JOINT IMPLEMENTATION PROJECT DESIGN DOCUMENT FORM
Version 01 - in effect as of: 15 June 2006

CONTENTS

SECTION A. General description of the project

A.1. Title of the project:

Lugansk Landfill Gas Recovery Project in Ukraine

Sectoral scope *13: Waste handling and disposal*

Version 01

19/12/2009

A.2. Description of the project:

The Lugansk Landfill Gas Recovery and Use Project in Ukraine (hereafter referred to as the "Project") involves the installation of an LFG collection and flaring system to utilize the recovered LFG at Site1 of the Lugansk Landfill located is Oleksandrivsk Town, Lugansk Region, Ukraine. The Project is developed by Nedra Luganschiny, Ltd[1]. The company was established in 2007 and is specialized in engineering and consulting, as well as extraction of fossil fuels and waste utilization.

It is estimated that the Project will lead to the capture and flaring of an average of 866 t/yr of CH_4 in the period 2010 – 2019. This will result in emission reduction of approximately 18,336 tCO_2/yr or 55,009 tCO_2 up to 2012 and 179,579 tCO_2/yr up to 2019.

History of the Project (including its JI component)

The problem of municipal solid waste (MSW) is one of the most critical environmental problems in Ukraine. As of today, there are almost 1000 landfills across the country, the majority of which were established more than 30 years ago without meeting the requirements of environmental protection and violating the current sanitary and technological regulations. Throughout Ukraine, landfills have typically never installed gas capture systems to date as there is no legal requirement to do so. As of December 2009, there are currently only two small landfills in the Crimea (Yalta and Alushta) which have installed a gas collection system, having been set up under the Joint Implementation of the Kyoto Protocol.

There are 29 landfills for district-centre towns and region-subordinated cities of Lugansk Region and more than 160 rural landfills in Lugansk Region. Total area occupied by landfills in region amounts to approximately 450 ha.

The Lugansk Landfill was established in Kruty Yar Gully, about 2.5 km from Oleksandrivsk Town. Pilot operation of the landfill (currently Site 1) commenced in 1979, and its full-scale operation started on February 26, 1980. The landfill is owned by the Lugansk City Council and is the only place for waste disposal for Lugansk City and the neighboring Yekaterynivsk Village, Yuvileyne Village and Oleksandrivsk Town. It is estimated that a total of 450 thousand people reside in these settlements. Over the years the landfill accepted an average of 69,341 t and approximately 2 million tons of MSW have been accumulated there over a period of 30 years until Site 1's closure in 2007.

The Lugansk Landfill is an unmanaged landfill with significant depth. The bottom of the landfill is covered with a screen of clay and bitumen. The depth of the landfill varies between 14 m and 25 m,

[1] http://nedralugansk.com.ua

depending on the relief. The total area of Site 1 of the landfill is 14.84 ha, out of which 11.68 ha are utilized for MSW disposal. The design size of Site 1 is 1,450 th.m^3.

Figure 1. Lugansk Landfill Site 1

All incoming MSW was directed to special deposition areas, where they were leveled by bulldozers. The landfill is being currently covered with a 3-meter layer of sand and other inert material as part of its closure and rehabilitation activities. Leachate is pumped out from 7-10 m below the upper level and spread over the landfill for faster evaporation. The composition of the MSW in the landfill is shown in Table 1 below[2].

WASTE TYPE	Share
Wood and wood products	3.00 %
Pulp, paper and cardboard	30.00 %
Food, food waste, beverages and tobacco	30.00 %
Textiles	5.00 %
Garden, yard and park waste	0.00 %
Glass, plastic, metal, other inert waste	32.00 %

Table 1. MSW Composition

In 2007, Site 1 of the landfill reached its full capacity and was closed, following the commencement of Site 2 in September 2006.

In 2007, Nedra Luganschiny Ltd., the Project developer, entered into an agreement (#650/07006 of 07.02.2007, attached) with the Lugansk City Council for the development and implementation of the Project at Site 1. Site 2 was decided not to be covered by this Project. Under funding from UNDP, Nedra Luganschiny developed a feasibility study for the Project in 2007 - 2008. On July 29, 2009, as part of the Project development, pump tests to determine methane concentration in the LFG were performed. The

[2] As no reliable data on the MSW composition is available, average data for the former Soviet Union countries is used,

tests demonstrated that on the average the MSW deposited at Site 1 of the landfill generated 478.5 m^3_{LFG}/h with an average methane concentration of 67.9 %. This translates into approximately 2,846,137 m^3_{CH4} per year[3]. The economic feasibility of two options for LFG utilization, 1) LFG flaring only, and 2) LFG capture and electricity generation, were analyzed. The analysis showed that both options are not economically feasible without JI funding, but will become economically attractive with the sale of ERUs. Based on further deliberations, including the expected volume of methane generation, it was decided to develop the Project with LFG flaring only.

In 2009, National Environmental Investment Agency of Ukraine issued a Letter of Endorsement for the Project. The Project has received all necessary permits to commence construction and operation.

a) Situation existing prior to the starting date of the Project

The MSW deposited at Site 1 decomposes under anaerobic conditions releasing freely methane into the atmosphere. There is currently no legislation in Ukraine, which requires landfill gas operators to flare methane gas for landfills which were established prior to 2005.

In 2005, National Construction Standard DBN V.2.4-2-2005 General Construction Guidelines for Landfills was introduced containing requirements on LFG collection and flaring/utilization. However, these guidelines are not mandatory as long as LFG collection is concerned and apply only to newly constructed landfills, but not to the Project landfill, which opened in 1979. In addition, the existing Ukrainian regulations do not require the capture and utilization of LFG, and no flaring or other equipment is currently installed at the Project site. No other policies on national or local level exist.

b) Baseline scenario

The baseline scenario is the continuation of the situation existing prior to the start of the Project meaning that under business-as-usual there will be no capturing and flaring of landfill gas: LFG is freely released into the atmosphere. Additional information on the procedure for establishing the baseline scenario is provided in Section B.1.

c) Project scenario (expected outcome, including a technical description)

As part of the Project, it is proposed to cover the landfill and install a system for LFG collection and flaring in a enclosed flare, thus chemically transforming methane into carbon dioxide and avoiding release of methane into the atmosphere. The enclosed flare guarantees high levels of methane decomposition, which may reach 99.5% in case of extremely efficient equipment.
.
As part of the Project, LFG will be collected through 30 vertical collectors located at holes 10 – 25 m deep, connected to a central system for collection and utilization of methane. The LFG collection system is planned to cover 80 % of Site 1 of the landfill and will have a collection efficiency of 75 %. Site 2 will not be covered by the Project.

This Project shall contribute to the economic development of Lugansk Region and reduce the amount of methane and odorous gas emissions from organic waste decomposition at landfills. It will also contribute to the improvement of environmental conditions by improving the landfill management, thus preventing the spread of unpleasant odors and infections.

[3] This figure is similar to the estimate that the methane tool provides for LFG generation for 2009. Please refer to section B for details on the method of estimation of LFG generation potential.

The Project will result in knowledge transfer by introduction of a state-of-the art technology for landfill gas collection and destruction in enclosed flares.

In the construction and operation phases the Project will also provide additional employment for skilled and unskilled workers. The number of permanent green jobs estimated to be created by the Project is estimated to be 7, as shown in Table 2 below. A number of temporary jobs for construction and other workers are also expected to be created as part of the Project implementation.

Position	Number of Staff
Unit Supervisor	**1**
Operation and Maintenance Staff	**4**
Security Guards	**2**
Total	***7***

Table 2. New Green Jobs

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 participants (Yes/ No)
Ukraine (host)	Nedra Luganshchiny, Ltd.	No
Belgium	Fortis Bank	No

A.4. Technical description of the project:

A.4.1. Location of the project:

The Project location is shown on the maps below.

A.4.1.1. Host Party(ies):

Ukraine

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

Lugansk Region

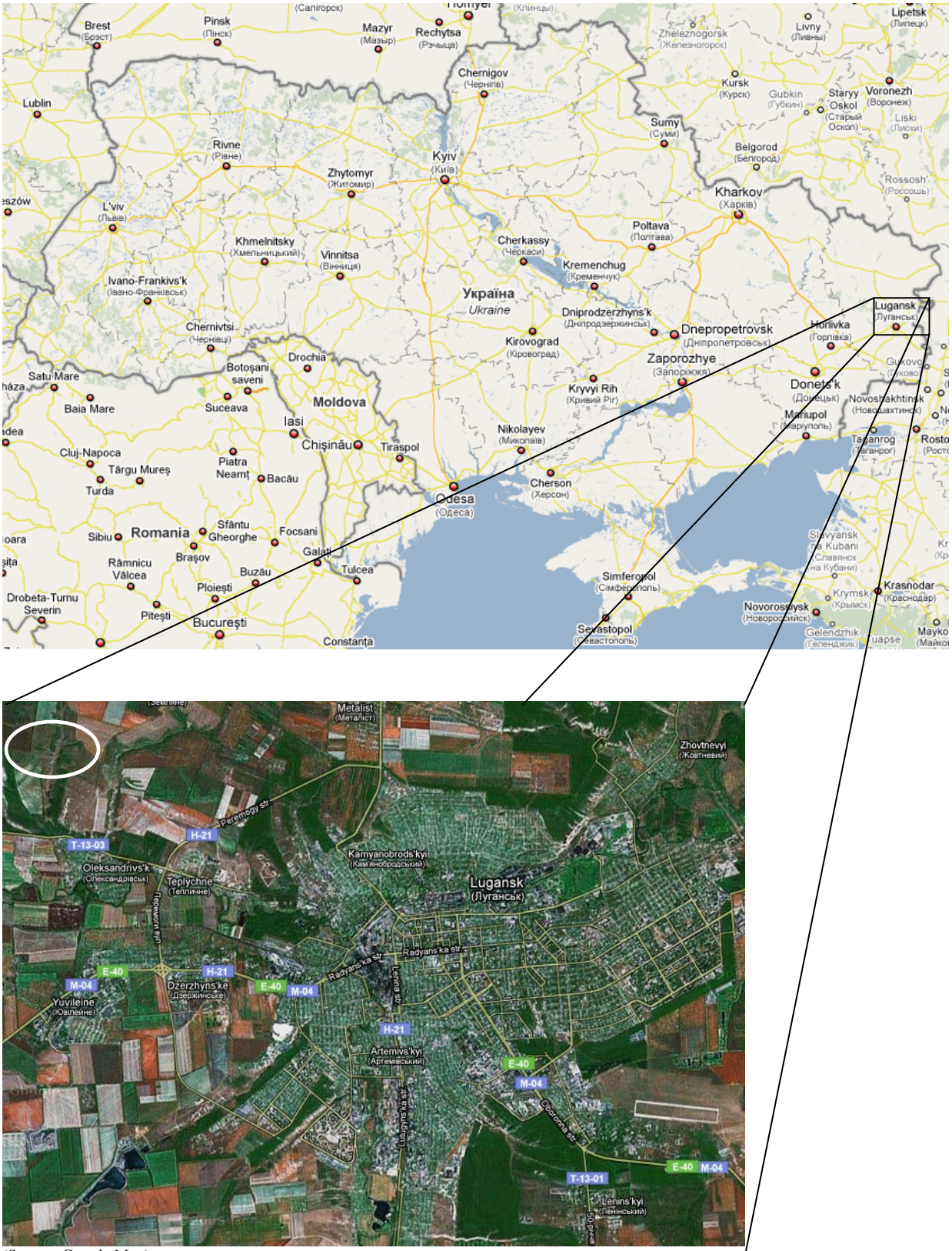
A.4.1.3. City/Town/Community etc.:

Oleksandrivsk Town

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

The proposed JI Project is located approximately 2.5 km from Oleksandrivsk Town, Lugansk Region in Ukraine. Geographical coordinates of the Project site are: 48^{o} 36 '18 " E, 39^{o} 8' 65" N.

The map is provided on Figure 2 below.



(Source: Google Map)

Figure 2. Location of the Project Site

A.4.2. Technology(ies) to be employed, or measures, operations or actions to be implemented by the project:

LFG will be collected only from Site 1, the area of the landfill that is already closed. 30 gas wells with an average depth of 10 – 25 m will be made across the landfill. They will cover approximately 80% of Site 1 of the landfill.

LFG will be collected through creating a vacuum in the gas well and sucking out the LFG. In order to increase the efficiency of LFG collection, it is expected that a polyethylene or other cover will be spread over the landfill. The expected efficiency of LFG collection is 75 %. The collected gas will be cleansed from impurities before being destroyed in the enclosed flare.

The system is presented on Figure 3 below.

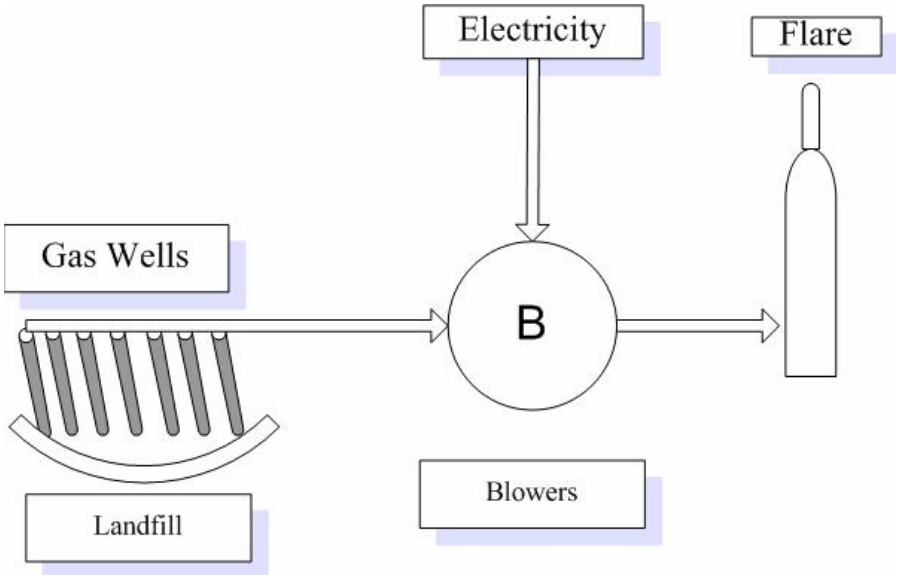


Figure 3. LFG collection and utilization system

The Project implementation schedule is presented in Figure 4 below.

	2009			2010		2011-2019
	Jan - Apr	Apr - Sept	Sept - Dec	Jan-Jun	Jul-Dec	
Design Phase						
1. ERPA negotiations						
2. PIN Development						
3. LoE Issuance						
4. PDD Preparation						
5. PDD Determination						
6. LoA Issuance						
Implementation Phase						
7. Construction works						
- gas wells						
- procurement of equipment						
- installation of						

equipment						
- employment of operation staff						
8. Project Operation						

Figure 4. Project Implementation Schedule

A.4.3. Brief explanation of how the anthropogenic emissions of greenhouse gases by sources are to be reduced by the proposed JI project, including why the emission reductions would not occur in the absence of the proposed project, taking into account national and/or sectoral policies and circumstances:

The Project will reduce anthropogenic greenhouse gas (GHG) emissions through the capture and destruction of landfill gas in an enclosed flare.

The Project faces significant technological and financial barriers, as well as barriers due to the prevailing practice to its implementation and it is unlikely, in the absence of JI financing, that it will be implemented and emission reductions would occur. Further details are provided in Section B.2.

In the current situation, LFG is released into the atmosphere, as this Project would not be undertaken under a business as usual scenario and GHG emissions reductions would be unlikely to occur in the business as usual scenario. Ukrainian legislation does not require flaring of gas for landfills which began operation prior to 2005. In addition, the Project will not generate any income in the absence of JI and will become attractive to investors only if it generates revenue from GHG emission reduction.

The Project is expected to lead to emission reductions of approximately 55,009 tCO_2e during the first crediting period (2010-2012) or an average of 18,336 tCO_2e per year through capture and destruction of LFG in an enclosed flare. The Project is expected to generate 179,759 tCO_2e of emission reductions during its lifetime.

A.4.3.1. Estimated amount of emission reductions over the crediting period:

Years	**Annual estimation of emission reductions in tonnes of CO_2e**
2010	11,604
2011	22,189
2012	21,216
Total estimated reductions (tonnes of CO_2e)	**55,009**
Total number of crediting years	3
Annual average over the crediting period of estimated reductions (tonnes of CO_2e)	18,336

Years	**Annual estimation of emission reductions in tonnes of CO_2e**
2013	20,288
2014	19,402
2015	18,556
2016	17,748
2017	16,977

2018	16,241
2019	15,538
Total estimated reductions (tonnes of CO_2e)	**124,750**
Total number of crediting years	7
Annual average over the crediting period of estimated reductions (tonnes of CO_2e)	17,821

A.5. Project approval by the Parties involved:

A Letter of Endorsement for the Project has been issued by the National Environmental Agency of Ukraine. The Project will obtain Letters of Approval from the Ukrainian and Belgian governments following successful completion of the determination.

SECTION B. Baseline

B.1. Description and justification of the baseline chosen:

Step 1. Indication of and description of the approach chosen regarding baseline setting

Following the JISC Guidance on criteria for baseline setting and monitoring, version 2, the baseline will be established following an existing CDM methodology for baseline determination. However, the baseline study will deviate from the Tool to calculate emission factor for an electricity system in order to make it applicable to the specific conditions of the Ukraine grid. Justifications are provided under Annex 2.

Baseline methodology

The Project will use the following methodology:

- ACM0001 "Consolidated baseline and monitoring methodology for landfill gas project activities", version 11

The Project will also apply the following tools as referred to in the methodology:

- "Tool for the demonstration and assessment of additionality", version 05.2
- "Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site", version 4
- "Tool to calculate baseline, project and/or leakage emissions from electricity consumption", version 1
- "Tool to determine project emissions from flaring gases containing methane", version 1
- "Tool to calculate the emission factor for an electricity system", version 2

Step 2. Application of the approach chosen

Applicability

ACM0001 is applicable to the Project, as outlined below:

- The Project is a landfill gas capture project, where the baseline scenario is total atmospheric release of LFG; and
- The project scenario involves utilization of LFG for flaring.

"Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site" is applicable as outlined below:

- The Project is located at a solid waste disposal site which can be clearly identified, the Lugansk Landfill;
- Hazardous waste is not disposed at the Lugansk Landfill.

"Tool to calculate baseline, project and/or leakage emissions from electricity consumption" is applicable as outlined below:

- The Project will consume electricity from the Ukrainian grid for the operation of the LFG collection and flaring equipment.

"Tool to determine project emissions from flaring gases containing methane" is applicable as outlined below:

- LFG that is going to be flared does not contain gases other than methane, carbon monoxide and hydrogen;
- The LFG to be flared is a result of decomposition of organic materials.

Baseline Determination

The baseline is established as per the stepwise procedure described in ACM0001.

Step 1: Identification of alternative scenarios

Sub-Step 1: Define alternatives to the Project

The following alternatives are defined regarding the disposal and treatment of MSW:

- **LFG1:** LFG is captured and flared *without JI assistance*
- **LFG2:** Free release of LFG in the atmosphere *(continuation of the current situation)*
- **LFG3:** Partial capture and flaring of LFG

Sub-Step 1b: Consistency with mandatory laws and regulations

In 2005, National Construction Standard DBN V.2.4-2-2005 General Construction Guidelines for Landfills was introduced containing requirements on LFG collection and flaring/utilization. However, these guidelines are not mandatory as long as LFG collection is concerned and apply only to newly constructed landfills, but not to the Project landfill, which opened in 1979. No other policies on national or local level exist. Therefore, all three options for LFG utilization are in line with the existing regulations in Ukraine.

Therefore, all of the above identified alternatives for MSW treatment are in line with the mandatory regulations in Ukraine.

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

Step 2 is not applicable as the project does not involve energy generation.

Step 3

Investment Analysis

Sub-step a: Determine appropriate analysis method.

As the Project and the Project and the proposed activities generate no financial or economic benefits without JI, the simple cost analysis method will be applied.

Sub-Step b: Apply simple cost analysis

Regarding, option LFG 1, the installation of an LFG collection and flaring equipment costs approximately USD 500,000. The project generates no additional financial or economic benefits in the absence of JI, therefore it cannot be implemented without the additional incentives from the sale of ERU.

The same arguments apply to option LFG3, partial flaring of LFG, therefore, it is also not economically attractive without JI revenue.

As for option LFG 2, continuation of the current practice, i.e. free release of LFG into the atmosphere, it involves no additional costs, and therefore remains the only attractive option in the absence of JI financing.

As elaborated further in this PDD, the Project is estimated to generate approximately 55,009 ERU in the period up to the end of 2012, which at 14 USD/ERU is equivalent to an income of 770,121 USD. Further, over its lifetime, the Project is expected to generate a total of 179,759 ERU, or 2,516,623 USD, which will cover all the investment and operational costs.

Barrier Analysis

Sub-step 3a – Identify barriers that would prevent the implementation of the proposed JI Project

The implementation of the Project is prevented by the following barriers.

Investment barriers

Landfill gas capture and utilization installation involve initial investment costs. For example, it is estimated that the LFG collection and flaring component of the Project will cost approximately 500,000 USD. This cost is extremely high for local administrative bodies that manage LFG sites especially since there is no return on this investment without any revenues from ERUs. There is only one project in Ukraine, where a LFG collection and flaring system is installed, “Landfill methane capture and flaring at Yalta and Alushta Landfills, Ukraine”, but that project is implemented under the JI framework. At the same time, there are no LFG utilization projects in Ukraine that have been developed without support from the JI mechanism.

Therefore, the investment barriers prevent the implementation of scenarios LFG1 and LFG3, but allow the continuation of the current situation, full release of LFG into the atmosphere (LFG2).

The investment and barrier analyses above demonstrated that in the absence of JI financing, Option LFG2, continuation of the current practice and free release of LFG into the atmosphere is the only viable option.

Step 4

Not applicable, as only one baseline alternative is identified.

The baseline emissions are, therefore, calculated as the methane emissions from the LFG that would have been released in the atmosphere in the absence of the Project as demonstrated below:

$BE_y = (MD_{project,y} - MD_{reg,y}) * GWP_{CH4}$

where:

$BE_{,y}$	baseline emissions in year y (tCO_2e)
$MD_{,project,y}$	the amount of methane that would have been destroyed/combusted during the year, in tonnes of methane (tCH_4)
$MD_{reg,y}$	the amount of methane that would have been destroyed/combusted during the year in the absence of the project, in tonnes of methane (tCH_4).
GWP_{CH4}	the Global Warming Potential value for methane for the first commitment period is 21 tCO_2e/tCH_4

As there are no regulations for methane capture in the baseline scenario, $MD_{reg,y}$ is assumed to be zero, and the above formula is simplified as follows:

$$BE_y = MD_{project,y} * GWP_{CH4}$$

And

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

where

$$MD_{flared,y} = (LFG_{flare,y} * w_{CH4,y} * D_{CH4}) - (PE_{flare,y} / GWP_{CH4})$$

where:

$MD_{flared,y}$	quantity of methane destroyed by flaring
$LFG_{flare,y}$	quantity of landfill gas fed to the flare during the year measured in cubic meters (m^3)
$w_{CH4,y}$	average methane fraction of the landfill gas as measured during the year and expressed as a fraction (in m^3CH_4/m^3LFG)
D_{CH4}	methane density expressed in tonnes of methane per cubic meter of methane (tCH_4/m^3CH_4)
$PE_{flare,y}$	project emissions from flaring of the residual gas stream in year y (tCO_2e) determined following the procedure described in the "Methodological Tool to determine project emissions from flaring gases containing methane"

In the Project, a enclosed flare is adopted. As per the flaring tool, the following two options are proposed for enclosed flares in order to determine the flare efficiency $\eta_{flare,h}$.

(a) 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 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.

(b) Continuous monitoring of the methane destruction efficiency of the flare (flare efficiency).

In the Project, the default value of 90% is adopted for the flare efficiency. Accordingly, Project emissions from the flare are calculated according to Steps 5~7 of the Flaring Tool. Moreover, as per the flaring tool, it is necessary to measure the temperature of the exhaust gas of the flare in order to determine whether or not the flare is operating. If there is no record of the temperature of the exhaust gas 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.

The flare efficiency is calculated for each hour of a year based on default values plus operational parameters. Project emissions are determined by multiplying the methane flow rate in the residual gas with the flare efficiency for each hour of the year.

$$PE_{flare,y} = \sum_{h=1}^{8760} TM_{RG,h} \times (1 - \eta_{flare,h}) \times \frac{GWP_{CH4}}{1000}$$

where:

$TM_{RG,h}$	Mass flow rate of methane in the residual gas in the hour h (kg/h)
$\eta_{flare,h}$	Flare efficiency in hour h

$$TM_{RG,h} = FV_{RG,h} \times fv_{CH4.RG,h} \times \rho_{CH4,n}$$

where:

$FV_{RG,h}$	Volumetric flow rate of the residual gas in dry basis at normal conditions in hour h (m^3/h) (monitored)
$fv_{CH4,RG,h}$	Volumetric fraction of methane in the residual gas on dry basis in hour h (monitored)
$\rho_{CH4,n}$	Density of methane at normal conditions (0.716 kg/m^3)

Flare efficiency ($\eta_{flare,h}$)

90 % - default value
50 % - if in a particular hour any of the flare operation parameters are out of the limits of the manufacturer's specifications.
0 % - if in a particular the recorded temperature is under 500 ^oC

For the ex-ante assessment of $MD_{project,y}$ the following formula is applied:

$MD_{project,y} = (BE_{CH4,SWDS,y}/GWP_{CH4}) * \eta_{LFG\ coll.}$

Where:

$BE_{CH4,SWDS,y}$ =	Methane generation from the landfill in the absence of the project activity at year y (tCO_2e), calculated as per the "Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site". The tool estimates methane generation adjusted for, using adjustment factor (f) any landfill gas in the baseline that would have been captured and destroyed to comply with relevant regulations or contractual requirements, or to address safety and odor concerns. As this is already accounted for in equation 2, "f" in the tool shall be assigned a value 0
$\eta_{LFG\ coll.}$	Efficiency of LFG collection

Furthermore the following guidance is taken into account:

- In the tool x refers to the year since the landfill started receiving wastes [x runs from the first year of landfill operation (x=1) to the year for which emissions are calculated (x=y)];

- The efficiency of the degassing system which will be installed in the project activity is taken into account while estimating the *ex ante* estimation ($\eta_{LFG\ coll.}$)

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

Where:

$BE_{CH4,SWDS,y}$	=	Methane emissions avoided during the year y from preventing waste disposal at the solid waste disposal site (SWDS) during the period from the start of the project activity to the end of the year y (tCO2e)
φ	=	Model correction factor to account for model uncertainties (0.9)
f	=	Fraction of methane captured at the SWDS and flared, combusted or used in another manner
GWP_{CH4}	=	Global Warming Potential (GWP) of methane, valid for the relevant commitment period
OX	=	Oxidation factor (reflecting the amount of methane from SWDS that is oxidised in the soil or other material covering the waste)
F	=	Fraction of methane in the SWDS gas (volume fraction) (0.5)
DOC_f	=	Fraction of degradable organic carbon (DOC) that can decompose
MCF	=	Methane correction factor
$W_{j,x}$	=	Amount of organic waste type j prevented from disposal in the SWDS in the year x (tons)
DOC_j	=	Fraction of degradable organic carbon (by weight) in the waste type j
k_j	=	Decay rate for the waste type j
j	=	Waste type category (index)
x	=	Year since the landfill started receiving wastes [x runs from the first year of landfill operation (x=1) to the year for which emissions are calculated (x=y)]
y	=	Year for which methane emissions are calculated

The tables below provide the list of parameters and other key information used to establish the baseline:

Data / Parameter	**$LFG_{flar,y}$**
Data unit	m^3
Description	quantity of landfill gas fed to the flare during the year y
Time of determination/monitoring	Monitored constantly during Project operation
Source of data (to be) used	Calculated.
Value of data applied (for ex ante calculations/determinations)	

Year	Volume
2010	1,729,283
2011	3,308,090
2012	3,164,493
2013	3,027,448
2014	2,896,641
2015	2,771,776
2016	2,652,569

	2017: 2,538,753 2018: 2,430,072 2019: 2,326,284
Justification of the choice of data or description of measurement methods and procedures (to be) applied	Estimated using the Methane Tool and based on the forecast for LFG availability and power generation. Data for annual volumes of waste disposed and waste composition are based on and information note from the Department of Environment of the Lugansk City Council.
QA/QC procedures (to be) applied	As per Ukrainian National Standards
Any comment	-

Data / Parameter	w_{CH4}
Data unit	m^3CH_4/m^3LFG
Description	average methane fraction of the landfill gas as measured during the year and expressed as a fraction
Time of determination/monitoring	Monitored constantly during Project operation
Source of data (to be) used	Nedra Luganshciny, Ltd.
Value of data applied (for ex ante calculations/determinations)	0.5
Justification of the choice of data or description of measurement methods and procedures (to be) applied	Default value
QA/QC procedures (to be) applied	As per Ukrainian National Standards
Any comment	-

Data / Parameter	D_{CH4}
Data unit	tCH_4/m^3CH_4
Description	Methane Density
Time of determination/monitoring	PDD production
Source of data (to be) used	ACM0001
Value of data applied (for ex ante calculations/determinations)	0.0007168
Justification of the choice of data or description of measurement methods and procedures (to be) applied	At standard temperature and pressure (0 degree Celsius and 1,013 bar) the density of methane is 0.0007168 tCH_4/m^3CH_4
QA/QC procedures (to be) applied	-
Any comment	-

Data / Parameter	$FV_{RG,h}$
Data unit	m^3/h
Description	Volumetric flow rate of the residual gas in dry basis at normal conditions in hour h
Time of determination/monitoring	Constantly

Source of data (to be) used	Calculated.
Value of data applied (for ex ante calculations/determinations)	

Year	Nm^3
2010	197
2011	378
2012	361
2013	346
2014	331
2015	316
2016	303
2017	290
2018	277
2019	266

Justification of the choice of data or description of measurement methods and procedures (to be) applied	Based on the estimates of methane availability using the methane Tool. Average hourly rate used.
QA/QC procedures (to be) applied	-
Any comment	-

Data / Parameter	$\rho_{CH4,n}$
Data unit	$kgCH_4/m^3CH_4$
Description	Methane Density
Time of determination/monitoring	PDD production
Source of data (to be) used	ACM0001
Value of data applied (for ex ante calculations/determinations)	0. 7168
Justification of the choice of data or description of measurement methods and procedures (to be) applied	At standard temperature and pressure (0 degree Celsius and 1,013 bar) the density of methane is 0.0007168 tCH_4/m^3CH_4
QA/QC procedures (to be) applied	-
Any comment	-

Data / Parameter	$fv_{CH4,RG,h}$
Data unit	-
Description	Volumetric fraction of methane in the residual gas on a dry basis in hour h
Time of determination/monitoring	Monitored constantly
Source of data (to be) used	Nedra Luganshiny Ltd.
Value of data applied (for ex ante calculations/determinations)	0.679
Justification of the choice of data or description of measurement methods and procedures (to be) applied	"Tool to determine methane emissions avoided from dumping waste at a solid waste disposal site"
QA/QC procedures (to be)	-

applied	
Any comment	A default value of 0.5 is recommended by IPCC.

Data / Parameter	**GWP_{CH4}**
Data unit	tCO_2e/tCH_4
Description	Global warming potential for CH_4
Time of determination/monitoring	Monitored annually
Source of data (to be) used	IPCC
Value of data applied (for ex ante calculations/determinations)	21
Justification of the choice of data or description of measurement methods and procedures (to be) applied	21 for the first commitment period. Shall be updated according to any future COP/MOP decisions.
QA/QC procedures (to be) applied	-
Any comment	-

Data / Parameter	$\eta_{LFGcoll}$
Data unit	%
Description	LFG collection efficiency
Time of determination/monitoring	PDD production
Source of data (to be) used	Nedra Luganschiny, Ltd.
Value of data applied (for ex ante calculations/determinations)	60%
Justification of the choice of data or description of measurement methods and procedures (to be) applied	75% efficiency of a LFG collection system based on the specification of the manufacturer. The system will cover 80% of Site 1 of the Lugansk Landfill.
QA/QC procedures (to be) applied	-
Any comment	-

Data / Parameter	$\eta_{flare,h}$
Data unit	%
Description	Flare efficiency in hour h
Time of determination/monitoring	PDD production
Source of data (to be) used	The default value of "Tool to determine project emissions from flaring gases containing methane"
Value of data applied (for ex ante calculations/determinations)	90 % - default value 50 % - if in a particular hour any of the flare operation parameters are out of the limits of the manufacturer's specifications. 0 % - if in a particular the recorded temperature is under 500 ^oC
Justification of the choice of	The default values of "Tool to determine project emissions from flaring

data or description of measurement methods and procedures (to be) applied	gases containing methane"
QA/QC procedures (to be) applied	-
Any comment	-

Data / Parameter	φ
Data unit	-
Description	Model correction factor to account for model uncertainties
Time of determination/monitoring	PDD production
Source of data (to be) used	"Tool to determine methane emissions avoided from dumping waste at a solid waste disposal site"
Value of data applied (for ex ante calculations/determinations)	0.9
Justification of the choice of data or description of measurement methods and procedures (to be) applied	Default value of "Tool to determine methane emissions avoided from dumping waste at a solid waste disposal site"
QA/QC procedures (to be) applied	-
Any comment	-

Data / Parameter	f
Data unit	-
Description	Fraction of methane captured at the SWDS and flared, combusted or used in another manner.
Time of determination/monitoring	PDD production
Source of data (to be) used	ACM0001
Value of data applied (for ex ante calculations/determinations)	0
Justification of the choice of data or description of measurement methods and procedures (to be) applied	Already reflected in $MD_{BL,y}$
QA/QC procedures (to be) applied	-
Any comment	-

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)
Time of determination/monitoring	PDD production
Source of data (to be) used	Nedra Luganschiny, Ltd.
Value of data applied (for ex ante calculations/determinations)	0
Justification of the choice of	

data or description of measurement methods and procedures (to be) applied	The proposed Project is not managed solid waste disposal site that is covered with oxidizing material such as soil or compost, therefore 0 is applied.
QA/QC procedures (to be) applied	-
Any comment	Confirmed through a site visit.

Data / Parameter	**F**
Data unit	-
Description	Fraction of methane in the SWDS gas (volume fraction)
Time of determination/monitoring	PDD production
Source of data (to be) used	IPCC 2006 Guidelines for National Greenhouse Gas Inventories
Value of data applied (for ex ante calculations/determinations)	0.5
Justification of the choice of data or description of measurement methods and procedures (to be) applied	"Tool to determine methane emissions avoided from dumping waste at a solid waste disposal site"
QA/QC procedures (to be) applied	-
Any comment	This factor reflects the fact that some degradable organic carbon does not degrade, or degrades very slowly, under anaerobic conditions in the SWDS. A default value of 0.5 is recommended by IPCC.

Data / Parameter	**DOC_F**
Data unit	
Description	Fraction of methane in the SWDS gas (volume fraction)
Time of determination/monitoring	PDD production
Source of data (to be) used	IPCC 2006 Guidelines for National Greenhouse Gas Inventories
Value of data applied (for ex ante calculations/determinations)	0.5
Justification of the choice of data or description of measurement methods and procedures (to be) applied	"Tool to determine methane emissions avoided from dumping waste at a solid waste disposal site"
QA/QC procedures (to be) applied	-
Any comment	-

Data / Parameter	**MCF**
Data unit	-
Description	Methane correction factor
Time of determination/monitoring	PDD production
Source of data (to be) used	IPCC 2006 Guidelines for National Greenhouse Gas Inventories
Value of data applied (for ex ante calculations/determinations)	0.8
Justification of the choice of data or description of measurement methods and	The Project is an unmanaged solid waste disposal site, which has depths between 14 and 25 meters depending on the relief, which is greater than 5 meters.

procedures (to be) applied	
QA/QC procedures (to be) applied	Type of landfill to be confirmed through a site visit and review of the landfill operation documents.
Any comment	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.

Data / Parameter:	DOC_J
Data unit:	
Description:	Fraction of degradable organic carbon (by weight) in the waste type j
Time of determination/monitoring	PDD production
Source of data (to be) used	IPCC 2006 Guidelines for National Greenhouse Gas Inventories (adapted from Volume 5, Tables 2.4 and 2.5)
Value of data applied (for ex ante calculations/determinations)	

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

Justification of the choice of data or description of measurement methods and procedures (to be) applied	"Tool to determine methane emissions avoided from dumping waste at a solid waste disposal site"
QA/QC procedures (to be) applied	-
Any comment	-

Data / Parameter:	$W_{j,x}$
Data unit:	t
Description:	Amount of organic waste type j prevented from disposal in the SWDS in the year x
Time of determination/monitoring	PDD production
Source of data (to be) used	Calculated.
Value of data applied (for ex ante calculations/determinations)	See Annex 2, Table 12.
Justification of the choice of data or description of measurement methods and procedures (to be) applied	Estimated using data on the amount of waste deposited at the landfill and waste composition from the Waste Collection Schedule of Lugansk City.

QA/QC procedures (to be) applied	-
Any comment	-

Data / Parameter	$\mathbf{k_j}$
Data unit	-
Description	Decay rate for the waste type *j*
Time of determination/monitoring	PDD production
Source of data (to be) used	IPCC 2006 Guidelines for National Greenhouse Gas Inventories (adapted from Volume 5, Tables 3.3)
Value of data applied (for ex ante calculations/determinations)	

Waste Type *j*		**Boreal and Temperate (MAT < 20oC)**
		Dry (MAP/PET < 1)
Slowly Degrading	Pulp, paper and cardboard; Textiles	0.04
	Wood, wood products and straw	0.02
Moderately Degrading	Other (non-food) organic putrescible garden and parkwaste	0.05
Rapidly Degrading	Food, food waste, sewage sludge, beverages and tobacco	0.06

Justification of the choice of data or description of measurement methods and procedures (to be) applied	The MAT of Lugansk City is 8.5ºC, MAP is 474mm and PET is 876.5mm. Therefore, MAP/PET<1.
QA/QC procedures (to be) applied	-
Any comment	-

Data / Parameter:	$\boldsymbol{CEF_{elec,BL,y}}$
Data unit:	tCO_2/MWh
Description:	Carbon emission factor of the Ukrainian grid
Time of determination/monitoring	PDD production
Source of data (to be) used	National Committee of Statistics of Ukraine, Ukrainian GHG inventory submission (May 2009)

Value of data applied (for ex ante calculations/determinations)	1.104
Justification of the choice of data or description of measurement methods and procedures (to be) applied	See Annex 2.
QA/QC procedures (to be) applied	-
Any comment	-

Data / Parameter:	**$FC_{i,y}$**
Data unit:	tce
Description:	Amount of each fossil fuel consumed by grid connected TPPs in the period 2006 - 2008
Time of determination/monitoring:	PDD production
Source of data (to be) used:	State Committee of Statistic of Ukraine
Value of data applied (for ex ante calculations/determinations):	
Justification of the choice of data or description of measurement methods and procedures (to be) applied	Best available official data.
QA/QC procedures (to be) applied:	-
Any comment:	Used in the *ex-post* calculation of the carbon emission factor in year *y*. The data on fuel consumption is already provided in energy units, tce. Therefore, there is no need to transform it into metric tons of fuel.

	Coal	Fuel oil	Natural Gas
2006	23,181,898	146,352	1,953,662
2007	23,984,018	82,019	2,532,617
2008	24,658,487	99,901	1,721,885

Data / Parameter:	**$EF_{CO2,i}$**
Data unit:	tCO_2/TJ
Description:	CO_2 emission factor of each fuel type
Time of determination/monitoring:	PDD production
Source of data (to be) used:	The most recent submission of the Ukrainian National GHG Inventory, May 2009
Value of data applied (for ex ante calculations/determinations):	
Justification of the choice of data or description of measurement methods and procedures (to be) applied	Fixed

Coal	Fuel oil	Natural Gas
98.30	77.40	56.10

QA/QC procedures (to be) applied:	-
Any comment:	Used in the *ex-post* calculation of the carbon emission factor in year *y*. The data on fuel consumption is already provided in energy units, tce. Therefore, there is no need to transform it into metric tons of fuel.

Data / Parameter:	**$EG_{BL, FF, y}$**
Data unit:	MWh
Description:	Electricity generation by grid connected TPPs in the period 2006-2008
Time of determination/monitoring:	PDD production
Source of data (to be) used:	State Committee of Statistic of Ukraine
Value of data applied (for ex ante calculations/determinations):	2006: 63,580,887; 2007: 67,486,510; 2008: 66,355,339
Justification of the choice of data or description of measurement methods and procedures (to be) applied	Best available official data.
QA/QC procedures (to be) applied:	-
Any comment:	Used in the *ex-post* calculation of the carbon emission factor in year *y*. The data on fuel consumption is already provided in energy units, tce. Therefore, there is no need to transform it into metric tons of fuel.

Data / Parameter:	**TDL**
Data unit:	%
Description:	Average technical transmission and distribution losses for providing electricity
Time of determination/monitoring:	PDD Production
Source of data (to be) used:	State Committee of Statistic of Ukraine
Value of data applied (for ex ante calculations/determinations):	13.5
Justification of the choice of data or description of measurement methods and procedures (to be) applied	Fixed
QA/QC procedures (to be) applied:	-
Any comment:	-

B.2. Description of how the anthropogenic emissions of greenhouse gases by sources are reduced below those that would have occurred in the absence of the JI project:

The Project reduces anthropogenic emissions of greenhouse gases below those that would have occurred in its absence as demonstrated in the following step-wise approach:

Step 1. Indication and description of the approach applied

Additionality is established using the approach described in Annex 1 to the JI Guidelines for baseline and monitoring, Paragraph 2 (b) (i), application of version 5.02 of the "Tool for demonstration and assessment of additionality".

Step 2. Application of the approach chosen

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

Step 1 is completed as part of the process of establishment of the baseline scenario in Section B.1.

Step 2: Investment Analysis

The Project will apply investment analysis and barrier analysis. Steps 2 and 3 of the Additionality Tool are completed as part of the baseline determination procedure in Section B.1.

The investment and barrier analyses above demonstrated that in the absence of JI financing, Option LFG2, continuation of the current practice and free release of LFG into the atmosphere is the only feasible option.

Step 4: Common practice analysis

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

There is only one project where a LFG collection and flaring system is installed, "Landfill methane capture and flaring at Yalta and Alushta Landfills, Ukraine", but that project is implemented under the JI framework. There are no LFG utilization projects in Ukraine that have been developed without the JI mechanism.

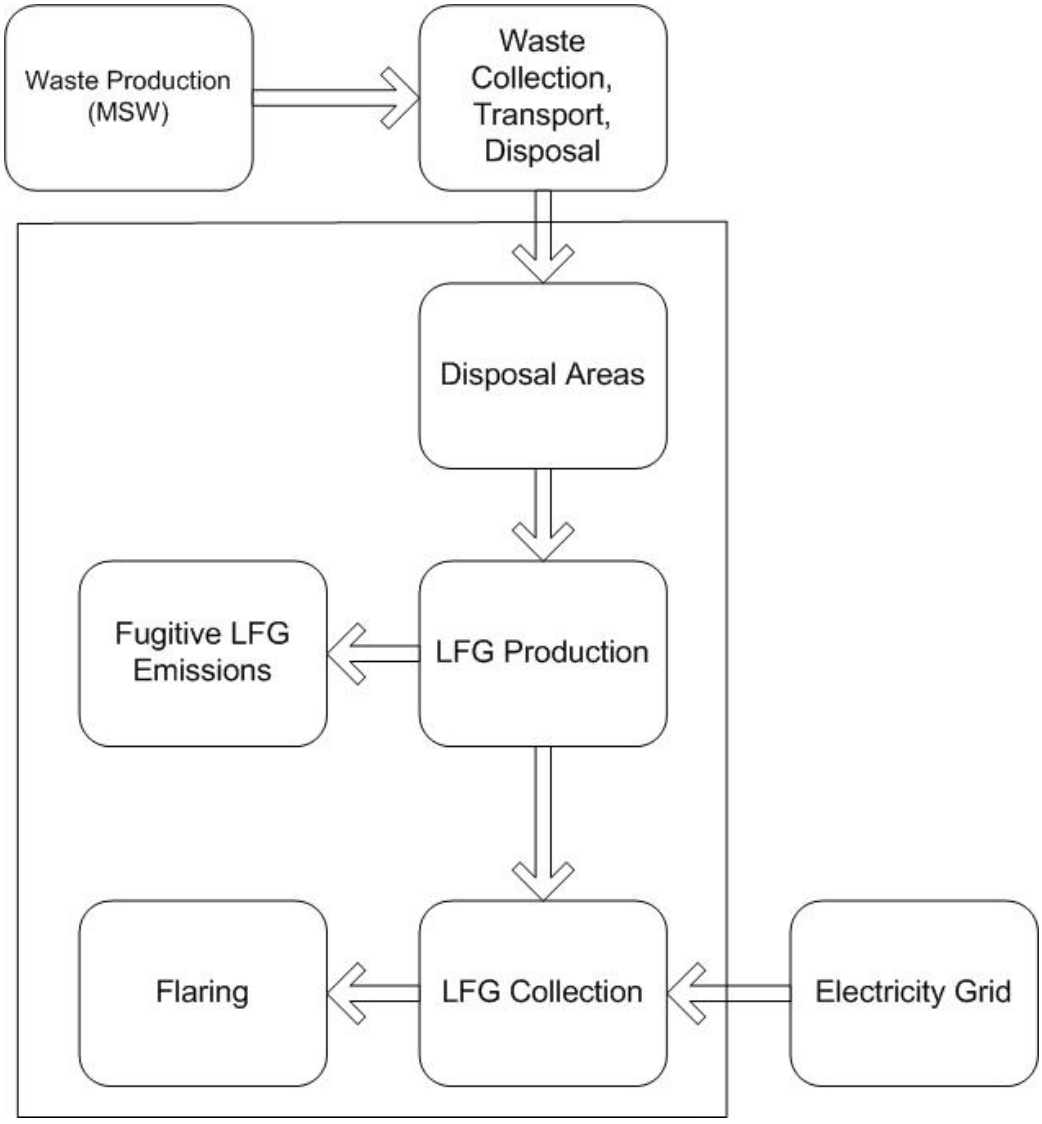
Sub-step 4: Discuss any similar Options occurring

Landfill sites in Ukraine are usually managed by local municipalities, which rely on their income from the state budget. The municipal governments are not required by law and will not allocate any funding for LFG capture and destruction, especially because such projects generate no additional income.

As no similar activities to the Project are observed or are expected to be observed in the future in the absence of JI financing, the Project is additional.

B.3. Description of how the definition of the project boundary is applied to the project:

The spatial extent of the Project boundary is the landfill site, as well as all power plants connected to the Ukrainian grid, as showed in the figure below.



Emission sources and gases included in or excluded from the Project boundary are listed in the below table:

	Source	Gas	Included?	Justification / Explanation
Baseline	Emissions from decomposition of waste at the landfill site	CH_4	Yes	The major source of emissions in the baseline
		N_2O	No	N_2O emissions are small compared to CH4 emissions from landfills. Exclusion of this gas is conservative.
		CO_2	No	CO_2 emissions from the decomposition of organic waste are not accounted
Project Activity	Emissions from on-site fossil fuel use	CO_2	No	Not applicable
		CH_4	No	Not applicable
		N_2O	No	Not applicable
	Emissions from on-site electricity use	CO_2	Yes	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.

B.4. Further baseline information, including the date of baseline setting and the name(s) of the person(s)/entity(ies) setting the baseline:

The Baseline Study was completed on 19/12/2009 by:

Clean Energy Finance Committee
Mitsubishi UFJ Securities Co. Ltd.
5-4-9 Toyosu, Koto-ku
Tokyo 135-0061, Japan
Tel: +81-3-6213-6382
Fax: +81-3-6213-6175
E-mail: arnaoudov-vladislav@sc.mufg.jp

SECTION C. Duration of the project / crediting period

C.1. Starting date of the project:

01/07/2010

C.2. Expected operational lifetime of the project:

20 years

C.3. Length of the crediting period:

01/07/2010 – 31/12/2019

Under the current JI rules, the crediting period can be extended until the end of the Project lifetime subject to a new agreement replacing the Kyoto Protocol and a decision by the Ukrainian government.

SECTION D. Monitoring plan

D.1. Description of monitoring plan chosen:

An outline of the monitoring plan is provided using a step-wise approach:

Step 1. Indication and description of the approach chosen regarding monitoring

In accordance with the JISC Guidelines for baseline and monitoring an approved simplified CDM baseline and monitoring methodology will be used. The monitoring plan is prepared in accordance with ACM0001, "Consolidated Baseline and Monitoring Methodology for Landfill Gas Project Activities", version 11.

Step 2. Application of the approach chosen

The monitoring plan is based on direct measurement of the amount of landfill gas captured and destroyed through electricity generation and flaring. The monitoring plan provides for continuous measurement of the quantity and quality of LFG flared. The main variables that are determined are the quantity of methane actually captured $MD_{project,y}$, and quantity of methane flared ($MD_{flared,y}$). The monitoring plan also measures the grid electricity consumed by the Project.

To determine these variables, the following parameters have to be monitored:

- The amount of landfill gas generated (in m³, using a continuous flow meter), where the total quantity ($LFG_{total,y}$) as well as the quantities fed to the flare(s) ($LFG_{flare,y}$) are measured continuously.

- The fraction of methane in the landfill gas ($w_{CH4,y}$) is measured with a continuous analyzer;

Methane fraction of the landfill gas and LFG flow have to be measured on same basis (either wet or dry). As per the "Tool to determine project emissions from flaring gases containing methane" the standard approaches to convert the flow from wet basis to dry basis are applied.

- The parameters used for determining the project emissions from flaring of the residual gas stream in year *y* ($PE_{flare,y}$) are monitored as per the "Tool to determine project emissions from flaring gases containing methane";

- Temperature (*T*) and pressure (*p*) of the landfill gas are monitored to determine the density of methane in the landfill gas;

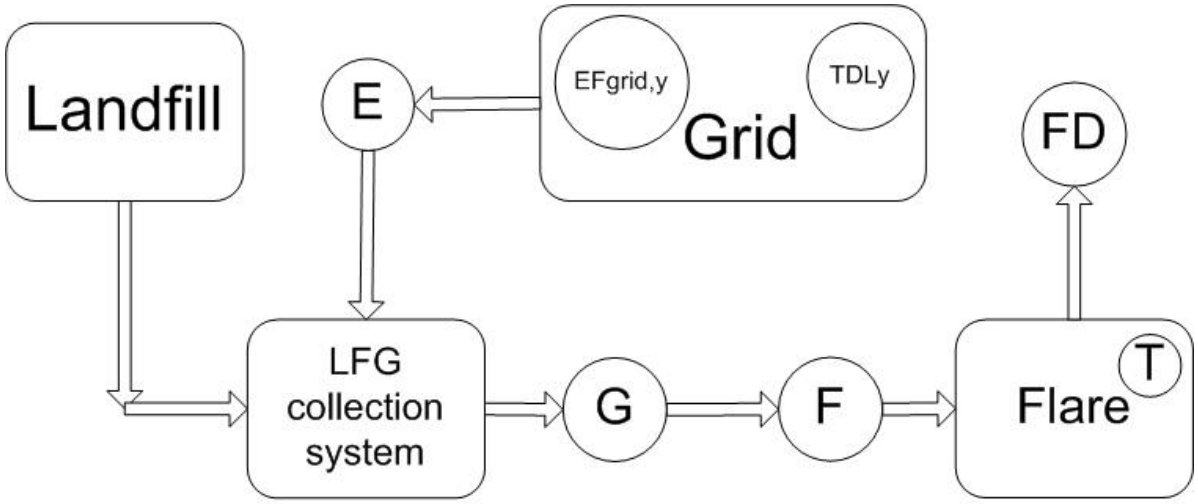
- The quantity of electricity imported, in the baseline and the project situation, to meet the requirements of the project activity, if any;

- Relevant regulations for LFG project activities will be monitored and updated at renewal of the credit period. Changes to regulation will be converted to the amount of methane that would have been destroyed/combusted during the year in the absence of the Project ($MD_{BL,y}$).

The measurement equipment for gas quality (humidity, particulate, etc.) is sensitive, so a strong QA/QC procedure for the calibration of this equipment will be implemented as per the Ukrainian national standards.

As per ACM0001, a **continuous monitoring system** for methane fraction of the landfill gas and LFG flow will be installed to continuously acquire data from the process (continuous sampling) in order to process it and deliver the required information (methane fraction of the landfill gas and LFG flow) as an average value in a time interval not greater than an hour. Paired values of the methane fraction of the landfill gas and LFG flow which are averaged for the same time interval will be used in the calculation of emission reductions (i.e. methane fraction of landfill gas averaged at hour x will be used with LFG flow which is averaged at the same hour x).

The monitoring system is presented in Figure 5 below.



G - Gas analyzer to measure methane fraction in LFG
F - Flow meter to continuously measure the flow of LFG fed to the flare and give the flow at normal conditions
T - Thermal couple to measure the temperature of the Exhaust Gas of the flare
FD - Flame detector
E - Electricity meter to measure the electricity supply from the grid
EFgrid,y - The emission factor for electricity generation from project electricity consumption in year y
TDLy - Average technical transmission and distribution losses in the grid in year y

Figure 5. Monitoring System

D.1.1. Option 1 – Monitoring of the emissions in the project scenario and the baseline scenario:

This section is left blank on purpose as Option 2 is selected.

D.1.1.2. Description of formulae used to estimate project emissions (for each gas, source etc.; emissions in units of CO_2 equivalent):

D.1.1.4. Description of formulae used to estimate baseline emissions (for each gas, source etc.; emissions in units of CO_2 equivalent):

D. 1.2. Option 2 – Direct monitoring of emission reductions from the project (values should be consistent with those in section E.):

a) Data and parameters that are not monitored throughout the crediting period but are determined only once (and thus remain fixed throughout the crediting period), and that are available already at the stage of determination regarding the PDD:

Data / Parameter:	**D_{CH4}**
Data unit:	tCH_4/m^3CH_4
Description:	Methane Density
Time of determination/monitoring:	PDD production
Source of data (to be) used:	ACM0001
Value of data applied (for ex ante calculations/determinations):	0.0007168
Description of measurement methods and procedures (to be) applied:	At standard temperature and pressure (0 degree Celsius and 1,013 bar) the density of methane is 0.0007168 tCH_4/m^3CH_4
QA/QC procedures (to be) applied:	-
Any comment:	Same monitoring item as $\rho_{CH4,n}$

Data / Parameter	$\eta_{flare,h}$
Data unit	%
Description	Flare efficiency in hour h

Time of determination/monitoring	PDD production
Source of data (to be) used	The default value of "Tool to determine project emissions from flaring gases containing methane"
Value of data applied (for ex ante calculations/determinations)	90 % - default value 50 % - if in a particular hour any of the flare operation parameters are out of the limits of the manufacturer's specifications. 0 % - if in a particular the recorded temperature is under 500 ^{o}C
Description of measurement methods and procedures (to be) applied:	The default values of "Tool to determine project emissions from flaring gases containing methane"
QA/QC procedures (to be) applied	-
Any comment	-

Data / Parameter:	$\boldsymbol{EF_{elec,BL,y}}$
Data unit:	tCO_2/MWh
Description:	Carbon emission factor of the Ukrainian grid
Time of determination/monitoring	PDD production
Source of data (to be) used	National Committee of Statistics of Ukraine, Ukrainian GHG inventory submission (May 2009)
Value of data applied (for ex ante calculations/determinations)	1.104
Description of measurement methods and procedures (to be) applied:	See Annex 2.
QA/QC procedures (to be) applied	-
Any comment	-

Data / Parameter:	**$FC_{i,y}$**
Data unit:	tce
Description:	Amount of each fossil fuel consumed by grid connected TPPs in the period 2006 - 2008
Time of determination/monitoring:	PDD production
Source of data (to be) used:	State Committee of Statistic of Ukraine
Value of data applied (for ex ante calculations/determinations):	

	Coal	Fuel oil	Natural Gas
2006	23,181,898	146,352	1,953,662
2007	23,984,018	82,019	2,532,617
2008	24,658,487	99,901	1,721,885

Description of measurement methods and procedures (to be) applied:	Fixed
QA/QC procedures (to be) applied:	-
Any comment:	Used in the *ex-post* calculation of the carbon emission factor in year *y*. The data on fuel consumption is already provided in energy units, tce. Therefore, there is no need to transform it into metric tons of fuel.

Data / Parameter:	**$EF_{CO2,i}$**
Data unit:	tCO_2/TJ
Description:	Carbon emission factor of each fuel type
Time of determination/monitoring:	PDD production
Source of data (to be) used:	The most recent submission of the Ukrainian National GHG Inventory, May 2009
Value of data applied (for ex ante calculations/determinations):	

Coal	Fuel oil	Natural Gas
98.30	77.40	56.10

Description of measurement methods and procedures (to be) applied:	Fixed
QA/QC procedures (to be) applied:	-
Any comment:	Used in the *ex-post* calculation of the carbon emission factor in year *y*. The data on fuel consumption is already provided in energy units, tce. Therefore, there is no need to transform it into metric tons of fuel.

Data / Parameter:	**$EG_{BL, FF, y}$**
Data unit:	-
Description:	Electricity generation by grid connected TPPs in the period 2006-2008
Time of determination/monitoring:	PDD production
Source of data (to be) used:	State Committee of Statistic of Ukraine
Value of data applied (for ex ante calculations/determinations):	2006: 63,580,887; 2007: 67,486,510; 2008: 66,355,339
Description of measurement methods and procedures (to be) applied:	Fixed
QA/QC procedures (to be) applied:	-
Any comment:	Used in the *ex-post* calculation of the carbon emission factor in year *y*. The data on fuel consumption is already provided in energy units, tce. Therefore, there is no need to transform it into metric tons of fuel.

Data / Parameter:	**TDL**
Data unit:	%
Description:	Average technical transmission and distribution losses for providing electricity

Time of determination/monitoring:	PDD Production
Source of data (to be) used:	State Committee of Statistic of Ukraine
Value of data applied (for ex ante calculations/determinations):	13.5
Description of measurement methods and procedures (to be) applied:	Fixed
QA/QC procedures (to be) applied:	-
Any comment:	-

b) Data and parameters that are not monitored throughout the crediting period, but are determined only once (and thus remain fixed throughout the crediting period), but that are not already available at the stage of determination regarding the PDD.

There are no parameters applicable to this category.

c) Data and parameters that are monitored throughout the crediting period:

Data / Parameter	**$LFG_{total,y}$**
Data unit	m^3
Description	Total amount of landfill gas captured
Time of determination/monitoring	Monitored constantly
Source of data to be used	On-site measurements
Value of data applied (for ex ante calculations/determinations)	

Year	Nm^3
2010	1,729,283
2011	3,308,090
2012	3,164,493
2013	3,027,448

	2014: 2,896,641 2015: 2,771,776 2016: 2,652,569 2017: 2,538,753 2018: 2,430,072 2019: 2,326,284
Description of measurement methods and procedures (to be) applied:	Measured continuously using a flow meter. Data to be aggregated monthly and yearly.
QA/QC procedures to be applied	Flow meters will be subject to a regular maintenance and testing regime to ensure accuracy.
Any comment	-

Data / Parameter	**$LFG_{flare,y}$**
Data unit	m^3
Description	Amount of landfill gas flared
Time of determination/monitoring	Monitored constantly
Source of data to be used	On-site measurements
Value of data applied (for ex ante calculations/determinations)	Year: Nm^3 2010: 1,729,283 2011: 3,308,090 2012: 3,164,493 2013: 3,027,448 2014: 2,896,641 2015: 2,771,776 2016: 2,652,569

	2017: 2,538,753 2018: 2,430,072 2019: 2,326,284
Description of measurement methods and procedures (to be) applied:	Measured continuously using a flow meter. Data to be aggregated monthly and yearly.
QA/QC procedures to be applied	Flow meters will be subject to a regular maintenance and testing regime to ensure accuracy.
Any comment	-

Data / Parameter	**$FV_{RG,h}$**
Data unit	m^3/h
Description	Volumetric flow rate of the residual gas in dry basis at normal condition in the hour h
Time of determination/monitoring	Monitored constantly
Source of data to be used	On-site measurement
Value of data applied (for ex ante calculations/determinations)	

Year	Nm^3
2010	197
2011	378
2012	361
2013	346
2014	331
2015	316
2016	303
2017	290
2018	277

	2019 | 266
Description of measurement methods and procedures (to be) applied:	Measured continuously using a flow meter. Values to be averaged hourly. The same bases (dry or wet) is considered for this measurement and the measurement of volumetric fraction of all components in the residual gas ($fv_{i,h}$) when the residual gas temperature exceed 60℃.
QA/QC procedures to be applied	Flow meters will be periodically calibrated according to the manufacturer's recommendation.
Any comment	These values will be used for the calculation of project emissions from flaring of residual gas stream in year y ($PE_{flare, y}$).

Data / Parameter	**Flare operation parameter**
Data unit	min/h
Description	Minutes that flare is detected during the hour h
Time of determination/monitoring	Monitored constantly
Source of data to be used	On-site measurement
Value of data applied (for ex ante calculations/determinations)	60 min/h
Justification of the choice of data or description of measurement methods and procedures (to be) applied	Measured continuously using a flame detector.
QA/QC procedures to be applied	-
Any comment	These values will be used for the calculation of project emissions from flaring of residual gas stream in year y ($PE_{flare, y}$). If is more than 20 min/h during the hour h, 50% of flare efficiency will be applied for the hour h, otherwise 0% will be applied.

Data / Parameter	$w_{CH4,y}$
Data unit	m^3CH_4/m^3LFG
Description	Methane fraction in the landfill gas
Time of determination/monitoring	Monitored constantly
Source of data to be used	On-site measurements
Value of data applied (for ex ante calculations/determinations)	50%
Description of measurement methods and procedures (to be) applied:	Before the open flare system is installed, this parameter will be measured periodically using a portable gas analyser. After installation of the open flare system, this parameter will be measured continuously using a continuous gas. analyser.
QA/QC procedures to be applied	Analysers will be periodically calibrated according to the manufacturer's recommendation. A zero check and a typical value check will be performed by comparison with a standard certified gas.
Any comment	The monitored parameter is also used for $fv_{CH4,h}$ in case this parameter is measured continuously using continuous gas analyser.

Data / Parameter	T
Data unit	^0C
Description	Temperature of the landfill gas
Time of determination/monitoring	Monitored constantly
Source of data to be used	On-site measurements using thermocouple by the gas flow meter of the flare
Value of data applied (for ex ante calculations/determinations)	-
Description of measurement methods and procedures (to be) applied:	Measured periodically
QA/QC procedures to be	-

applied	
Any comment	-

Data / Parameter	**p**
Data unit	Pa
Description	Pressure of the landfill gas
Time of determination/monitoring	Monitored constantly
Source of data to be used	On-site measurements
Value of data applied (for ex ante calculations/determinations)	-
Description of measurement methods and procedures (to be) applied:	Measured periodically to determine the density of methane (D_{CH4}) using a pressure transmitter.
QA/QC procedures to be applied	-
Any comment	-

Data / Parameter	**EL_{IMP}**
Data unit	MWh
Description	Total amount of electricity imported to meet project requirement
Time of determination/monitoring	
Source of data to be used	On-site measurements
Value of data applied (for ex ante calculations/determinations)	175.2 MWh/yr
Description of measurement methods and procedures (to be)	Measured continuously using an electricity meter.

applied:	
QA/QC procedures to be applied	-
Any comment	Cross check with the invoices for electricity purchase if any

Data / Parameter	**-**
Data unit	-
Description	Regulatory requirements relating to landfill gas projects
Time of determination/monitoring	
Source of data to be used	Local/national data
Value of data applied (for ex ante calculations/determinations)	-
Description of measurement methods and procedures (to be) applied:	The information will be recorded annually.
QA/QC procedures to be applied	-
Any comment	-

No additional parameters have to be monitored in accordance with Ukrainian environmental legislation.

D.1.2.2. Description of formulae used to calculate emission reductions from the project (for each gas, source etc.; emissions/emission reductions in units of CO_2 equivalent):

The methodology ACM0001 "Consolidated monitoring methodology for landfill gas projects activities" uses the following formula for estimation of the GHG emissions reductions from the Project:

Emission Reductions

$ER_y = BE_y - PE_y$

where:

ER_y	Emission reductions in year y (tCO2e/yr)
BE_y	Baseline emissions in year y (tCO_2e/yr)
PE_y	Project emissions in year y (tCO_2/yr)

Baseline Emissions

Baseline emissions in a given year "y" (BE_y) are estimated as follows:

$BE_y = MD_{project,y} * GWP_{CH4}$

where:

BE_y	Baseline emissions in year y (tCO_2e)
$MD_{project,y}$	The amount of methane that would have been destroyed/combusted during the year, in tonnes of methane (tCH_4) in project scenario
GWP_{CH4}	the Global Warming Potential value for methane for the first commitment period is 21 tCO_2e/tCH_4

where

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

where:

$MD_{flared,y}$	Quantity of methane destroyed by flaring (tCH_4)

$MD_{flared,y} = (LFG_{flare,y} * w_{CH4,y} * D_{CH4}) - (PE_{flare,y} / GWP_{CH4})$

where:

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

As explained in the section B.1, an open flaring system is selected to burn excess LFG. As per the guideline in the "Methodological Tool to determine project emissions from flaring gases containing methane", following equations are used to calculate project emissions from flaring of the residual gas ($PE_{flare,y}$)

$$PE_{flare,y} = \sum_{h=1}^{8760} TM_{RG,h} \times (1 - \eta_{flare,h}) \times \frac{GWP_{CH4}}{1000}$$

where:

$TM_{RG,h}$	Mass flow rate of methane in the residual gas in the hour h (kg/h)
$\eta_{flare,h}$	Flare efficiency in hour h

And

$$TM_{RG,h} = FV_{RG,h} \times fv_{CH4.RG,h} \times \rho_{CH4,n}$$

where:

$FV_{RG,h}$	Volumetric flow rate of the residual gas in dry basis at normal conditions in hour h (m_3/h) (monitored)
$fv_{CH4,RG,h}$	Volumetric fraction of methane in the residual gas on dry basis in hour h (monitored)

$\rho_{CH4,n}$ Density of methane at normal conditions (0.716 kg/m_3)

And

Flare efficiency ($\eta_{flare,h}$)

- 90 % - default value
- 50 % - if in a particular hour any of the flare operation parameters are out of the limits of the manufacturer's specifications.
- 0 % - if in a particular the recorded temperature is under 500 ^oC

Project Emissions

Project emissions are the emissions from the net import of electricity from the grid to the Project.

Determination of $CEF_{elec,BL,y}$

For estimation of the $CEF_{elec,BL,y}$, the "Tool to calculate the emission factor for an electricity system" is applied. OM margin is determined ex-post using the data for the last available three years, 2006 -2008. Unlike the prescriptions of the Tool the CEF is estimated only as the Operating Margin of the Ukrainian grid and the Build Margin is assumed to be zero.

The $CEF_{elec,BL,y}$ is fixed ex-ante and not monitored. Further information is provided in Annex 2.

Project emissions are calculated as follows:

$PE_{EC,y} = EC_{PJ,y} * FE_{EL,y} *(1 + TDL_y)$

$EC_{PJ,y}$ Quantity of electricity consumed by the project activity during the year y (MWh)
$FE_{EL,y}$ The emission factor for electricity generation from project electricity consumption in year y (tCO_2e/MWh)
TDL_y Average technical transmission and distribution losses in the grid in year y for the

voltage level at which electricity is obtained from the grid at the project site

D.1.3. Treatment of leakage in the monitoring plan:

According to ACM0001, the Project results in no leakage.

D.1.3.2. Description of formulae used to estimate leakage (for each gas, source etc.; emissions in units of CO_2 equivalent):

D.1.4. Description of formulae used to estimate emission reductions for the project (for each gas, source etc.; emissions/emission reductions in units of CO_2 equivalent):

Emission Reductions

Emission reductions are calculated as follows:

$ER_y = BE_y - PE_y$

where:

ER_y	Emission reductions in year y (tCO2e/yr)
BE_y	Baseline emissions in year y (tCO_2e/yr)
PE_y	Project emissions in year y (tCO_2/yr)

D.1.5. Where applicable, in accordance with procedures as required by the host Party, information on the collection and archiving of information on the environmental impacts of the project:

No additional information has to be collected.

D.2. Quality control (QC) and quality assurance (QA) procedures undertaken for data monitored:

Data *(Indicate table and ID number)*	Uncertainty level of data (high/medium/low)	Explain QA/QC procedures planned for these data, or why such procedures are not necessary.
$LFG_{total,y}$	Low	Flow meters will be subject to a regular maintenance and periodical calibration according to the manufacturer's recommendation to ensure accuracy.
$LFG_{flared,y}$	Low	Flow meters will be subject to a regular maintenance and periodical calibration according to the manufacturer's recommendation to ensure accuracy.
$PE_{flare,y}$	Low	All equipment used to collect data will be subject to regular maintenance and calibration according to the manufacturer's recommendation to ensure accuracy.
$W_{CH4,y}$	Low	The gas analyser will be subject to a regular maintenance and testing regime to ensure accuracy.
T	Low	The temperature probe should be subject to a regular maintenance and testing regime to ensure accuracy.
P	Low	The pressure gauge should be subject to a regular maintenance and testing regime to ensure accuracy.
T_{flare}	Low	Analysers will be periodically calibrated according to the manufacturer's recommendation. A zero check and a typical value check will be performed by comparison with a standard certified gas.
EL_{imp}	Low	Electricity meters will be subject to a regular maintenance and testing regime to ensure accuracy. Amount of electricity exported will be double checked with receipt of sale.
CEF	Low	Default data for emission factors will be used. All sources where data is obtained are cited and come from reputable sources.

D.3. Please describe the operational and management structure that the project operator will apply in implementing the monitoring plan:

Figure 6 below outlines the operational and management structure that Nedra Luganshchiny, Ltd. has implemented to monitor emission reductions generated by the Project. Nedra Luganshchiny, Ltd. has formed an operational and management team, which will be responsible for monitoring of all the parameters aforementioned. This team composes of a general manager and a group of operators. A group of operators, who are under the supervision of the general manager, are assigned for monitoring of different parameters on a timely basis as well as recording and archiving data in an orderly manner. Operators will be trained in the operation of all monitoring equipment and all readings will be taken under the supervision of management. An operations manual will be developed for the operating personnel.

Quality control and assurance procedures are to be undertaken for data monitored as outlined in the monitoring plan. A database will be maintained to record all relevant data as outlined in the monitoring plan. Monitoring reports are forwarded to and reviewed by the general manager on a monthly basis in order to ensure the Project follows the requirements of the monitoring plan.

All monitoring equipment will be installed by experts using standard methods. Once installed, this equipment will be calibrated to the highest standards by Project staff. Any irregularities or problems with equipment will be reported to management and rectified as soon as possible.

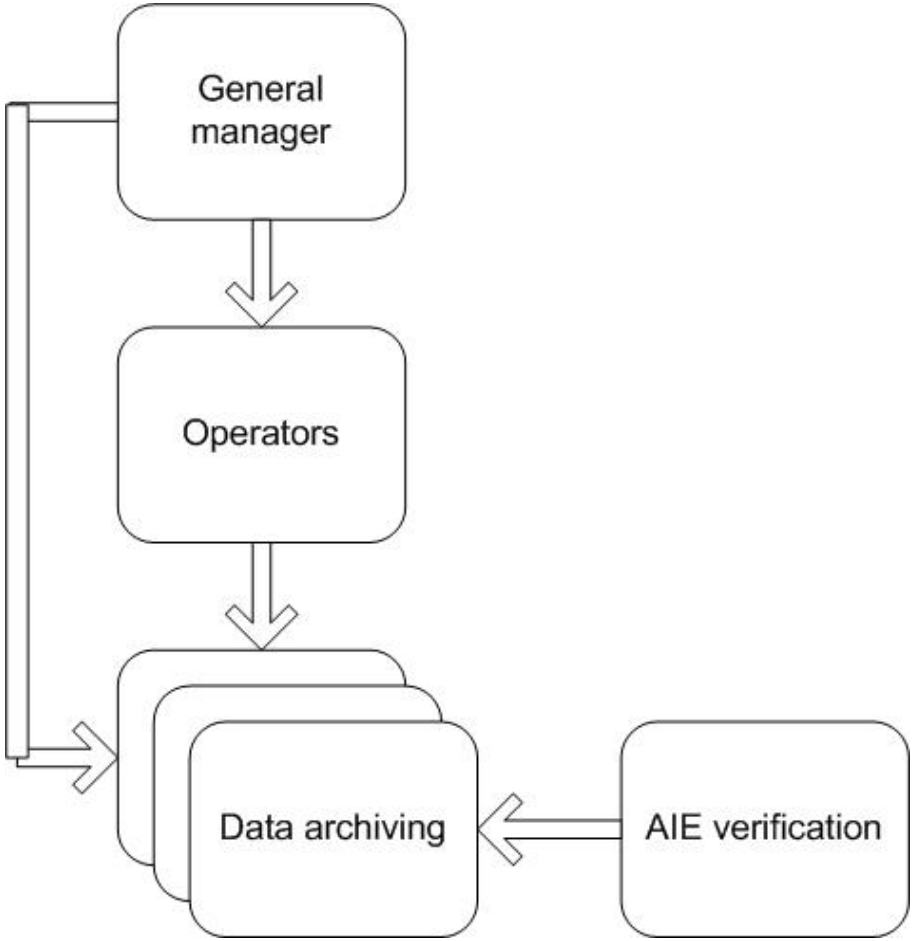


Figure 6. Operating and Management Structure of the Project

D.4. Name of person(s)/entity(ies) establishing the monitoring plan:

The monitoring plan was completed on 19/12/2009 by:

Clean Energy Finance Committee
Mitsubishi UFJ Securities Co. Ltd.
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Tokyo 135-0061, Japan
Tel: +81-3-6213-6382
Fax: +81-3-6213-6175
E-mail: arnaoudov-vladislav@sc.mufg.jp

SECTION E. Estimation of greenhouse gas emission reductions

Following the instructions outlined in the ACM0001, *ex ante* emission reduction estimates for methane gas are estimated for reference purposes only. The emission reductions will be determined on an *ex post* basis by measuring data that is stipulated in the monitoring plan.

E.1. Estimated project emissions:

The only Project emissions are forming the import of electricity from the grid.

$PE_y = PE_{EC,y}$

Where:

PE_y	Project emission in year y
$PE_{EC,y}$	Emissions from consumption of electricity in the Project case. The emissions from electricity purchase from the grid will be calculated using as per the "tool to calculate baseline, project and/or leakage emissions from electricity consumption". When electricity is directly supplied from the landfill gas engines no emissions are accounted.

Project emissions and calculated following the latest version of "Tool to calculate project emissions from electricity consumption", as follows:

$PE_{EC,y} = EC_{PJ,y} * FE_{EL,y} *(1 + TDL_y)$

Where

$EC_{PJ,y}$	Quantity of electricity consumed by the project activity during the year y (MWh)
$FE_{EL,y}$	The emission factor for electricity generation from project electricity consumption in year y (tCO_2e/MWh)
TDL_y	Average technical transmission and distribution losses in the grid in year y for the voltage level at which electricity is obtained from the grid at the project site

$EC_{PL,y} = 175.2$ MWh/year

$FE_{EL,y} = 1.104\ tCO_2e/MWh$

$TDL_y = 13.5\%$

An example of the calculations is given below:

$PE_{EC,,y} = 175.2\ MWh * 1.104 tCO_2e/MWh * (1+13.5\%) = 220\ tCO_2$

E.2. Estimated leakage:

According to ACM0001, leakage from this Project is insignificant and therefore does not need to be taken into account.

E.3. The sum of E.1. and E.2.:

Table 3. Project Emissions (2010 – 2012)

Year	Project Emissions CO_2 t/y
2010	110
2011	220
2012	220
Total	**549**

Table 4. Project Emissions (2013 – 2019)

Year	Project Emissions CO_2 t/y
2013	220
2014	220
2015	220
2016	220
2017	220
2018	220
2019	220
Total	**1,537**

E.4. Estimated baseline emissions:

ACM0001 stipulates that an Adjustment Factor (AF) for regulatory or contractual requirements shall be used and justified, taking into account the context of the Project. The AF has been set at 0% due to the fact that there are no enforced regulatory or contractual requirements for LFG collection/utilization in Ukraine.

As explained in the section B.1., an enclosed flaring system is selected to combust LFG. As per the guidelines in the "Methodological Tool to determine project emissions from flaring gases containing methane", default values of flare efficiency will be used. For *ex ante* project emission calculation, 90% of flare efficiency will be used.

$BE_y = MD_{project,y} * GWP_{CH4}$

For illustrative purposes, data for 2010 is used

$BE_y = 558 CH_4$ t/y * 21 = 11,714 CO_2 t/y

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

$MD_{project,y} = 558$ tCH_4 /y

$MD_{flared,y} = (LFG_{flare,y} * w_{CH4,y} * D_{CH4}) - (PE_{flare,y} / GWP_{CH4})$

$LFG_{flare,y} * w_{CH4,y} * D_{CH4} = 1,729,283\ m^3/y * 50\% * 0.0007168 = 620\ tCH_4/y$

$PE_{flare,y} = (1,729,283\ m^3/y * 50\% * 0.0007168) * 10\% * 21 = 1,302\ tCO_2\ t/y$

$MD_{flared,y} = 620\ CH_4\ t/y - 1,302\ CO_2\ t/y / 21 = 558 CH_4\ t/y$

Data for the whole project life is presented in Tables 3 and 4.

Table 5. Baseline Emissions (2010 – 2012)

Year	Baseline Emissions CO_2 t/y
2010	11,714
2011	22,408
2012	21,436
Total	**55,557**

Table 6. Baseline Emissions (2013 – 2019)

Year	Baseline Emissions CO_2 t/y
2013	20,507
2014	19,621
2015	18,775
2016	17,968
2017	17,197
2018	16,461
2019	15,758
Total	**126,287**

E.5. Difference between E.4. and E.3. representing the emission reductions of the project:

$ER_y = BE_y - PE_y$

The results of the estimates for the emission reductions are provided below.

Table 7. Emission Reductions (2010 – 2012)

Year	Emission Reductions CO_2 t/y
2010	11,604
2011	22,189
2012	21,216
Total	**55,009**

Table 8. Emission Reductions (2013 – 2019)

Year	Emission Reductions CO_2 t/y
2013	20,288
2014	19,402
2015	18,556
2016	17,748
2017	16,977
2018	16,241
2019	15,538
Total	**124,750**

E.6. Table providing values obtained when applying formulae above:

Year	Estimated baseline emissions (tonnes of CO_2 equivalent)	Estimated project emissions (tonnes of CO_2 equivalent)	Estimated leakage (tonnes of CO_2 equivalent)	Estimated emission reductions (tonnes of CO_2 equivalent)
2010	11,714	110	0	11,604
2011	22,408	220	0	22,189
2012	21,436	220	0	21,216
Total (tonnes of CO_2 equivalent)	**55,557**	**549**	**0**	**55,009**
Annual Average (tonnes of CO_2 equivalent)	**18,519**	**183**	**0**	**18,336**

Year	Estimated baseline emissions (tonnes	Estimated project emissions (tonnes of CO_2	Estimated leakage (tonnes of CO_2	Estimated emission reductions

	of CO_2 equivalent)	equivalent)	equivalent)	(tonnes of CO_2 equivalent)
2013	20,507	220	0	20,288
2014	19,621	220	0	19,402
2015	18,775	220	0	18,556
2016	17,968	220	0	17,748
2017	17,197	220	0	16,977
2018	16,461	220	0	16,241
2019	15,758	220	0	15,538
Total (tonnes of CO_2 equivalent)	**126,287**	**1,537**	**0**	**124,750**
Annual Average (tonnes of CO_2 equivalent)	**18,041**	**220**	**0**	**17,821**

SECTION F. Environmental impacts

F.1. Documentation on the analysis of the environmental impacts of the project, including transboundary impacts, in accordance with procedures as determined by the host Party:

The Project has completed all necessary procedures for the assessment and analysis of its environmental impact as per Ukrainian legislation, mainly described in State Construction Standards DBN A.2.2-1-2003. These involve completion of an Environmental Impact Assessment Study, as well as public disclosure of information about the landfill in the media. No public hearings are required.

The implementation of the Project will deliver a number of positive environmental effects. The collection of LFG prevents the accumulation of biogas inside the landfill, which can cause explosions or spontaneous fires. The flaring of landfill will also reduce the emissions of odorous gases, as well as methane, which is a highly potent greenhouse gas.

As a result of this Project the following positive environmental effects will be achieved:

People

Collection and utilization of biogas reduces the risk of explosions and potential negative health effects on nearby residents, as well as on landfill management staff.

Flora and Fauna

Management and closure of landfills create a less favorable environment for growth of parasites and outbreak of diseases. Closed managed landfills also do not attract scavenger birds such as ravens and crows, thus having an additional positive effect on the environment. The Project also will reduce the concentration of methane in the atmosphere that destroys the vegetation in the vicinity of the landfill site.

Air

Highly efficient LFG flaring system guarantees almost complete decomposition of methane and other toxic gases contained in LFG, which would have otherwise been freely emitted into the atmosphere in the absence of the Project.

Landscape

Covering and leveling of the surface of the landfill with sand and inert materials will allow it to fit better with the surrounding landscape. The presence of the flare, blowers and the associated noise and vibration will be minimal and within the limits defined in Ukrainian legislation.

Conclusions

Collection of biogas and its utilization have a significant positive impact on the environment. Reduced emissions of greenhouse gases, mainly methane, and odorous gases will have reduce the occurrence of spontaneous fires, and reduce health and environmental hazards.

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

The EIA Study concluded that the environmental impacts of project activities are insignificant and no further action is required.

SECTION G. Stakeholders' comments

G.1. Information on stakeholders' comments on the project, as appropriate:

Stakeholder consultations on the Project were held in Lugansk Oblast in cities close to the landfill in the Oleksandrivsk Town on 10th December 2009 and in Lugansk City on 11th December 2009. The consultations were widely publicized in the evening newspaper "Lugansk Evening City" and on the local televison. Over 40 participants attended the meetings including representatives from the United Nations Development Programme (UNDP), the Lugansk Regional State Administration, the Lugansk Municipal Council, the Lugansk Regional State Council, the Department of Ecology in Lugansk Region, the Department of Ecology in Lugansk City, the Public Community of Lugansk City, and the Public Community of Oleksandrivsk Town. Private sector representatives from the companies Nedra Luganschiny, Mittalservice Ltd., and United Cargo Transport Company also attended the meetings. In addition, there were representatives from the environmental NGO "Green Wave", as well as local residents from both the Oleksandrivsk and Lugansk communities. In general, the comments received on the Project were positive. Most of the comments focused on the specific project itself. However, some comments were related to the overall management of the landfill and the landfill site.

Feedback from the stakeholder meetings was that it would be preferable, if possible, to use the captured methane gas to produce heat and/or electricity. Nedra Luganshiny explained that in the first phase of the project this was not possible, due to low estimates about the amount of methane gas available in the landfill making such an investment likely to not be economically viable, but that it could be considered at a later stage once the precise volume of gas is known. Secondly, stakeholders requested that the Ukrainian environmental legislation which requires at least three meter of soil for capping the landfill be rigorously applied. They were informed that this would be the case as part of the Project. Thirdly, stakeholder comments by one commentator also requested the complete closure of the second section of the landfill. It was explained that by capping the project and capturing methane and flaring this would indeed be the case and that odor from the landfill would be reduced improving local air pollution in addition to the global benefit of reducing greenhouse gas emissions. Finally, an additional comment was received during the ten day commenting period which focused on the relevance of the project for the city and its positive benefits in terms of reducing greenhouse gas emissions.

Full records from the stakeholder consultations and the comments which have been received on this Project during the stakeholder meetings and the stakeholder consultation period can be provided upon request.

Annex 1

CONTACT INFORMATION ON PROJECT PARTICIPANTS

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E-mail:	NedraLugansk@i.ua
URL:	www.nedralugansk.com.ua
Represented by:	
Title:	Head of Department
Salutation:	Mr.
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FAX:	
E-Mail:	
URL:	
Represented by:	
Title:	
Salutation:	
Last name:	
Middle name:	
First name:	
Department:	
Phone (direct):	
Fax (direct):	
Mobile:	
Personal e-mail:	

Annex 2

BASELINE INFORMATION

Table 9. Information about the landfill

Parameter	Units	Data
Landfill data		
Year landfill started operation		1979
Waste in place at the beginning of Project	M tons	2.010
Area of site	Ha	11,6
Date gas collection project starts		01.01.2010
Project operational data		
Gas collection efficiency	%	60%
General data		
Methane content of landfill gas	%	67.9%
GWP of CH_4	tCO_2/tCH_4	21
Density of Methane	tCH_4/m^3	0.0007168
Baseline data		
The emission factor for electricity generation from project electricity consumption in year	tCO_2e/ MWh.	1.104
Proportion of methane flared in Baseline (AF)	-	0%

Table 10. Share of Various Types of Waste

WASTE TYPE	Share
Wood and wood products	3.00%
Pulp, paper and cardboard	30.00%
Food, food waste, beverages and tobacco	30.00%
Textiles	5.00%
Garden, yard and park waste	0.00%
Glass, plastic, metal, other inert waste	32.00%

Table 11. Amount of MSW disposed at the landfill

Year	Annual Amount	Wood and Wood Products	Pulp, Paper and Cardboard	Food, Food waste Beverages and Tobacco	Textile	Garden, Yard and Park Waste	Inert Waste	Aggregate Amount
-	*t/year*	*t/year*	*t/year*	*t/year*	*t/year*	*t/year*	*t/year*	*t*
1979	44,000	1,320	13,200	13,200	2,200	0	14,080	44,000
1980	55,132	1,654	16,540	16,540	2,757	0	17,642	99,132
1981	61,666	1,850	18,500	18,500	3,083	0	19,733	160,798
1982	63,888	1,917	19,166	19,166	3,194	0	20,444	224,686
1983	67,166	2,015	20,150	20,150	3,358	0	21,493	291,852
1984	70,576	2,117	21,173	21,173	3,529	0	22,584	362,428
1985	71,588	2,148	21,476	21,476	3,579	0	22,908	434,016
1986	72,226	2,167	21,668	21,668	3,611	0	23,112	506,242
1987	72,710	2,181	21,813	21,813	3,636	0	23,267	578,952
1988	72,568	2,177	21,770	21,770	3,628	0	23,222	651,520
1989	73,744	2,212	22,123	22,123	3,687	0	23,598	725,264
1990	74,162	2,225	22,249	22,249	3,708	0	23,732	799,426
1991	74,690	2,241	22,407	22,407	3,735	0	23,901	874,116
1992	74,866	2,246	22,460	22,460	3,743	0	23,957	948,982
1993	73,744	2,212	22,123	22,123	3,687	0	23,598	1,022,726
1994	71,478	2,144	21,443	21,443	3,574	0	22,873	1,094,204
1995	68,564	2,057	20,569	20,569	3,428	0	21,940	1,162,768
1996	69,388	2,082	20,816	20,816	3,469	0	22,204	1,232,156
1997	68,772	2,063	20,632	20,632	3,439	0	22,007	1,300,928
1998	68,310	2,049	20,493	20,493	3,416	0	21,859	1,369,238
1999	66,286	1,989	19,886	19,886	3,314	0	21,212	1,435,524
2000	59,400	1,782	17,820	17,820	2,970	0	19,008	1,494,924
2001	63,404	1,902	19,021	19,021	3,170	0	20,289	1,558,328
2002	71,037	2,131	21,311	21,311	3,552	0	22,732	1,629,365
2003	74,052	2,222	22,216	22,216	3,703	0	23,697	1,703,417
2004	75,163	2,255	22,549	22,549	3,758	0	24,052	1,778,580
2005	76,290	2,289	22,887	22,887	3,815	0	24,413	1,854,870
2006	77,435	2,323	23,231	23,231	3,872	0	24,779	1,932,305
2007	78,596	2,358	23,579	23,579	3,930	0	25,151	2,010,901
2008	0	0	0	0	0	0	0	2,010,901
2009	0	0	0	0	0	0	0	2,010,901

Estimation of the Grid Emission Factor of Ukraine

1. Methodological Background

Version 11 of ACM0001 refers to the Tool to calculate the emission factor of an electricity system, version 2, (the "Tool") for the calculation of the CEF. According to the tool, the CEF of the grid is the weighted average of the operating margin (OM) and the build margin (BM) of the grid with default values of the weights of 0.5. Alternative weights are suggested but, they should not exceed 0.75.

It has to be noticed that the Tool was developed for countries where there is a growing energy demand and insufficient power generation capacity, in other words, cases when new power plants are being constantly built to meet the increasing demand for power. Therefore, each new CDM project activity is expected to influence the process of construction of new power plants and respectively influence the BM.

The case of Ukraine is different, however. Any new renewable energy project is not expected to affect the build margin due to the large excess installed capacity of the Ukraine grid. The current excess capacity is over 46%; peak demand is approximately 24,104 MW compared to a total installed capacity of 52,453 MW (Ministry of Fuel and Energy of Ukraine (MFE) 2008 data). Capacity additions have been very few in the past 30 years and, given the large excess capacity in the system, little are planned for the future: for example in 2004 only two 1 GW nuclear power plants, which were previously partially completed projects left over from the former USSR, commenced operations; these two plants are the only major capacity additions to the Ukraine grid since the 1970's[4]. Therefore, under the Ukrainian conditions it is considered that any renewable energy product will affect only the OM and the weight of the BM is zero. The validity of this assumption has to be reassessed after December 31, 2012.

The Tool provides four methods for calculating the grid emission factor. The first choice is the Dispatch Data Analysis OM, which requires the use of dispatch data. This data is not publicly accessible in Ukraine, so this option is not selected. The second option is the use of the Simple OM. This option is applicable, if the low-cost/must-run resources are less than 50%. If this condition is not met, the grid CEF can be calculated using the Adjusted Simple OM. To calculate this, data for total power generation for each hour of the year is required in order to confirm how many hours the low-cost/must-run plants were on the margin. If this cannot be calculated due to data unavailability, the last option is the Average OM.

In Ukraine, low-cost/must-run resources (nuclear power plants and HPPs, excluding combined heat and power (CHP) plants)[5] constituted 55.4% of total grid generation in 2008. Therefore, the condition for the application of the Simple OM is not met, and the Simple Adjusted OM method has to be used. However, load curves for selected days in 2008 confirm that even at times of minimum electricity demand, low-cost/must-run resources would have to increase to over 70% of total generation before entering the margin, which is not the case. Therefore in the case of Ukraine, Simple OM calculations will provide the same results as the Adjusted OM calculations, and Simple OM method is selected.

Demand for power in Ukraine is forecast to increase in future years. This increased demand will be mainly met by thermal power plants, resulting in the portion of low-cost/must-run resources on the

[4] In addition, it has to be noted that the Ukrainian energy system was not developed originally as a separate national system but as part of the energy system of the Soviet Union. Due to its large coal deposits, Ukraine has become one of the energy hubs of the Soviet Union in charge of providing energy not only for the territory of the Ukrainian SSR, but for the whole USSR. Therefore, the existence of excess capacity after the collapse of the USSR is not a surprise.

[5] Data was not available for generation by low cost/must run CHP plants but it is most likely to be under 2% of total grid generation.

Ukraine grid decreasing. Therefore, the Project will not displace low-cost/must-run resources (at any point in time) now or in the foreseeable future.

2. Application of the Tool

The baseline scenario for a renewable energy project is the amount and type of electricity that would have otherwise been generated by the operation of grid-connected power plants. The Project will displace electricity produced by thermal and other plants during peak periods. Emissions reductions will be claimed based on total CO_2 emission mitigated by the Project.

Aggregated data for generation and fuel consumption, obtained from the State Committee of Statistics of Ukraine (national statistic form 11- MTP "Report of fuel, electricity and heat use"), is used in OM calculations[6]. IPCC 2006 default values are used for the net calorific values and carbon emission factors for the different fuel types, if national values are not available.

As per the Tool, the operating margin is the generation-weighted average of all generating sources, excluding least-cost/must-run resources[7], determined ex post (for each year, constantly updated) or ex-ante (for a three-year period, fixed).

The Simple OM EF is defined as the generation-weighted average emissions per unit of power (tCO_2/MWh) for all generating sources serving the system, excluding low-cost/must-run power plants. The Simple OM is determined *ex ante*. The Simple OM emission factor is calculated with the following formula:

Simple OM EF (tCO_2/MWh)	=	Total CO_2 emissions (tCO_2/3-yr period)	/	Total electricity generated from fossil-fuel-based plants (MWh/3-yr period)

Where:

Total CO_2 Emissions (tCO_2/year)	=	Emissions from coal (tCO_2/yr)	+	Emissions from oil (tCO_2/yr)	+	Emissions from natural gas (tCO_2/yr)	+	Emissions from other solid fuel (tCO_2/yr)

And:

CO_2 emissions for each fuel (tCO_2/year)	=	Fuel consumption (10^3 tce/yr)	x	Conversion Factor[8] (TJ/tce)	x	Carbon emission factor[9] (tCO_2/TJ)

For the purpose of PDD production, OM EF calculations are performed based on the data on aggregate fuel consumption and electricity generation for each generation type in the Ukraine grid for the last three available years. Default IPCC constants are used for the carbon emission factors of the different types of

[6] No data was available on generation as well as fuel consumption of low-cost/must -run CHP plants. Assuming that the average efficiency of these plants is similar to that of thermal plants, the CEF should not be affected if this data is not excluded.

[7] In the case of the Ukraine grid, nuclear power plants, hydropower plants and some CHP plants are classified as least-cost/must-run resources.

[8] 29.308 TJ/tce

[9] 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 2: Energy, p.2.6

fuel and the conversion factor for tonnes of coal equivalent to tetrajoules is given by the State Statistic Committee of Ukraine[10]. For illustration purposes, the Ukraine grid data for year 2007 are used in the following calculations.

The calculations of the CO_2 emissions from natural gas (tCO_2e) are shown below:

CO_2 emissions from Natural Gas (tCO_2/year)	=	2,532 (10^3 tce/year)	x	29.308 (TJ/tce)	x	56.10 (tCO_2/TJ)

CO_2 emissions from Natural Gas (tCO_2/year)	=	4,164,018 (tCO_2/yr)

The above calculations are repeated to obtain the CO_2 emissions (tCO_2/year) from the combustion of coal, oil and other solid fuels in the Ukraine grid-connected power plants as shown in the table below:

[10] www.ukrstat.gov.ua

Table 12. Ukraine Grid Data (2006-2008)[11]

Year	Name	Total	Fuel Type					
			Coal					
			Total	Coking Coal	Lignite	Others Solid Fuel	Fuel Oil	Natural Gas (Dry)
2006	Fuel Consumption for electricity generation by TPPs (tce)	**25,281,912**	**23,181,898**	**0**	**0**	**0**	**146,352**	**1,953,662**
	Fuel Consumption (TJ)	740,952	679,406	0	0	0	4,289	57,257
	Carbon Emission Factor (tCO_2/TJ)		98.30	NA	NA	94.60	77.40	56.10
	Total Emission (tCO_2)	***70,329,701***	***66,785,590***	***0***	***0***	***0***	***331,986***	***3,212,126***
2007	Fuel Consumption for electricity generation by TPPs (tce)	**26,598,654**	**23,984,018**	**0**	**0**	**0**	**82,019**	**2,532,617**
	Fuel Consumption (TJ)	779,543	702,914	0	0	0	2,404	74,225
	Carbon Emission Factor (tCO_2/TJ)		98.30	NA	NA	94.60	77.40	56.10
	Total Emission (tCO_2)	***73,446,518***	***69,096,447***	***0***	***0***	***0***	***186,053***	***4,164,018***
2008	Fuel Consumption for electricity generation by TPPs (tce)	**26,480,273**	**24,658,487**	**0**	**0**	**0**	**99,901**	**1,721,885**
	Fuel Consumption (TJ)	776,073	722,681	0	0	0	2,928	50,464
	Carbon Emission Factor (tCO_2/TJ)		98.30	NA	NA	94.60	77.40	56.10
	Total Emissions (tCO_2)	***74,097,214***	***71,039,550***	***0***	***0***	***0***	***226,616***	***2,831,048***

[11] www.ukrstat.gov.ua

The emission values for all types of thermal power plants are added up to obtain the total amount of CO_2 emissions for the Ukraine grid in year 2007.

Total CO_2 emissions (tCO_2/year)	=	Emissions from coal (tCO_2/yr)	+	Emissions from oil (tCO_2/yr)	+	Emissions from natural gas (tCO_2/yr)
Total CO_2 emissions (tCO_2/year)	=	69,096,447	+	186,053	+	4,164,018
Total CO_2 emissions (tCO_2/year)	=	73,446,518 (tCO_2/year)				

The total amount of CO_2 emission for the three-year period is divided by the total power generated by fossil-fuel-based power plants to calculate the Simple OM emission factor.

Simple OM EF (tCO_2/MWh)	=	Total CO_2 emissions (tCO_2/3-yr period)	/	Total electricity generated from fossil-fuel-based plants (MWh/3-yr period)

Table 13. Ukraine Total Fossil-fuel Based Power Generation (2006 – 2008)[12]

	Year			
	2006	2007	2008	Total (2006-2008)
Electricity Production by TPPs (MWh)	63,580,887	67,486,510	66,355,339	197,422,736

OM EF for 2006-2008 (tCO_2/MWh)	=	70,329,701 + 73,446,518 + 74 097 214 (tCO_2/3-yr period)	/	197,422,736 (MWh/3-yr period)

OM EF for 2006-2008 (tCO_2/MWh)	=	**1.104 (tCO_2/MWh)**

[12] www.ukrstat.gov.ua

Annex 3

MONITORING PLAN

The monitoring plan is a document used as a standard by the Project staff that are assigned to collect and archive relevant data necessary for determining the baseline and measuring project emissions. It must be utilized in a complete and accurate manner until the end of the crediting period (with archiving only ending 2 years after the end of the crediting period). Its effective use will facilitate accurate and consistent monitoring of the Project's ERUs.

Monitoring staff

Nedra Luganschiny, Ltd. will form and operational and management team, which will be responsible for monitoring/ acquisition and recording for JI purposes. This team composes of a general manager and a group of operators. Operators will be trained in the operation of all monitoring equipment and all readings will be taken under the supervision of management. Quality control and assurance procedures are to be undertaken for data monitored as outlined in Section D. of this PDD. A database will be maintained to record all relevant data as outlined in the monitoring plan.

Monitoring equipment

All monitoring equipment will be installed by experts using standard methods. Once installed, this equipment will be calibrated to the highest standards by Project staff. Any irregularities or problems with equipment will be reported to management and rectified as soon as possible.

Items to be monitored and archived

Data is to be collected and archived as directed in section D.1.2. of this JI-PDD
