FRİTOLAY GIDA SAN.VE TİC. AŞ. (Addition)	2010	0,330	Biogas	2,40
Sönmez Enerji Üretim (Uşak) (Addition)	2010	2,564	Natural Gas	19,77
Polyplex Europa Polyester Film	2010	7,808	Natural Gas	61,00
ALTEK ALARKO Elektrik Santralleri	2010	21,890	Natural Gas	151,36
RASA ENERJİ (VAN) (Addition)	2010	10,124	Natural Gas	64,41
International Hospital Istanbul	2010	0,770	Natural Gas	6,00
Kulp IV HES	2010	12,298	Hydro (run of river)	46,00
Cindere HES (Denizli) (Addition)	2010	9,065	Hydro (With Dam)	28,29
Bayburt Hes	2010	14,631	Hydro (run of river)	51,00
UZUNÇAYIR HES (Tunceli) (Addition)	2010	27,330	Hydro (With Dam)	105,00
Alakır Hes.	2010	2,060	Hydro (run of river)	6,00
Peta Müh. En. (Mursal II Hes.)	2010	4,500	Hydro (run of river)	19,00
Hetaş Hacısalihoğlu (Yıldızlı Hes)	2010	1,200	Hydro (run of river)	5,00
Doğubay Elektrik (Sarımehmet Hes)	2010	3,100	Hydro (run of river)	10,00
Nuryol Enerji (Defne Reg. Ve hes.)	2010	7,230	Hydro (run of river)	22,00
Birim Hidr. Üretim A.Ş. (Erfelek Hes)	2010	3,225	Hydro (run of river)	19,00
Nisan E. Mekanik En. (Başak Reg. Hes.)	2010	6,850	Hydro (run of river)	22,00
UZUNÇAYIR HES (Tunceli) (Addition)	2010	27,330	Hydro (With Dam)	105,00
Fırtına Elektrik Üretim A.Ş. (Sümer Hes)	2010	21,600	Hydro (run of river)	70,00
Birim Hidr. Üretim A.Ş. (Erfelek Hes)	2010	3,225	Hydro (run of river)	19,00
Karadeniz El. Üret. (Uzundere-1 Hes)	2010	62,200	Hydro (run of river)	165,00
Akım Enerji (Cevizli Reg. Ve Hes.)	2010	91,400	Hydro (run of river)	330,00
Ceyhan Hes. (Oşkan Hes.) (Enova En.)	2010	23,889	Hydro (run of river)	98,00

Erenler Reg. Ve Hes. (BME Bir. Müt. En.)	2010	45,000	Hydro (run of river)	85,00
Kale Reg. Ve Hes (Kale Enerji Ür.)	2010	34,140	Hydro (run of river)	116,00
Çamlıkaya Reg. Ve Hes	2010	5,648	Hydro (run of river)	19,00
Dinar Hes. (Elda Elekrik Üretim)	2010	4,440	Hydro (run of river)	15,00
Dim Hes (Diler Elektrik Üretim)	2010	38,250	Hydro (run of river)	123,00
Kirpilik Reg. Ve Hes (Özgür Elektrik)	2010	6,240	Hydro (run of river)	22,00
Yavuz Reg. Ve Hes (Masat Enerji)	2010	22,500	Hydro (run of river)	83,00
Gök Reg. Ve Hes (Gök Enerji El. San.)	2010	10,008	Hydro (run of river)	43,00
Karşıyaka HES (Akua Enerji Üret.)	2010	1,592	Hydro (run of river)	8,00
Ceyhan Hes. (Berkman Hes) (Enova En.)	2010	25,200	Hydro (run of river)	103,00
Güdül I Reg. Ve HES (Yaşam Enerji)	2010	2,360	Hydro (run of river)	14,00
Tektuğ Elektrik (Andırın Hes)	2010	40,500	Hydro (run of river)	106,00
Kozan Hes (Ser-Er Enerji)	2010	4,000	Hydro (run of river)	9,00
Kahraman Reg. Ve Hes (Katırcıoğlu)	2010	1,420	Hydro (run of river)	6,00
Narinkale Reg. Ve Hes (EBD Enerji)	2010	3,100	Hydro (run of river)	10,00
Erenköy Reg. Ve Hes (Türkerler)	2010	21,456	Hydro (run of river)	87,00
Kahta I HES (Erdemyıldız Elektrik Üretim)	2010	7,120	Hydro (run of river)	35,00
Ulubat Kuvvet Tüneli ve Hes	2010	97,000	Hydro (With Dam)	372,00
Sabunsuyu II HES (Ang Enerji Elk.)	2010	7,350	Hydro (run of river)	21,00
Burç Bendi ve Hes (Akkur Enerji)	2010	27,330	Hydro (run of river)	113,00
Murgul Bakır (Ç.kaya) (Addition)	2010	19,600	Hydro (run of river)	40,50
Yedigöze HES (Yedigöze Elektrik)	2010	155,330	Hydro (With Dam)	474,00
Umut III Reg. Ve HES (Nisan Elek.)	2010	12,000	Hydro (run of river)	26,00
FEKE 2 Barajı ve HES (Nisan Elek.)	2010	69,340	Hydro	223,00

			(With Dam)	
Kalkandere Reg. Ve Yokuşlu HES.	2010	14,540	Hydro (run of river)	63,00

Annex 5

MONITORING INFORMATION

- - - - -