

**Gold Standard for the Global Goals
Transition Annex**

*(To be used by all GS CDM/VER stand alone projects and PoAs,
Micro Scale stand alone projects and Micro PoAs)*



Version 1 – September 2017

KEY PROJECT INFORMATION

Title of Project/PoA/Activity:	Kayseri Molu Landfill Gas to Electricity Project, Turkey
GS ID of the project/PoA/activity:	GS1061
GS Version:	GS4GG Version 1.2
Brief description of Project:	Her Enerji ve Çevre Teknolojileri Elektrik Üretim A.Ş. (Her Enerji) invested into a biogas power plant to generate electricity and feed it into the Turkish grid. The biogas power project was 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. 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.
Project type: Energy/Land Use	Energy
For Renewable Energy Projects – intention to apply RECs Labels (y/n)	No
GS Stream (CDM/VER):	VER
Scale (large/scale/micro):	Large
GS Registration Date:	08/10/2013
GS Crediting period start date:	01/12/2011 – First Crediting Period
CDM Registration Date:	-
CDM Crediting period start date:	-
Project Developer:	Her Enerji ve Çevre Teknolojileri Elektrik Üretim A.Ş.
Project Representative:	Life İklim ve Enerji Ltd.Şti.
Project Participants and any communities involved:	Her Enerji ve Çevre Teknolojileri Elektrik Üretim A.Ş.
Host Country/Location:	Turkey/ Kayseri
Methodologies applied:	ACM0001: Flaring or use of landfill gas Version 19.0
SDG Impacts:	1 – SDG 7-Affordable and clean energy 2 – SDG 8-Decent work and economic growth 3 – SDG 13-Climate action

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Estimated amount of SDG Impact (GSVERs and others)	SDG 13	Emission Reduction: 13,234 tCO2e /y
	SDG 8	<p>Quality of Employment: Training certificates on Occupational Health and Safety issue are provided for all employees working at the plant. At least 10 employment will be provided.</p> <p>Quantitative Employment and Income Generation: Positive impact on the local economy. Necessary donations are provided to the local community where applicable.</p>
	SDG 7	Access to affordable and clean energy services: 24,907 MWh/yr

SECTION A Sustainable Development Goals (SDG) outcomes

A.1 Relevant target for each of the three SDGs

SDGs	Target	Indicator	Target Brief
SDG 13: Climate action	13.3 Improve education, awareness-raising and human and institutional capacity on climate change mitigation, adaptation, impact reduction and early warning	13.3.1	Emission Reduction: 13,234 tCO ₂ /yr
SDG 7: Affordable and clean energy	7.2 By 2030, increase substantially the share of renewable energy in the global energy mix	7.2.1	24,907 MWh/annually renewable energy
SDG 8: Decent work and economic growth	8.8 Protect labour rights and promote safe and secure working environments for all workers, including migrant workers, in particular women migrants, and those in precarious employment	8.8.2	At least 10 employees will work at the WPP. HSE trainings will be provided to all employees at the plant.

Table 1: Timeline for the project milestones

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
24/10/2011	Operation date for first gas engine
21/11/2011	Date of Submission of Initial PDD to DOE
19/07/2012	Operation date for second gas engine
05/07/2013	Operation date for third gas engine
31/03/2014	End date of the first monitoring period
31/12/2016	End date of the second monitoring period

A.1.1 Eligibility of the Project under Gold Standard

The project activity meets the eligibility criteria as per section 3.1.1 of the GS4GG Principles & Requirements document as described below:

- The Project applies ACM0001: Flaring or use of landfill gas --- Version 19.0.
- The project type is power generation using Landfill Gas Energy, an eligible project type per 1.1.1 a) and 1.1.1 b) of the Eligible Project Types & Scope under Renewable Energy Activity Requirements.
- The project activity results in the displacement of electricity from thermal power plants while contributing to the sustainable development of Turkey. Hence, the Project contributes to the Gold Standard Vision and Mission.
- Landfill Gas to Energy is an approved project type and does not require approval from Gold Standard.
- This project activity is not associated with geo-engineering or energy generated from fossil fuel or nuclear fossil fuel switch, nor does it enhance or prolong such energy generation.
- The Project is not registered with any other schemes.

- a) General Eligibility Criteria under Renewable Energy Activity Requirements Project Type: The project type is eligible as discussed above.
- b) Project Location: The Project is located in Turkey, which is not located in an HCV area. Kayseri Molu Landfill Gas to Energy Project seeks registration only in the GS4GG program. The project activity has not participated in other emissions trading programs, other binding limits, other forms of environmental credits or other GHG programs. Any other GHG programs do not reject this Project. Therefore, no double counting of impacts is potentially in this project activity. This information is confirmed in the no-double counting declaration by the project owner. Thus, the Project is eligible.
- c) Project Scale: The Project is a large scale project.
- d) Host Country Requirements: The proposed project activity complies with applicable Turkey's laws and environmental, ecological and social regulations, including the law on investment, the law on environmental protection, the electricity law, the labour code, the law on gender equality, the land law. Kayseri Molu LFG Energy Project has been granted a generation license on 01/08/2011 for a LFG power plant by EMRA.

A.2 Explanation of methodological choices/approaches for estimating the SDG outcome

A.2.1 SDG 13 Calculated

CO2e Emissions Reduction:

Baseline emissions

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;

$$BE_y = BE_{CH_4,y} + BE_{EC,y} \quad (1)$$

where

BE_y	Baseline emissions in year y (t CO ₂ e)
$BE_{CH_4,y}$	Baseline emissions of methane from the SWDS in year y (t CO ₂ e/yr)
$BE_{CE,y}$	Baseline emissions associated with electricity generation in year y (t CO ₂ /yr)

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

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

$$BE_{CH_4,y} = (1 - OX_{top-layer})(F_{CH_4,PJ,y} - F_{CH_4,BL,y})GWP_{CH_4} \quad (2)$$

Where:

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

There is neither regulatory nor contractual requirements for methane destruction/combustion. There is also no LFG flared without the project activity, therefore $F_{CH_4,BL,y}$ is equal zero.

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

During the crediting period, $F_{CH_4,PJ,y}$ is determined as the sum of 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:

$$F_{CH_4,PJ,y} = F_{CH_4,flared,y} + F_{CH_4,EL,y} + F_{CH_4,HG,y} + F_{CH_4,NG,y} \quad (3)$$

Where:

$F_{CH_4,PJ,y}$	Amount of methane in the LFG which is flared and/or used in the project activity in year y (t CH ₄ /yr)
$F_{CH_4,flared,y}$	Amount of methane in the LFG which is destroyed by flaring in year y (t CH ₄ /yr)
$F_{CH_4,EL,y}$	Amount of methane in the LFG which is used for electricity generation in year y (t CH ₄ /yr)
$F_{CH_4,HG,y}$	Amount of methane in the LFG which is used for heat generation in year y (t CH ₄ /yr)
$F_{CH_4,NG,y}$	Amount of methane in the LFG which is sent to the natural gas distribution network in year y (t CH ₄ /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, $F_{CH_4,PJ,y}$ will be calculated as follow:

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

Determination of $F_{CH_4,flared,y}$ and $F_{CH_4,EL,y}$

The sum of the quantities fed to the flares ($F_{CH_4,flared,y}$) and to the power plant ($F_{CH_4,EL,y}$) will be summed up annually be adopted as $F_{CH_4,PJ,y}$

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$F_{CH_4,PJ,y}$ 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. $F_{CH_4,PJ,y}$ 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* ($F_{CH_4, t}$) 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:

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

With

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

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 (m³ 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 (m³ gas *i*/m³ dry gas)
- $\rho_{i,t}$ Density of greenhouse gas *i* in the gaseous stream in time interval *t* (kg gas /m³ 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:

$$F_{CH_4,EL,n} = \sum_{h=1}^{h=hn} F_{CH_4,t} \quad (7)$$

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

$F_{CH_4, flared, y}$ 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:

$$F_{CH_4,flared,y} = F_{CH_4,sent_flare,y} - (PE_{flare,y} / GWP_{CH_4}) \quad (8)$$

Where:

$F_{CH_4,flared,y}$	Amount of methane in the LFG which is destroyed by flaring in year y (t CH ₄ /yr)
$F_{CH_4, sent_flare,y}$	Amount of methane in the LFG which is sent to the flare in year y (t CH ₄ /yr)
$PE_{flare,y}$	Project emissions from flaring of the residual gas stream in year y (t CO ₂ e/yr)
GWP_{CH_4}	Global warming potential of CH ₄ (t CO ₂ e/t CH ₄)

$F_{CH_4, sent_flare,y}$ and $F_{CH_4,EL,y}$ 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.

$$F_{CH_4,sent_flared,y} = FV_{RG,y} * w_{CH_4} * D_{CH_4} \quad (9)$$

$$F_{CH_4,EL,y} = LFG_{electricity,y} * w_{CH_4} * D_{CH_4} \quad (10)$$

$PE_{flare,n}$ 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 ($F_{CH_4,RG,m}$). The flare efficiency is determined for each minute m of year y based either on monitored data or default values.

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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 . $F_{CH_4,m}$ 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 ($F_{CH_4, RG, m}$). $F_{CH_4, m}$ 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

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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 for the 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:

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

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:

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

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 CH ₄ /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 CO ₂ e/yr)
η_{PJ}	Efficiency of the LFG capture system that will be installed in the project activity (%)
GWP_{CH4}	Global warming potential of CH ₄ (t CO ₂ e/t CH ₄)

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

- f_y 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

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- 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 to the methodological tool “Emissions from solid waste disposal sites” version 06.0.1, ex-ante calculation of $BE_{CH_4,SWDS,y}$ based on the formulation below:

$$BE_{CH_4,SWDS,y} = \varphi \cdot (1-f) \cdot GWP_{CH_4} \cdot (1-OX) \cdot \frac{16}{12} \cdot F \cdot DOC_f \cdot MCF \cdot \sum_{x=1}^y \sum_j W_{j,x} \cdot DOC_j \cdot e^{-k_j(y-x)} \cdot (1-e^{-k_j}) \quad (13)$$

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 oxidised 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 $F_{CH_4,BL,y}$

This step provides a procedure to determine the amount of methane that would have been captured and destroyed (by flaring) in the baseline due to regulatory or contractual requirements, or to address safety and odour concerns (collectively referred to as *requirement* in this step). The methodology ACM0001 version 13 provides 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,

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

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

The baseline emissions associated with electricity generation in year y ($BE_{EC,y}$) is calculated 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

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- $EC_{BL,k,y}$ 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 CO₂ emission intensity of the baseline source of electricity is given in Annex 4.

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

Where:

$BE_{EC,y}$	Baseline emissions for electricity generation in year y (tCO ₂ /yr)
$EC_{BL,k,y}$	Quantity of electricity that would be generated using LFG in year y (MWh/yr)
$EF_{EL,k,y}$	Emission factor for electricity generation for source k in year y (tCO ₂ /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 electricity 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 02.2.1¹ is used to find this combined margin (emission coefficient) as described below:

Step 1: 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 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 Centre²’. 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

¹ See, <http://cdm.unfccc.int/methodologies/PAMethodologies/tools/am-tool-07-v2.pdf>

² See: <http://www.epdk.org.tr/english/regulations/electric/license/licensing.doc> (page 21)

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the tool, the emission factor for imports from neighbouring countries is considered 0 (zero) tCO₂/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.³ 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 2: Share of Low Cost Resource (LCR) Production 2006-2010 (Production in GWh)⁴

	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
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

³ See: <http://www.epdk.gov.tr/documents/10157/d03e6570-d4c8-461c-9e78-9cfe38f71be1> (page 39)

⁴ See: [http://www.teias.gov.tr/istatistik2010/front%20page%202010-%C3%A7i%C3%A7ek%20kitap/uretim%20tuketim\(22-45\)/35\(75-10\).xls](http://www.teias.gov.tr/istatistik2010/front%20page%202010-%C3%A7i%C3%A7ek%20kitap/uretim%20tuketim(22-45)/35(75-10).xls)

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The Simple OM emission factor is calculated as the generation-weighted average CO₂ emissions per unit net electricity generation (tCO₂/MWh) of all generating power plants serving the system, not including low-cost/must-run power plants. The calculation of the simple OM emission factor can be based on:

- net electricity generation and corresponding CO₂ 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:

$$EF_{grid,OMsimple,y} = \frac{\sum_i FC_{i,y} \times NCV_{i,y} \times EF_{CO_2,i,y}}{EG_y} \quad (15)$$

Where:

- EF_{grid,OMsimple,y} = Simple operating margin CO₂ emission factor in year y (tCO₂/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} = CO₂ emission factor of fossil fuel type i in year y (tCO₂/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 CO₂ emission due to electricity generation in Turkey for the years of 2008, 2009 and 2010 are given in Table 9.

Table 3: CO₂ emissions from electricity production 2008-2010 (ktCO₂e)⁵

	2008	2009	2010
CO₂-Emissions [ktCO₂]	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 CO₂ and thus are not taken into account in calculations.

⁵ For detail calculation see Annex 3.

Table 4: Gross electricity production by fossil energy sources 2008-2010 (GWh)⁶

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
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 5: Net/gross electricity production 2008-2010 (GWh)⁷

	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 6: Electricity supplied to the grid, relevant for OM (GWh)⁸

	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) tCO₂/MWh.

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

Table 7: Calculation of Weighted $EF_{grid,OMsimple,y}$ (ktCO₂/GWh)

	2008	2009	2010
CO ₂ -Emissions (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

⁶[http://www.teias.gov.tr/istatistik2010/front%20page%202010-%C3%A7i%C3%A7ek%20kitap/uretim%20tuketim\(22-45\)/35\(75-10\).xls](http://www.teias.gov.tr/istatistik2010/front%20page%202010-%C3%A7i%C3%A7ek%20kitap/uretim%20tuketim(22-45)/35(75-10).xls)

⁷ For Net Production See, [http://www.teias.gov.tr/istatistik2009/32\(75-09\).xls](http://www.teias.gov.tr/istatistik2009/32(75-09).xls) (column L)

⁸[http://www.teias.gov.tr/istatistik2010/front%20page%202010-%C3%A7i%C3%A7ek%20kitap/ithalat-ihracat\(50-54\)/52.xls](http://www.teias.gov.tr/istatistik2010/front%20page%202010-%C3%A7i%C3%A7ek%20kitap/ithalat-ihracat(50-54)/52.xls)

EF _{grid,OMsimple,y} (ktCO ₂ /GWh)	0.6560	0.6489	0.6642
3-year Generation Weighted Average EF_{grid,OMsimple,y} (ktCO₂/GWh)	0.6531		

Step 5: 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 8: 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.

Step 6: Calculate the build margin emission factor

The build margin emissions factor is the generation-weighted average emission factor (tCO₂/MWh) of all power units *m* during the most recent year *y* for which power generation data is available, calculated as per formula in the tool:

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

Where:

- $EF_{grid,BM,y}$ = Build margin CO₂ emission factor in year y (tCO₂/MWh)
- $EG_{m,y}$ = Net quantity of electricity generated and delivered to the grid by power unit m in year y (MWh)
- $EF_{EL,m,y}$ = CO₂ emission factor of power unit m in year y (tCO₂/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:

$$EF_{EL,m,y} = \frac{EF_{CO_2,m,i,y} \times 3.6}{\eta_{m,y}} \quad (17)$$

Where:

- $EF_{EL,m,y}$ = CO₂ emission factor of power unit m in year y (tCO₂/MWh)
- $EF_{CO_2,m,i,y}$ = Average CO₂ emission factor of fuel type i used in power unit m in year y (tCO₂/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 16. 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 9: BM emission factor calculation as per tool equations

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			

Step 7: Calculate the combined margin emission factor

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

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

Where:

- $EF_{grid,BM,y}$ = Build margin CO₂ emission factor in year y (tCO₂/MWh)
- $EF_{grid,OM,y}$ = Operating margin CO₂ emission factor in year y (tCO₂/MWh)

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- 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:

$$EF_{grid,CM,y} = 0.6513 \text{ tCO}_2/\text{MWh} * 0.5 + 0.4096 \text{ tCO}_2/\text{MWh} * 0.5 = 0.5313 \text{ tCO}_2/\text{MWh}$$

Project emissions

$$PE_y = PE_{EC,y} + PE_{FC,y} \tag{19}$$

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,

$$PE_{EC,y} = \sum_k EC_{PJ,j,y} \times EF_{EL,j,y} \times (1 + TDL_{j,y}) \tag{20}$$

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)
 $EF_{EL,j,y}$ 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 CO₂ 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.

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

Where

FC_{i,j,y} quantity of fuel type i combusted in process j during the year y
COEF_{i,y} CO2 emission coefficient of fuel type i in year y

The CO2 emission coefficient is calculated following Option B as fuel combust chemical composition of the fuel.

The CO2 emission coefficient is calculated following Option B based on net calorific value and CO2 emission factor of the fuel type I as follows:

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

Where

COEF_{i,y} CO2 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 CO2 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:

$$ER_y = BE_y - PE_y \quad (23)$$

Where:

ER_y Emission reductions in year y (t CO2e/yr)
BE_y Baseline emissions in year y (t CO2e/yr)
PE_y Project emissions in year y (t CO2/yr)

A.2.2 SDG 7

Firstly, the Project helps to accelerate the growth of the wind power industry and stimulate the designation and production of renewable energy technologies in Turkey. Then, other entrepreneurs irrespective of sector are encouraged to invest in wind power generations. It also assists to reduce Turkey’s increasing energy deficit and diversify the electricity generation mix while reducing import dependency, especially for natural gas. More importantly, rural development are maintained in the areas around the project site by providing infrastructural investments to these remote villages.

Implementation of the proposed Project contributes to wider deployment of wind power technology in local and national level. It demonstrates the viability of larger grid connected wind farms, which support the

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improved energy security, alternative sustainable energy, and also renewable energy industry development. This will also strengthen pillars of Turkish electricity supply based on ecologically sound technology.

The Project’s contribution to SDG 7 is determined via a simple calculation that provides the overall renewable energy generation fed into the grid. This approach is based on the following calculation:

$$\text{Net electricity supplied to grid by the WPP} = \text{Electricity supplied to the grid} - \text{Electricity consumption from the grid}$$

A.2.3 SDG 8

The employment of local people that have necessary technical qualifications for the required post is the priority and enhanced by all project activities during construction and operation of the wind farm. As a result, local poverty and unemployment are partially eliminated by increased job opportunities and project business activities. Construction materials for the foundations, cables and other auxiliary equipment have preferentially been sourced locally. Moreover as contribution of the Project to welfare of the region, the quality of the electricity consumed in the region is increased by local electricity production, which also contributes decreasing of distribution losses.

As per the indicator 8.8.2, the monitoring is based on the followings:

- Quantitative employment and income generation which are controlled via social security records and interviews with the employees. At least 10 employment will be provided.
- Quality of employment which is controlled via number trainings given to employees

A.3 Data and parameters fixed ex ante for monitoring contribution to each of the three SDGs

Relevant SDG Indicator	SDG 13: Climate action Target: 13.3 by emission reduction Indicator: 13.3.1
Data/parameter	$EF_{grid,CM,y}$
Unit	tCO ₂ /MWh
Description	Combined margin CO ₂ emission factor for the project electricity system in year y
Source of data	As per “Tool to calculate the emission factor for an electricity system”
Value(s) applied	0.5313 tCO ₂ /MWh
Choice of data or Measurement methods and procedures	Combined Margin Emission Factor ($EF_{grid,CM,y}$) is calculated ex ante as the weighted average CO ₂ of Operating Margin Emission Factor ($EF_{grid,OM,y}$) and Build Margin Emission Factor ($EF_{grid,BM,y}$)
Purpose of data	To show CO ₂ e reduction in order to monitor the SDG 13 Indicator
Additional comment	Calculation of baseline emissions

Relevant SDG Indicator	SDG 13: Climate action Target: 13.3 by emission reduction Indicator: 13.3.1
Data / Parameter	$EF_{grid,OM,y}$
Unit	tCO ₂ /MWh

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Description	Operating margin CO2 emission factor for the project electricity system in year y
Source of data	As per “Tool to calculate the emission factor for an electricity system”
Value(s) applied	0.6531 tCO2/MWh
Choice of data or Measurement methods and procedures	Operating Margin Emission Factor ($EF_{grid,OM,y}$) is calculated ex ante in accordance with “Tool to calculate the emission factor for an electricity system” by using TEIAS values
Purpose of data	To show CO2e reduction in order to monitor the SDG 13 Indicator
Additional comment	Calculation of baseline emissions

Relevant SDG Indicator	SDG 13: Climate action Target: 13.3 by emission reduction Indicator: 13.3.1
Data / Parameter	$EF_{grid,BM,y}$
Unit	tCO2/MWh
Description	Build margin CO2 emission factor for the project electricity system in year y
Source of data	As per “Tool to calculate the emission factor for an electricity system”
Value(s) applied	0.4096 tCO2/MWh
Choice of data or Measurement methods and procedures	Combined Margin Emission Factor ($EF_{grid,CM,y}$) is calculated ex ante in accordance with “Tool to calculate the emission factor for an electricity system” by using TEIAS values
Purpose of data	To show CO2e reduction in order to monitor the SDG 13 Indicator
Additional comment	Calculation of baseline emissions

SECTION B Safeguarding Principles Assessment

B.1 Analysis of social, economic and environmental impacts

Safeguarding principles	Assessment questions	Assessment of relevance to the Project (Yes/potentially/no)	Justification	Mitigation measure (if required)
3.2 Gender Equality and Women’s Rights	1.Does Project promote gender equality and the empowerment of women? 2.Does Project recognise projects that contribute to	1.Yes 2. No 3.Yes 4. Yes	1. The Project Activity enables workplace for women. There are not any application that may result in gender inequality throughout the construction and operation phase of the Project. 2. The project activity doesn’t recognise projects that	No.

	<p>discrimination against women or reinforce gender-based discrimination and/or inequalities?</p> <p>3.Does Project recognise and seeks to contribute to SDG5?</p> <p>4.Does the Project achieve gender equality and empower all women and girls?</p>		<p>contribute to discrimination against women or reinforce gender-based discrimination and/or inequalities</p> <p>3. The project activity contributes to women’s empowerment by enabling them workplace.</p> <p>4. The Project Activity contributes to women’s empowerment by enabling them workplace.</p>	
3.4.3 Land Tenure and Other Rights	<p>a. Does the Project require any change to land tenure arrangements and/or other rights?</p> <p>b. For Projects involving land-use tenure, are there any uncertainties with regards land tenure, access rights, usage rights or land ownership?</p> <p>c.</p>	<p>a. No</p> <p>b. No</p>	<p>The Project does not require any change to land tenure arrangements and/or other rights. The project area is state-owned, and state bodies give tenure permission. Therefore, there are no uncertainties regarding land tenure, access rights, usage rights, or land ownership.</p>	N/A
3.6.2 Negative Economic Consequences	<p>1.Does Project promote equitable, sustainable economic growth and stability and is the Project appropriate and considerate of the economic</p>	<p>1.Yes</p> <p>2.Yes</p> <p>3.Yes</p>	<p>1. Project Activity promotes sustainable economic growth for the project area by creating job opportunities for local people.</p> <p>2. On June 13, 1967, equal pay contracts and on June 9, 1973, equal treatment contracts were published in the official</p>	

	<p>situation in which it is developed?</p> <p>2.Does Project ensure that projects respect and promote worker’s rights, promote the right to decent work, fair treatment, nondiscrimination, and equal opportunity for workers, and avoid the use of forced labour and child labour?</p> <p>3.Does Project prioritise appropriate and properly considered local employment and procurement wherever possible?</p>		<p>gazette in Turkey; that is why these terms are well-known terms all around Turkey. For this reason, the Project shall apply the principles of non-discrimination, equal treatment, and equal pay for equal work</p> <p>https://ailevecalisma.gov.tr/media/1332/tuerkiye-taraf%C4%B1ndan-onaylanan-ilo-soezle%C5%9Fmeleri.pdf</p> <p>(C100 & C118)</p> <p>3. The Project makes significant contributions to local economy by local employment.</p>	
<p>4.1.1 Emissions</p>	<p>Does the Project increase greenhouse gas emissions over the Baseline Scenario unless this is specifically allowed within Activity Requirements or Gold Standard Approved Impact Methodologies ?</p>	<p>No.</p>	<p>The Project is being appropriately implemented following all relevant national regulations and requirements. The Project Activity prevents the emissions of methane where in the absence of the Project, methane could have been emitted to the environment without capture or treatment since there is no regulation in place in Turkey that requires the capture of methane. The Project Activity is designed to make use of at least 65 % of the methane captured.</p> <p>Furthermore, the share of the electricity generated from</p>	<p>The methane utilisation ratio will continuously be monitored.</p> <p>The yearly amount of avoided CO2 will be monitored.</p> <p>CO, NMVOC and NOx emissions will be monitored.</p>

			<p>fossil fuel fired plants is dominantly higher than electricity generated from renewable energy sources and these fossil fuel fired plants causes CO, NMVOC and NOx emissions. Therefore, CO, NMVOC and NOx emissions of biogas fired plants are significantly lower than the average (mainly coal fired) grid connected power plant in the baseline.</p>	
4.1.2 Energy Supply	Does the Project affect the availability and reliability of energy supply to other users?	No.	<p>The Project Activity generates electricity with methane captured in the baseline scenario would be emitted to the atmosphere and not used by the locals. The Project use the electricity that is generated by itself. In Turkey, a feed-in-tariff system requires that generated electricity be fed to the Turkish national grid. In other words, there is a centralised electricity distribution system, so landfill gas to electricity plant sufficiently feeds the grid and has no effect on the local electricity consumption</p>	<p>The internal electricity consumption of the Project and the electricity generated by the facility will be monitored.</p>
4.2.1 Impact on natural water patterns and flow	Will the Project affect the natural or pre-existing pattern of watercourses, groundwater and/or the watershed(s) such as high seasonal flow variability, flooding potential, lack of aquatic	No.	<p>Groundwater is not used for project activities.</p> <p>There is no lake or pond in the impact area of the Project. In Turkey, it is enforced by law to collect the leachate and send it to a wastewater treatment plant.</p> <p>Additionally, the Project is being appropriately implemented following all relevant national regulations and requirements. The Project Activity prevents the disposal</p>	N/A

	connectivity or water scarcity?		of the leachate generated at the landfill site via a drainage system. According to the relevant regulation, the leachate is being properly collected and transferred to the Municipality's treatment plant. Moreover, utilizing monitoring wells around the project site, groundwater quality is regularly monitored.	
4.2.1 Erosion and/or water body stability	1. Could the Project directly or indirectly cause additional erosion and/or water body instability or disrupt the natural pattern of erosion? If 'Yes' or 'Potentially' proceed to next question? 2. Is the Project's area of influence susceptible to excessive erosion and/or water body instability?	1.No. 2.No	The Project does not cause directly or indirectly cause additional erosion and/or water body instability or disrupt the natural pattern of erosion.	N/A.
4.2.3 Landscape modification and soil	Does the Project involve the use of land and soil for production of crops or other products?	No.	The Project Activity does not involve new landscape modification since it operates in a site that has been constructed before the project activity. The Project does not involve the use of land and soil for the production of crops or other products.	N/A.
4.3.2 Vulnerability to Natural Disaster	Will the Project be susceptible to or lead to	No.	The project area is not a place for specific extreme climatic conditions. The project	N/A.

	increased vulnerability to wind, earthquakes, subsidence, landslides, erosion, flooding, drought or other extreme climatic conditions?		activity is not located in an earthquake zone.	
4.3.3 Genetic Resources	Could the Project be negatively impacted by the use of genetically modified organisms or GMOs (e.g., contamination, collection and/or harvesting, commercial development)?	No	The Project is being implemented in a proper way. There is no relevance to GMO of a Landfill Gas to Energy plant.	N/A.
4.3.4 Release of pollutants	Could the Project potentially result in the release of pollutants to the environment?	No.	On the contrary, the project activity reduces the release of pollutants to the environment. Most importantly, the project activity prevents methane generated at the landfill from being released into the atmosphere. The Project activity also prevents wastewater release to the environment. The rainwater and leaking water from the project site are drained to a water collecting drainage system constructed on the site.	N/A
4.3.5 Hazardous and Non-hazardous Waste	Does the Project involve the manufacture,	No	Hazardous wastes are not accepted to the facility following the regulations and requirement defined by the	N/A

	trade, release, and/ or use of hazardous and non-hazardous chemicals and/or materials?		Ministry of Environment and Urbanization.	
4.3.6 Pesticides and fertilisers	Does the Project involve the application of pesticides and/or fertilisers?	No	The Project does not involve the application of pesticides or fertilisers.	N/A
4.3.7 Harvesting of forests	Does the Project involve the harvesting of forests?	No	Forest harvesting is not in the scope of the commercial activities of the Project.	N/A
4.3.8 Food	Does the Project modify the quantity or nutritional quality of food available such as through crop regime alteration or export or economic incentives?	No	The Project does not modify the quantity or nutritional quality of food available such as through crop regime alteration or export or economic incentives	N/A
4.3.9 Animal Husbandry	Does the Project involve animal husbandry?	No	The Project does not involve animal husbandry.	N/A

SECTION C Monitoring plan

C.1 Data and parameters to be monitored

Relevant SDG Indicator/Safeguarding Principle	SDG 13: Climate action Target: 13.3 by emission reduction Indicator: 13.3.1
Data / Parameter	Air quality
Unit	tons of CO ₂ e
Description	Amount of CO ₂ emission
Source of data	Monthly meter readings for calculation of emission reduction.
Value(s) applied	Expected annual CO ₂ emission avoidances with project implementation is 13,234 tCO ₂ e/yr.

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Measurement methods and procedures	Amount of annual net electricity generation, which is calculated by monthly settlement notifications on monthly meter readings, will be used to calculate estimated CO ₂ emission reduction by project activity.
Monitoring frequency	Annually.
QA/QC procedures	Amount of annual net electricity generation, which is calculated by monthly settlement notifications on monthly meter readings.
Purpose of data	To show CO ₂ e reduction in order to monitor the SDG 13 Indicator.
Additional comment	-

Relevant Indicator/Safeguarding Principle	SDG SDG 13: Climate action Target: 13.3 by emission reduction Indicator: 13.3.1
Data/Parameter	Air quality (emissions other than GHGs)
Unit	tons/GWh
Description	a) Amount of CO, NMVOC emissions b) Level of dust emissions
Source of data	Monthly meter readings
Value(s) applied	a) According to latest official data CO and NMVOC emissions due to electricity generation in 2010 are: 0.134 tons/GWh and 0,034 tons/ GWh respectively. CO is 3.3 tons/year and for NMVOC is 0.8 tons/year avoidance with annual generation of the project b) Opinions of the locals have been taken regarding the dust emissions.
Measuring/reading/recording frequency	a) Annually b) During the first verification of first crediting period
Calculation method (if applicable)	a) Amount of annual net electricity generation, which is calculated by monthly settlement notifications of EPIAŞ based on monthly meter readings, will be used to calculate estimated CO and NMVOC emission reductions by project activity. b) Interview with the locals
QA/QC procedures	Amount of annual net electricity generation, which is calculated by monthly settlement notifications of EPIAŞ based on monthly meter readings, will be used to calculate estimated CO and NMVOC emission reductions by project activity.
Purpose of data	To account for Emissions Reductions of CO, NMVOC.
Additional comments	Assigned technician by Plant Manager or assigned carbon consultant

Relevant Indicator/Safeguarding Principle	SDG SDG 8: Decent work and economic growth Target: 8.8 by employment and decent work Indicator: 8.8.2
Data / Parameter	Quality of employment
Unit	-
Description	Quality of employment
Source of data	Occupational Health & Safety training records
Value(s) applied	Occupational Health and safety trainings are given to employees at the plant.
Measurement methods and procedures	Training attendance list and/or certificates
Monitoring frequency	Annually (Once at the end of the each monitoring period). After first verification period, only new cases will be reported.
QA/QC procedures	The training records for all the employees.
Purpose of data	To ensure Employment and decent work for all.

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Additional comment	-
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Relevant Indicator/Safeguarding Principle	SDG SDG 8: Decent work and economic growth Target: 8.8 by employment and decent work Indicator: 8.8.2
Data / Parameter	Quantitative employment and income generation
Unit	-
Description	a) Number of employment b) Expropriation documents
Source of data	a) Social security records of employees b) Expropriation Documents
Value(s) applied	Employment records and expropriation documents will be provided. The project activity will provide employment at least for 10 people.
Measurement methods and procedures	a) For number of local employment: social security records of employees. After first verification, only changes in employees will be reported. b) By expropriation documents
Monitoring frequency	a) Number of local employment: Annually b) Only at the first verification
QA/QC procedures	Social security records of the employees.
Purpose of data	To exhibit employment performance of the plant in order to monitor the SDG 8 Indicator.
Additional comment	Assigned technician by Plant Manager or assigned carbon consultant.

Relevant Indicator/Safeguarding Principle	SDG SDG 7: Affordable and clean energy Target: 7.2 by using renewable energy systems Indicator: 7.2.1
Data / Parameter	$EG_{\text{facility},y}$
Unit	MWh/y
Description	Quantity of net electricity generation supplied by the project plant/unit to the grid in year y
Source of data	Electricity Meters and and EPIAŞ datum will be used as source of data
Value(s) applied	24,907 MWh/y

<p>Measurement methods and procedures</p>	<p>Two electricity meters are placed (one main and one reserve) at the 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 buyers.</p> <p>On the last day of each month, the production index is taken from the main as well as the reserve meter by Market Financial Settlement Center (in Turkish EPIAŞ, a state institution responsible for electricity market settlement operations) via Automatic Meter Reading System (OSOS) In following month, EPIAŞ issue electricity generation records for each generation unit which can be accessed by plant operators via logging to secured website. These records are used to monitor net monthly generation of the power plant. For each month, the net electricity amount supplied to the grid is calculated by electricity fed into grid minus electricity withdrawn from the grid available in EPIAŞ records. Monthly meter reading protocols, which are kept by staff, are used to cross-check the EPIAŞ records. TEIAS notices are used to cross-check the EPIAŞ records. TEIAS sends an electronic spreadsheet that includes daily and monthly electricity generation and withdrawn amounts for each power plant. Thus, cross-check source is the TEIAS meter readings.</p> <p>Since the meters are reading electricity supplied to the system and withdrawn from the system separately, the net electricity amount supplied to the grid is calculated by electricity supplied minus electricity withdrawn.</p>
<p>Monitoring frequency</p>	<p>Continuous measurement and at least monthly readings</p>
<p>QA/QC procedures</p>	<p>According to the Article 2 of the Communiqué of Meters in Electricity Sector⁹: ‘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 Trade and Industry (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’¹⁰ (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.</p> <p>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.</p> <p>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.</p>
<p>Purpose of data</p>	<p>Calculation of Baseline and Project Emission</p>
<p>Additional comment</p>	<p>Plant Manager will be responsible for monitoring data.</p>

⁹See, <https://www.epdk.gov.tr/Detay/DownloadDocument?id=+6B2PMv4N4A=> (<https://www.epdk.gov.tr/Detay/Icerik/3-0-0-128/tebligler>)

¹⁰ See, <http://www.mevzuat.gov.tr/Metin.Aspx?MevzuatKod=7.5.6381&MevzuatIlski=0&sourceXmlSearch=>

C.1.1 Other elements of monitoring plan (if applicable)

Relevant SDG Indicator/Safeguarding Principle	Other Safeguarding Principle: 3.9.4 Release of pollutants
Data/Parameter	Disposal of leachate
Unit	-
Description	Amount of leachate treated
Source of data	A statement from the Kayseri Municipality regarding leachate disposal will be provided.
Value(s) applied	Leachate generated will be treated in the treatment plant of the Kayseri Municipality
Measuring/reading/recording frequency	Annually
Calculation method (if applicable)	N/A
QA/QC procedures	Receipts or a signed statement by the Municipality will be obtained by the Project Proponent showing the proper leachate transfer to the treatment plant.
Purpose of data	To demonstrate that the Project does not impact nearby soil conditions
Additional comments	Monitoring is carried out by Assigned technician by Plant Manager or assigned carbon consultant

SECTION D Duration and crediting period

D.1 Duration of Project

D.1.1 Start date of Project

Starting date of the project activity is 29/04/2011, which is the date of electromechanical contract signature

D.1.2 Expected operational lifetime of Project

10 years

D.1 GS Crediting period of the project/activity

D.2.1 Start date of the ongoing GS crediting period

01/12/2011

D.2.3 End date of the ongoing GS crediting period

31/12/2021

D.2.3 Total length of the GS crediting periods

10 years

SECTION E Stacking of new assets

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Appendix 1. Contact information of project participants

Organisation name	Her Enerji ve Çevre Teknolojileri Elektrik Üretim A.Ş.
Registration number with relevant authority	Merter VD. 461 040 68 95
Street/P.O. Box	Abdurrahman Nafiz Gürman Mah. General Ali Rıza Gurcan. Cad.
Building	Platform Merter B Blok No : 27 /210
City	İstanbul
State/Region	Merter - Gungoren
Postcode	34169
Country	TURKEY
Telephone	+90 (276) 266 79 79
Fax	+90 (276) 266 79 80
E-mail	info@herenerji.com.tr
Website	www.herenerji.com.tr
Contact person	Hakkı Azizlerlioğlu
Title	Project Manager
Salutation	Mr
Last name	Azizlerlioglu
Middle name	
First name	Hakkı
Department	
Mobile	+ 90 (505) 707 31 71
Direct fax	
Direct tel.	
Personal e-mail	hakkia@herenerji.com.tr