JOINT IMPLEMENTATION PROJECT

Sunflower Husk Utilization for Steam and Electricity Generation at the Oil-Extraction Factory CJSC Modified Fats Factory

Position of the head of organization, company, entity being the developer of documents

Managing Director, GreenStream Network Plc

01.06.12 Markku Ahponen

(date) (signature) (first, middle and last name)

stamp

Position of the head of company being the emission source owner where the Joint Implementation project is envisaged

Director, PrJSC Modified Fats Factory

5.06.12 Sergiy Viktorovych Tymchenko

(date) (signature) (first, middle and last name)

stamp

Kirovograd, June 2012

JOINT IMPLEMENTATION PROJECT DESIGN DOCUMENT FORM FOR SMALL-SCALE PROJECTS
Version 01.1 - in effect as of: 27 October 2006

CONTENTS

SECTION A. General description of the small-scale project

A.1. Title of the small-scale project:

Sunflower Husk Utilization for Steam and Electricity Generation at the Oil-Extraction Factory CJSC Modified Fats Factory

Type I JI SSC – Renewable energy project

Sectoral scope 1: Energy industries (renewable/non-renewable sources)

Sectoral scope 13: Waste handling and disposal

Project category: Type I: Renewable energy project – C. thermal energy for the user

PDD version 04.1, 23/12/2011

A.2. Description of the small-scale project:

The project owner, PrJSC Modified Fats Factory[1], is one of the biggest producers of fat products in Ukraine. The PrJSC Modified Fats Factory (MFF) was commissioned in 2005 and produces mainly fat and margarine production. In 2007, the project owner decided to extend its product line and construct the Oil Extraction Plant (OEP). OEP is designed to extract vegetable oil from sunflower seed and produce types of fat product (see Figure 1). MFF and OEP are located adjacently and are both under the PJSC Creative Group, but belong to two separated operational entities. After the decision of construction of OEP, the project developer started looking for a solution to meet the energy demand of OEP and partly displace the energy consumption of MFF.

Prior to the project activity, the steam was supplied by natural gas boilers installed at MFF: two existing natural gas boilers are the type of THS-50 and another one is Boiler Avogadro. In the perspective of business-as-usual, the solution of energy supply for OEP will be the installation of new natural gas boiler. Meanwhile, the husk of sunflower seed will be transported to the Kirovograd municipal landfill site 20.5 km far away and disposed there.

Thus, the brief description of the baseline scenario is as follows: the existing natural gas boilers will be operated continuously. Meanwhile, new natural gas boilers will be installed to produce the heat needed by the production extension. The husks will be dumped or left to decay mainly under clearly anaerobic conditions. Please refer to the Section B for detailed baseline description and justification.

Since the initiation of OEP, the husk has been considered as a renewable source to meet the energy demand of both MFF and OEP. The project activity will install two husk boilers at PrJSC MFF in Kirovograd, Ukraine. The husk generated by OEP will be combusted in these husk boilers with the purpose to generate carbon-neutral steam. The project activity will combust 27,950 tonnes of husk annual and generate steam. However, during the crediting period of the project, the existing natural gas boilers will serve as backup in case of steam supply shortage. The working performance of these natural gas boilers will be recorded as the baseline till their retirement or closure of lifetime.

[1] Since 02/06/2011, the enterprise registration name has been changed from "CJSC Modified Fats Factory" to "PrJSC Modified Fats Factory" in accordance with Excerpt of United State Register of Legal Entities and Individual entrepreneurs of Ukraine as of 02/06/2011.

A steam turbine for electricity generation using steam from MFF boilers is expected to be installed only after 2012. Therefore, emissions reductions related to electricity generation are not taken into consideration.

The project is under the UKEEP (Energy Efficiency Programme for Banks in Ukraine), which is a framework facility constructed by EBRD (European Bank for Reconstruction and Development). UKEEP finances the private sector companies for industrial energy efficiency and renewable energy projects and encourages the financed project commercialize the reduced GHG emission. The carbon revenue has been pre-considered as an additional profit to make the project activity attractive in finance perspective. The project owner management meeting was held on 5 July 2007 where the positive decision was made regarding the JI project implementation and carbon revenue from JI [2]. Through the MCCF (Multilateral Carbon Credit Fund), established by EBRD, documents have been developed for the commercialization of the Emission Reduction Units under the JI framework. The Letter of Endorsement (No. 757/23/7) of the project activity was issued by the National Environmental Investment Agency of Ukraine at July 3, 2009. The Letter of Approval from Ukraine government is expected be issued by State Environmental Investments Agency of Ukraine after the submission of project PDD and Determination report.

Setting the two husk boilers into testing operation began since September 24, 2009 which is defined to be the starting date of crediting period.

The project activity was initially designed to install two husk boilers and one electricity steam generator. However, during the project implementation the installation of the electricity steam turbine was not realized because of the delay of finance raising. The PDD is developed basing on the condition of the investment and operation of two husk boilers for the thermal energy generation.

A.3. Project participants:

Party involved	Legal entity project participants (as applicable)	Please indicate if the Party involved wishes to be considered as project participant (Yes/No)
Ukraine (Host party)	PrJSC Modified Fats Factory	No
Ukraine (Host party)	UkrEximBank	No
Netherlands, Spain, Switzerland	Stichting Carbon Finance (SCF)	No

A.4. Technical description of the small-scale project:

A.4.1. Location of the small-scale project:

[2] The management meeting Protocol #12a is provided in supporting documentation

A.4.1.1. Host Party(ies):

Ukraine

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

Kirovograd Oblast

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

Kirovograd

A.4.1.4. Detail of physical location, including information allowing the unique identification of the small-scale project:

The project activity is located at PrJSC Modified Fats factory which is situated at 14 Promyslovyy avenue in the western part of Kirovograd City. The project is located in the industrial part of Kirovograd.

Coordinates: 48.5172N, 32.1944E

Figure 1: Project Locations

A.4.2. Small-scale project type(s) and category(ies):

Project Types:

Type I – Renewable energy project, Category I.C. – Thermal energy for the user

Applicability under small-scale JI project the paragraph 7 and 8 of the "Provision for Joint Implementation Small-Scale Projects" is referred to. The project activity satisfies the threshold of JI SSC project:

- The project activity applies renewable energy technologies that supply thermal energy that displaces fossil fuel use. The total installed capacity of the co-generator is less than 45 $MW_{thermal}$.

According to the type-I JI SSC project, the project activity displaces the use of natural gas by husk in order to produce the thermal energy. The installed capacity of the husk boilers is 16.4 MW, smaller than 45 $MW_{thermal}$.

A.4.3. Technology(ies) to be employed, or measures, operations or actions to be implemented by the small-scale project:

The technical flow of production at MFF is illustrated in Figure 2, parts of which consume steam, i.e. oil purification, oil hydrogenation. In absence of the project activity, the steam is supplied by three on-site natural gas boilers. The project activity will produce part of required steam utilizing husk of sunflower seed, which otherwise will be disposed in the landfill site.

The two husk boilers are produced by CJSC NPP "Ekoenergomash" in Russia for the utilization of sunflower husk by using of doubled swirling-type furnace with the capacity of 16 ton steam per hours under the pressure of 24 bars. Overheated steam temperature is 350º C. After the installation of husk boilers, the existing natural gas boilers will also operate to generate steam in case sunflower husk is supplied irregularly or insufficient.

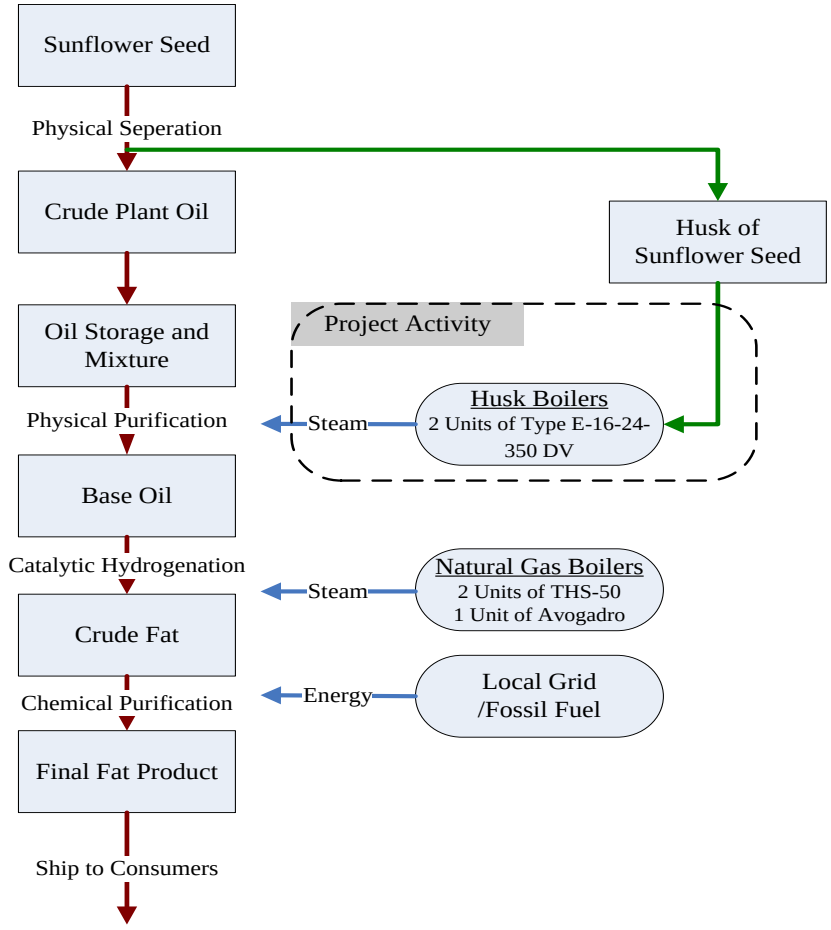

Figure 2: Technical flow of main producing body and project activity

Figure 3 describes the process of steam generation and utilization. In the project activity, the generated steam (24 bars-350º C) will flow out from the boilers by two steam pipelines (Ø159×5)[3] separately. Steams join up to a large steam pipeline (Ø273×8) and then partly flow into No.1 heat exchanger, where the steam is transferred to 6 bar-159º C, and partly flow into No.2 heat exchanger, where the steam is transferred to 14 bar-194º C. These vapor stream flow into the different units in the technical flow of the main producing body, i.e. ventilating chamber, neutralization area, steam jet ejector, extraction chamber, and so on. The exhaust steam from these consumers still remains part of heat value, circa 1.5 bars-105º C. They will be conducted back to the heat exchangers and mixed with the energy-intensive steam there, which will recycle the steam and save the energy.

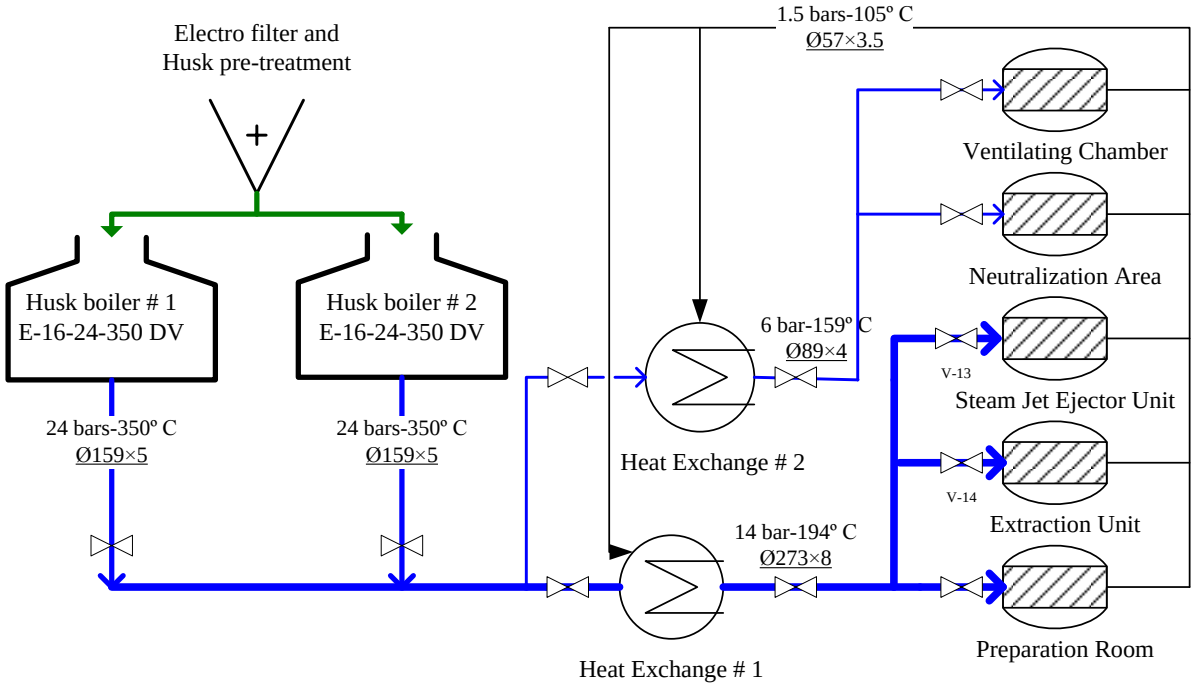

Figure 3: Principle diagram of steam generation and utilization

The history of the project activities is given in Table 1.

Table 1: Project history

#	**Project activity**	**Date**
1	PrJSC Modified Fats Factory management meeting on making decision regarding the JI project implementation	5 July, 2007
2	The letter of Endorsement (LoE) of the project activity (No. 757/23/7) was issued by the National Environmental Investment Agency of Ukraine.	3 July, 2009
	Project implementation	
3	Start of the testing operation of the two husk	24 September,

[3] Type of pipeline is marked as Ø calibre (mm) × thickness (mm).

	boilers type of E-16-24-350 DV	2009
4	Completion of testing the two husk boilers type of E-16-24-350 DV	16 October, 2009
5	Commissioning of the two husk boilers type of E-16-24-350 DV	27 November, 2009

A.4.4. Brief explanation of how the anthropogenic emissions of greenhouse gases by sources are to be reduced by the proposed small-scale project, including why the emission reductions would not occur in the absence of the proposed small-scale project, taking into account national and/or sectoral policies and circumstances:

The project activity will reduce the anthropogenic emission of GHG by the replacement of production of heat by the existing natural gas boiler, and the avoidance of methane emission from the decay of husk in landfill site. Meanwhile, several types of GHG emissions are caused by the operation of husk boilers and ancillary activities, *inter alia*: emission from the consumption of electricity and fossil fuel by the project activity, and methane emission from the combustion of husk. Details regarding to estimation of emission reductions are indicated in Section E.

The project activity is implemented voluntarily by the project developer, as there is neither mandate regulation nor financial attractiveness on the project activity. Section B2 will illustrate that the emission reduction would not occur in absence of the proposed project.

The existing natural gas boiler THS-50 will remain operation up to 2021, and the Avogadro boiler will remain in operation up to 2027. The installed new husk boilers have lifetime of 20 years.

A.4.4.1. Estimated amount of emission reductions over the crediting period:

	Years
Length of the crediting period	3 years and 3 months
Year	Estimate of annual emission reductions in tonnes of CO_2 equivalent
2009 (24/09/2009-31/12/2009)	4,462
2010	19,843
2011	21,775
2012	23,859
Total estimated emission reductions over the crediting period (tonnes of CO_2 equivalent)	69,939
Annual average of estimated emission reductions over the crediting period (in tonnes of CO_2 equivalent)	21,520

	Years
Length of the crediting period	6 years and 9 months
Year	Estimate of annual emission reductions in tonnes of CO_2 equivalent
2013	25,677
2014	27,440

2015	29,152
2016	30,813
2017	32,425
2018	33,989
2019 (01/01/2019-23/09/2019)	26,630
Total estimated emission reductions over the crediting period (tonnes of CO_2 equivalent)	206,126
Annual average of estimated emission reductions over the crediting period (tonnes of CO_2 equivalent)	30,537
Total estimated emission reductions over the total crediting period (2009 - 2019) (tonnes of CO_2 equivalent)	276,065
Annual average of estimated emission reductions over the total crediting period (2009-2019) (tonnes of CO_2 equivalent)	27,607

A.4.5. Confirmation that the proposed small-scale project is not a debundled component of a larger project:

On behalf of the project participant, PrJSC Modified Fats Factory confirms that the project is not a debundled component because none of the following has occurred:

- Existing JI project with a publicly available determination which has the same project participants; and
- Which applies the same technology/measure
- Whose determination has been made publicly available in accordance with paragraph 34 of the JI guidelines within the previous 2 years; and
- Whose project boundary is within 1km of the project boundary at the closest point

A.5. Project approval by the Parties involved:

The Letter of Endorsement (LoE) of the project activity (No. 757/23/7) was issued by the National Environmental Investment Agency of Ukraine on July 3, 2009.

SECTION B. Baseline

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

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

A baseline will be identified by listing and describing plausible future scenarios on the basis of conservative assumptions and selecting the most plausible one. With respect to "Guidance on criteria for baseline setting and monitoring, ver.3, the project select an approach for baseline setting and monitoring developed in accordance with appendix B of the JI guidelines (JI-specific approach). The paragraph 11 of the Guidance further explains that project that select a JI-specified approach may use selected elements or combinations of approved CDM baseline and monitoring methodologies or approved CDM methodological tool. Thus, project activity exercises the use of JI specific approach for baseline setting and monitoring based on elements of ACM0006 ver. 11.2.0, a methodology for baseline setting and monitoring approved by the Executive Board of CDM. ACM0006 Consolidated methodology for electricity generation from biomass residues in power and heat plants, ver.11.2.0 is applicable to the project specification, because:

- The installed husk boilers will be operated next to existing heat boilers fired with natural gas and will partly replace the heat generation from the existing heat boilers.
- No other biomass type than husks are used in the project activity and the husk is the predominant fuel used in the project activity;
- The implementation of the project will not result in an increase of the processing capacity of raw input in the host body of MFF and OEP;
- The husk used by the husk boilers will not be stored for more than one year;
- The husk used by the husk boilers is not obtained from chemically processed biomass. And there is no significant energy required to prepare the husks before fuel combustion.

2. Application of the approach chosen

With respect of ACM0006 ver.11.2.0, the selection of the baseline scenario shall be conducted by applying the following steps:

Step 1: Identification of alternative scenarios

Step 1a: Define alternative scenarios to the proposed project activity
According to the existing regulations and contractual requirement related to the treatment of biomass residues (husks) and the energy generation in Ukraine, as well as local economic and technological circumstances, the available alternatives of the project are:

For heat generation, the realistic and credible alternatives may include:
H1: Heat generation will be supplied by biomass residue/husk boiler, which is not undertaken as a JI project activity;

This is the project scenario without the help of JI.

H2: The continuation of heat generation in existing natural gas boilers. The new energy demand caused by production extension will be satisfied by the installation of new natural gas boiler;
This is the continuation of the baseline scenario.

H3: The existing natural gas boilers will be retrofitted to meet the demand of heat.
The retrofitting of existing natural gas boilers can not meet the demand of heat of the proposed project.

H4: The installation of new plants at the project site different from those installed under the project activity. The new plants shall utilize the fossil fuel energy rather than natural gas;
Considering that natural gas is one of the most common and appropriate energy sources, it is not realistic to install another new plants onsite which consumes other fossil fuel rather than natural gas.

H5: The generation of heat in specific off-site plants;
Due the reason of the remote location, it is not realistic to transfer heat from other specific off-site plants.

H6: The production of heat from district heating;
The project is located in the remote industrial park which keeps a distance of approximately 2 km to the closest residence community. The connection of district heating is not realistic because 1) the cost connection pipe will cause extra investment, 2) the connection will be requested to obtain the governmental approval and a license.

For the treatment of husks (biomass residue), the realistic and credible alternatives may include:

B1: The husks are dumped or left to decay mainly under aerobic conditions.
With respect to “On protection of atmospheric air” (21/06/2001, #2556-III), the aerobical disposal of husks, i.e. decaying on fields, is forbidden, because the husks on fields will be blown away by wind, which will cause pollution and impact local ecology in a negative manner. The uncontrolled burning of husk is forbidden too. Therefore, the alternative B1 is not credible.

B2: The husks are dumped or left in nearby landfill site under clearly anaerobic conditions;
This is the continuation of the baseline scenario.

B3: The husks are burnt in an uncontrolled manner without utilizing it for energy purposes;
For the same reason with alternative B1, the alternative B3 is not credible.

B4: The husks are used for power and/or heat generation at the project site in new and/or existing plants which is not undertaken as a JI project activity;
This is the project scenario without the help of JI.

B5: The husks are used for power and/or heat generation at other sites in new and/or existing plants;

Husk is not welcomed in the indoor heating system, because of its transportation and packaging cost, the low NCV of husk and ash management.

B6: The husks are used for other energy purposes, such as the generation of biofuels;
The technology to produce biofuels with husk is not sound because of the high ash content in husk. In addition, considering the transportation cost, it is not a realistic alternative to utilize the husk for the generation of biofuel. The project owner will not deconcentrate its focus on the food industry. It is not realistic to sell the husk in a liquid market because of its transportation and packaging cost, the low NCV of husk and ash management.

B7: The husks are used for non-energy purpose, e.g, as fertilizer or as feedstock in processes;
Husk is not a proper raw material to produce bio-fertilizer. The bio-fertilizer requires balanced nutritional materials, i.e. nitrogen, potassic materials, which husk does not have. The cost of these additives will cause B7 unrealistic. In addition, the project owner will not deconcentrate its focus on the food industry. It is not realistic to sell the husk in a liquid market because of its transportation and packaging cost, the low NCV of husk and ash management.

B8: The husks are purchased from a market or retailers, or the primary source of the biomass residues and/or their fate in the absence of the project activity can not be clearly identified.
There is not such a market or retailers where the project developer can purchase the husk. Besides, it can not be a realistic alternative because of the high transportation cost.

Combined baseline options and scenarios applicable to this methodology are listed in Table 2.

Table 2: Combinations of baseline options and scenarios

Scenario	Baseline		Description of situation
	Heat generation	Husks treatment	
1	H1	B4	The proposed project activity prescribed in the PDD, but without JI revenue.
2	H2	B2	The existing natural gas boilers will be operated continuously. Meanwhile, new natural gas boilers will be installed to produce the heat needed by the production extension. The husks will be dumped or left to decay mainly under clearly anaerobic conditions.

In accordance with ACM0006 ver.11.2.0, a step-wise approach presented in Section B.2 is used to select the most plausible baseline scenario to treat the husk and obtain the energy. Whilst, they will prove that the project activity would not occur in absence of the JI project and Scenario 2 is the baseline of the project activity.

In accordance with ACM0006 ver.11.2.0, the baseline emission of the project activity shall be calculated with 6 steps. In brief, the baseline emission consists of the baseline emission from electricity generation,

the baseline emission from the consumption of fossil fuel for process heat, the baseline emission from the uncertain electricity generation, and the baseline emission due to disposal of biomass residues. Below formulae presents these four baseline emission sources.

The details of the calculation procedure shall be found at Section D.1.

$$BE_y = EL_{BL,GR,y} * EF_{EG,GR,y} + \sum FF_{BL,HG,y,f} * EF_{FF,y,f} + EL_{BL,FF/GR,y} * min\,(EF_{EG,GR,y}; EF_{EG,FF,y}) + BE_{BR,y}$$

Where

BE_y = Baseline emission in year *y* (tCO_2)
$EL_{BL,GR,y}$ = Baseline minimum electricity generation in the grid in year *y* (MWh)
$EF_{EG,GR,y}$ = Grid emission factor in year *y* (tCO_2/MWh)
$FF_{BL,HG,y,f}$ = Baseline fossil fuel demand for process heat in year *y* (kcal)
$EF_{FF,y,f}$ = CO_2 emission factor for fossil fuel type in year *y* (kg CO_2 / kcal)
$EL_{BL,FF/GR,y}$ = Baseline uncertain electricity generation in the grid or on-site in year *y* (MWh)
$EF_{EG,GR,y}$ = CO_2 emission factor for electricity generation with fossil fuels at the project site in the baseline in year *y* (tCO_2/MWh)
$BE_{BR,y}$ = Baseline emission due to disposal of biomass residues in year *y* (tCO_2e)
y = Year of the crediting period
f = Fossil fuel type

The key information and data used to establish the baseline are provided in the following tables:

Data / Parameter:	**$EF_{FF,y,f}$**
Data unit:	kg CO_2/Tcal
Description:	CO_2 emission factor of fuel type *i* in year *y*
Time of determination/monitoring	Determined only once and available already at the stage of determination regarding the PDD
Source of data (to be) used:	1996 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 3: Reference Manual, Chapter 1: Energy, Table 1-4, Carbon Emission Factors for Fuels from Different Studies Stationary, Pg. 1.24: http://www.ipcc-nggip.iges.or.jp/public/gl/guidelin/ch1ref2.pdf
Value of data applied:	Default value applied: 234,722
Justification of the choice of data or description of measurement methods and procedures (to be applied)	The type of fossil fuel is Natural Gas.
QA/QC procedures (to be) applied	-
Any comment:	IPCC value is applied as 15.3 ton C/TJ. 1 cal = 4.1868 J

Data / Parameter:	**η_{BL}**
Data unit:	
Description:	The efficiency of the existing natural gas boilers which will

	service in the baseline scenario
Time of determination/monitoring	Determined only once and available already at the stage of determination regarding the PDD
Source of data (to be) used:	Tool to determine the baseline efficiency of thermal or electric energy generation system, version 01, Table 1. Pg. 7
Value of data applied:	Default value applied: 87%
Justification of the choice of data or description of measurement methods and procedures (to be applied)	The existing natural gas boilers have serviced for 10 years.
QA/QC procedures (to be) applied	
Any comment:	

Data / Parameter:	**$H_{husk\ boiler}$**
Data unit:	Kcal/h
Description:	The heat value generated by the husk boiler per hour
Time of determination/monitoring	Determined only once and available already at the stage of determination regarding the PDD
Source of data (to be) used:	Calculated with the data given by the operation chart of the husk boiler
Value of data applied:	<table><tr><td>Working load</td><td>50%</td><td>75%</td><td>100%</td></tr><tr><td>$H_{husk\ boiler}$</td><td>3,524,430</td><td>5,727,200</td><td>7,048,860</td></tr></table>
Justification of the choice of data or description of measurement methods and procedures (to be applied)	<table><tr><td>Husk boiler</td><td>50%</td><td>75%</td><td>100%</td></tr><tr><td>Steam generation (ton/h)</td><td>8</td><td>13</td><td>16</td></tr><tr><td>Saturated steam pressure (kgf/cm^2)</td><td>24</td><td>24</td><td>24</td></tr></table> With help of a calculation tool, the hourly heat value generated by the husk boiler can be calculated.
QA/QC procedures (to be) applied	The calculation tool is developed by Spirax-sarco, a specialist in steam system over 100 years.
Any comment:	The calculation tool is available at: http://www.spiraxsarco.com/resources/calculators/steam-flow-and-heat-rate/steam-flow-rate-to-heat-rating.asp

Data / Parameter:	**H_{husk}**
Data unit:	Kcal/h
Description:	The heat value contained in the husk which is consumed in one hour
Time of	Determined only once and available already at the stage of

determination/monitoring	determination regarding the PDD
Source of data (to be) used:	Calculated with the data given by the operation chart of the husk boiler
Value of data applied:	Working load: 50% / 75% / 100% H_{husk}: 6,099,000 / 10,710,000 / 12,180,000
Justification of the choice of data or description of measurement methods and procedures (to be applied)	Working load: 50% / 75% / 100% Husk consumption (kg/h): 1450 / 2550 / 2900 NCV of husk is 4137 kcal/kg.
QA/QC procedures (to be) applied	
Any comment:	Working load: 50% / 75% / 100% / Mean $H_{husk\ boiler}$: 58.75% / 54.29% / 58.75% / 57.27%

Data / Parameter:	**φ**
Data unit:	
Description:	Model correction factor to account for model uncertainties
Time of determination/monitoring	Determined only once and available already at the stage of determination regarding the PDD
Source of data (to be) used:	Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site, Version 05.1.0, Table "Data and parameters monitored", Pg. 3
Value of data applied:	Default value applied: 0.9
Justification of the choice of data or description of measurement methods and procedures (to be applied)	Oonk et al. (1994) have validated several landfill gas models based on 17 realized landfill gas projects. The mean relative error of multi-phase models was assessed to be 18%. Given the uncertainties associated with the model and in order to estimate emission reductions in a conservative manner, a discount of 10% is applied to the model results.
QA/QC procedures (to be) applied	
Any comment:	

Data / Parameter:	**OX**
Data unit:	
Description:	Oxidation factor
Time of determination/monitoring	Determined only once and available already at the stage of determination regarding the PDD

Source of data (to be) used:	Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site, Version 05.1.0, Table "Data and parameters monitored", Pg. 3
Value of data applied:	Default value applied: 0
Justification of the choice of data or description of measurement methods and procedures (to be applied)	The solid waste disposal sites where the husk should be disposed in absence of the project activity are not covered with oxidizing material. Thus, 0 is applied as the oxidation factor.
QA/QC procedures (to be) applied	
Any comment:	

Data / Parameter:	**DOC_f**
Data unit:	
Description:	Fraction of degradable organic carbon that can decompose
Time of determination/monitoring	Determined only once and available already at the stage of determination regarding the PDD
Source of data (to be) used:	Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site, Version 05.1.0, Table "Data and parameters monitored", Pg. 4
Value of data applied:	Default value applied: 0.5
Justification of the choice of data or description of measurement methods and procedures (to be applied)	It is applicable for the domestic solid waste in the host country. It is referred to the Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site, Version 05.1.0.
QA/QC procedures (to be) applied	
Any comment:	

Data / Parameter:	**MCF**
Data unit:	
Description:	Methane correction factor
Time of determination/monitoring	Determined only once and available already at the stage of determination regarding the PDD
Source of data (to be) used:	Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site, Version 05.1.0, Table "Data and parameters monitored", Pg. 4
Value of data applied:	Default value applied: 1 for Anaerobic managed solid waste disposal sites
Justification of the choice of data or description of measurement methods and procedures (to be applied)	The solid waste disposal sites where the husk should be disposed in absence of the project activity are identified as the Anaerobic managed solid waste disposal sites.
QA/QC procedures (to be) applied	
Any comment:	

Data / Parameter:	**DOC_j**

Data unit:	%
Description:	Fraction of degradable organic carbon in the waste type *j*
Time of determination/monitoring	Determined only once and available already at the stage of determination regarding the PDD
Source of data (to be) used:	Table 1 of Sunflower Seed Hulls, Mushroom Growers' handbook 2, Pg. 101 available at: http://www.alohamedicinals.com/book2/chapter-4-02-04.pdf
Value of data applied:	Default value applied: 39
Justification of the choice of data or description of measurement methods and procedures (to be applied)	The sunflower seed husk consists of total organic carbon (42%), ash (3%) and other compositions. The degradable organic carbon should the total organic carbon deducting the ash.
QA/QC procedures (to be) applied	
Any comment:	

Data / Parameter:	**k_j**
Data unit:	
Description:	Decay rate for the waste type *j*
Time of determination/monitoring	Determined only once and available already at the stage of determination regarding the PDD
Source of data (to be) used:	Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site, Version 05.1.0, Table "Data and parameters monitored", Pg. 6
Value of data applied:	Default value applied: 0.03 for Kirovograd
Justification of the choice of data or description of measurement methods and procedures (to be applied)	According to the information of meteorological and physical characteristic of Kirovograd Municipal Landfill Site given in Annex 2, the project is located in the Temperate because the average annual high temperature is 11.9 °C and the annual average low temperature is 3.6 °C in the project location. The evapotranspiration in the project location is less than the annual precipitation (549 mm). Therefore, the project location is indentified as wet.
QA/QC procedures (to be) applied	
Any comment:	

Data / Parameter:	**F**
Data unit:	--
Description:	Fraction of methane in the landfill gas
Time of determination/monitoring	Determined only once and available already at the stage of determination regarding the PDD
Source of data (to be) used:	Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site, Version 05.1.0, Table "Data and parameters monitored", Pg. 4
Value of data applied:	Default value applied: 0.5
Justification of the choice of data or description of	Most waste in landfill site generates a gas with approximately 50% CH_4. Only material including substantial amounts of fat or

measurement methods and procedures (to be applied)	oil can generate gas with substantially more than 50% CH_4. The use of the default value for the fraction of CH_4 in landfill gas (0.5) is therefore encouraged.
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	Monitored annually
Source of data (to be) used:	On-site check in the landfill site
Value of data applied:	*Ex-ante* value: 0%
Justification of the choice of data or description of measurement methods and procedures (to be applied)	
QA/QC procedures (to be) applied	This parameter is decided by the status of LFG capture in the landfill site. The on-site status will be checked annually. Once there is any activity of LFG collection and destroy implemented in the landfill site, latest ACM 0002 will be used to estimate the value of F.
Any comment:	

Data / Parameter:	**$Q_{husk,y}$ / $BR_{PJ,n,y}$**
Data unit:	Tons/a
Description:	Quantity of biomass residues of category n used in the project activity during the year y (tonnes on dry-basis)
Time of determination/monitoring	Monitored throughout the crediting period
Source of data (to be) used:	Log recorded by the project developer
Value of data applied:	*Ex-ante value:* 27,950
Justification of the choice of data or description of measurement methods and procedures (to be applied)	The total weight of the sunflower seed which is processed in the plant will be recorded by the project developer. Following the experimental and statistical method, husk consists of 14% of the total weight of the sunflower seed. Thus, the can be calculated by multiplying 14% with the total weight of the sunflower seed.
QA/QC procedures (to be) applied	The total amount of the sunflower seed will be weighted by electronic weight hopper which will be calibrated according the manufacturer's requirement.
Any comment:	

Data / Parameter:	GWP_{CH4}
Data unit:	tCO_2e/tCH_4
Description:	Global Warming Potential
Time of determination/monitoring	Monitored for the each commitment period
Source of data (to be) used:	Decision FCCC/CP/1999/7, page 14, Table 1
Value of data applied:	21
Justification of the choice of data or description of measurement methods and procedures (to be applied)	
QA/QC procedures (to be) applied	GWP_{CH4} shall be updated according to any future COP/MOP decisions.
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 small-scale project:

Step 1: Identification of alternative scenarios

Sub-step 1a: Define alternative scenarios to the proposed JI project activity

Two combined alternative scenarios are defined to the proposed JI project activity listed in Table 2 of Section B1.

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

Currently there is no mandatory law or regulation which obligates the project developer to utilize the husk. As a processing waste, the husk is transported to landfill site and disposed there. In 2005, National Construction Standard DBN V2.4-2-2005 was introduced containing requirement on LFG collection and venting after the landfill closure. However, such requirements are not implemented yet due to substantial financial barriers in the public service system in Ukraine.

With respect to "On protection of atmospheric air" (21/06/2001, #2556-III), the aerobical disposal of husks, i.e. decaying on fields, is forbidden, because the husks on fields will be blown away by wind, which will cause pollution and impact local ecology in a negative manner. The uncontrolled burning of husk is forbidden too. Both of Alternative 1 and 2 have no conflicts with the current laws and regulations in Ukraine.

Step 2: Barrier analysis

Sub-step 2a: Indentify barriers that would prevent the implementation of alternative scenarios

This step will establish a complete list of realistic and credible barriers that may prevent alternative scenarios to occur as follows, investment barriers, technological barriers, and prevailing practice barriers.

Sub-step 2b: Eliminate alternative scenarios which are prevented by the identified barriers

Investment barriers

The immobilization of investment depends on the expected return of the investment on the project activity. There would be no investment if the return is not acceptable, as analyzed in step 3.

Technological barriers

In the project activity, the two husk boilers are imported from the manufacturer in Russia and tailor-designed for the project specification. Comparing with natural gas boiler, the husk boiler needs to meet higher standards in some technical perspectives. The husk boiler has to solve two main problems: first, the difficulty of retaining the volatile matter in the process of incineration; second, the possibility of creation of high ash concentration in the furnaces or fuel economizers. The technology barriers are not obvious as they can be eliminated by appropriate biomass boiler procurement and providing extensive training to the operation team.

Prevailing practice barriers

Theoretically, it is possible that husk is used by a third party for power generation, or heat generation, or indoor heating. In practice, neither of above three alternatives is realistic. Husk is not welcomed in the indoor heating system, because of its transportation and packaging cost, the low NCV of husk and ash management. There are few oil-extraction plants utilizing the husk for power/heat generation. However, the lack of operation experience, high investment cost, and the uncertainty of technology block the applicability of husk utilization in Ukraine.

Regarding the on-site energy supply, natural gas is one of the most common and appropriate energy sources in Ukraine. In 2007, natural gas contributed 40.88% of energy supply in Ukraine, in industrial sector it contributed 31.94%[4]. Therefore, natural gas will be baseline energy source to meet either the current heat demand or the energy demand increased by the extension of product activity.

Scenario 2 shall be removed from the alternatives scenario due the investment barriers indicated in step 3.

Step 3: Investment analysis

Sub-step 3a: Analysis Method

Scenarios 1 (Project without JI Revenue) and 2 (Baseline) provide the same amount of steam and electricity to the operations of the project proponent. They do not affect any revenues of the company. As a result, investment comparison analysis is applicable.

The investment costs of the baseline scenario are relatively minor compared to the project activity. However the project activity results in lower operating costs over time, especially for the purchase of natural gas. The cost comparison uses the following approach:

[4] Energy Statistics of Ukraine (2007) http://www.iea.org/stats/balancetable.asp?COUNTRY_CODE=UA

1. The investment analysis is based on the relevant information available at the time of the investment decision in mid-2008. The analysis is completed at constant prices in Ukraine's national currency on a pre-tax basis.

2. The assessment period is not limited to the proposed crediting period of the JI activity 2009 to 2012 but extended to 20 years (2009 to 2029) reflecting the expected period of operation of the project and the alternative baseline investment. At the end of the 20-year period the residual value of the equipment is zero as the equipment is fully depreciated.

3. The investment analysis uses the following parameters in accordance with the Ukraine's tax code:

Table 3: Parameters for investment analysis

Variable	Value
Depreciation Period	20 years
VAT on Capital Costs	20%

4. The cost of financing expenditures (i.e. loan interest payment) or depreciation is not included in the calculation of the project IRR.

5. Future costs are discounted to 2008 at the benchmark rate in order to obtain the Net Present Value (NPV) of all costs.

6. The NPV of the Project without JI Revenue is compared to the NPV of the Baseline.

Sub-step 3b: Choice and Justification of Discount Rate

The benchmark rate can be calculated as the sum of two factors, the required rate of return on risk-free investments plus a project-specific risk factor adjustment. A minimum rate of return not including project specific risks is given by the yield on 2013 Ukrainian Sovereign Eurobonds, which was 7.73% at 19 Sep 2008.[5] . The Ukrainian Sovereign Eurobonds are dominated by US dollar. Ukraine had to withdraw another Eurobond issue due to the high yield.[6] In order to correct for inflation, the average US inflation index for the period during 1993-2008 was applied, which was 102.42%.[7] Due to the lack of data for similar projects in Ukraine the risk factor adjustment can be identified only on the basis of expert opinion. Based on a conservative approach the risk factor adjustment is estimated to be 8%. The figure corresponds to Russia's official "Methodological Recommendations on Evaluation of Investment Projects Efficiency 21.06.1999 N ВК 477". The benchmark figure is therefore (1.0773 * 1.08 / 1.0242) - 1 = 13.60%.

Sub-step 3C: Calculation of NPV for Project and Baseline Alternative

[5] See the following websitehttp://kommersant.ua/doc/1028171?isSearch=True

[6] See the following website http://www.kyivpost.com/news/business/bus_general/detail/65112/

The critical financial parameters of the Project and the Baseline are presented in Table 3 and 4. More detailed information of finance model shall be found in Appendix II.

Table 4: Project's financial parameters

Project	**UAH**
Investment costs	
Husk boilers and Electrical Filters	91 million
Husk transportation & preparation	1.288 million
Operating costs	
Manpower Existing Boilers	
Manpower	0.365 million per year
Husk transport and preparation	1.96128 million per year
Maintenance	1.5% of Initial capital costs
Insurance	0.6% of Initial capital costs
Husk consumption	27950 tonnes/year
Depreciation period	20 years
Discount Rate	13.60%
NPV (million UAH)	**-117.27**

Table 5: Baseline financial parameters

Baseline	**UAH**
Investment costs	
New gas boilers	12.6 million
Operating costs	
Manpower – existing boilers	0.207 million per year
Manpower – new boilers	0.157 million per year
Maintenance	1.5% of initial capital costs
Insurance	0.6% of initial capital costs
Specific natural gas consumption	80.22 m^3 / tonne of steam
Natural gas purchase	10.3 million m^3/year
Price of natural gas	1.56 UAH/ m^3
Depreciation period	20 years
Discount Rate	13.60%
NPV	**-104.71**

Conclusion: The discounted costs of the project activity without JI revenues (Scenario 2) are significantly higher than the discounted costs of Scenario 1. The project is not financially attractive without the revenue from ERU sales.

[7] See the CPI history of U.S. from 1913 to Present is available at the following website: ftp://ftp.bls.gov/pub/special.requests/cpi/cpiai.txt.

Sub-step 3d: Sensitivity Analysis[8]

Table 6: Sensitivity Analysis

	Fluctuation		
Parameter	-10%	0%	+10%
Difference in Project NPV and Baseline NPV (in million UAH)			
CAPEX	-3.68	-12.56	-21.43
Steam Production	-21.46	-12.56	-3.65
Natural Gas Price	-21.46	-12.56	-3.65

Conclusion: The sensitivity analysis confirms that the proposed project is unlikely to be financially attractive without the revenue from ERU sales.

Step 4: Common practice analysis

There are three similar activities in Ukraine paralleling with the proposed project activity, which are Project "Utilization of sunflower seeds husk for heat and power production at closed joint-stock company (CJSC) 'Pology oil-extraction plant, South-east Ukraine'"(under determination), Project "Utilization of biomass for steam and power supply at Peresechansk sunflower oil extraction mill 'PSOEM'" (under determination), Project "Utilization of sunflower seeds husk for steam and power production at the oil extraction plant OJSC 'Kirovogradoliya'" (withdrawn). All of them initiate to obtain the additional finance from carbon revenue.

Conclusion

With the analysis in above four steps, the scenario 2 in Table 2 is the most plausible baseline scenario in absence of the project activity. The project activity without JI revenues (Scenario 1) is not financially attractive, however the JI will alleviate this identified investment barriers.

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

According the JISC's "Guideline on criteria for baseline setting and monitoring", the project boundary encompasses all anthropogenic emissions by sources which are under the control of the project participants, reasonably attributable and significant. Table 7 summaries the gases and sources in the project boundary.

Table 7: Summary of gases and sources included in the project boundary

	Sources	Gas	Included?	Justification / Explanation
Baseline	Heat generation	CO_2	Yes	Main emission source.
		CH_4	No	Excluded for simplification. This is conservative.
		N_2O	No	Excluded for simplification. This is conservative.

[8] The detailed investment analysis has been made available to the verifier.

	Uncontrolled burning or decay of surplus biomass residues	CO_2	No	It is assumed that CO_2 emissions from surplus biomass residues do not lead to changes of carbon pools in the LULUCF sector.
		CH_4	Yes	The anaerobic degradation of husks will generate methane and emit it into atmosphere during the unmanaged landfill disposal.
		N_2O	No	Excluded for simplification. This is conservative. Note also that emissions from natural decay of biomass are not included in GHG inventories as anthropogenic sources.
Project Activity	Emissions from on-site fossil fuel and electricity consumption attributed to the project activity	CO_2	Yes	An important emission source.[9]
		CH_4	No	Excluded for simplification. The emission source is assumed to be very small.
		N_2O	No	Excluded for simplification. The emission source is assumed to be very small.
	Off-site transportation of biomass residues	CO_2	Yes	Comparing with the husks transportation from project location to the landfill site, the project activity utilizes the husks in site and reduces the transportation distance quite a lot. However, the emission reduction from the reduced transportation will be considered in the PDD as a conservative manner. Beside, the transportation of biomass will be monitored for any possibility that the project will utilize part of biomass from the outside of project boundary.
		CH_4	No	Excluded for simplification.
		N_2O	No	Excluded for simplification.
	Combustion of biomass residues for electricity and/or heat generation	CO_2	No	It is assumed that CO_2 emissions from surplus biomass do not lead to changes of carbon pools in the LULUCF sector.
		CH_4	Yes	This emission source is included because the baseline of husks treatment is the anaerobic decay in the landfill site.
		N_2O	No	Excluded for simplification.

The spatial extent of the project boundary encompasses the husk boilers at the project site, the means for transportation of biomass residues to the project sites, all power plants connected physically to the electricity system which MFF connects to, the existing natural gas boilers, the landfill site where the husks would have been left for decay. Figure 4 presents the project boundary.

[9] According to ACM0006 ver. 11.2.0, CO_2 emissions from on-site fossil fuel and electricity consumption that is attributable to the project activity shall be included to determine GHG emission of the project activity. The natural gas which is parallel consumed by the existing natural gas boilers whilst the project operation should not be included here.

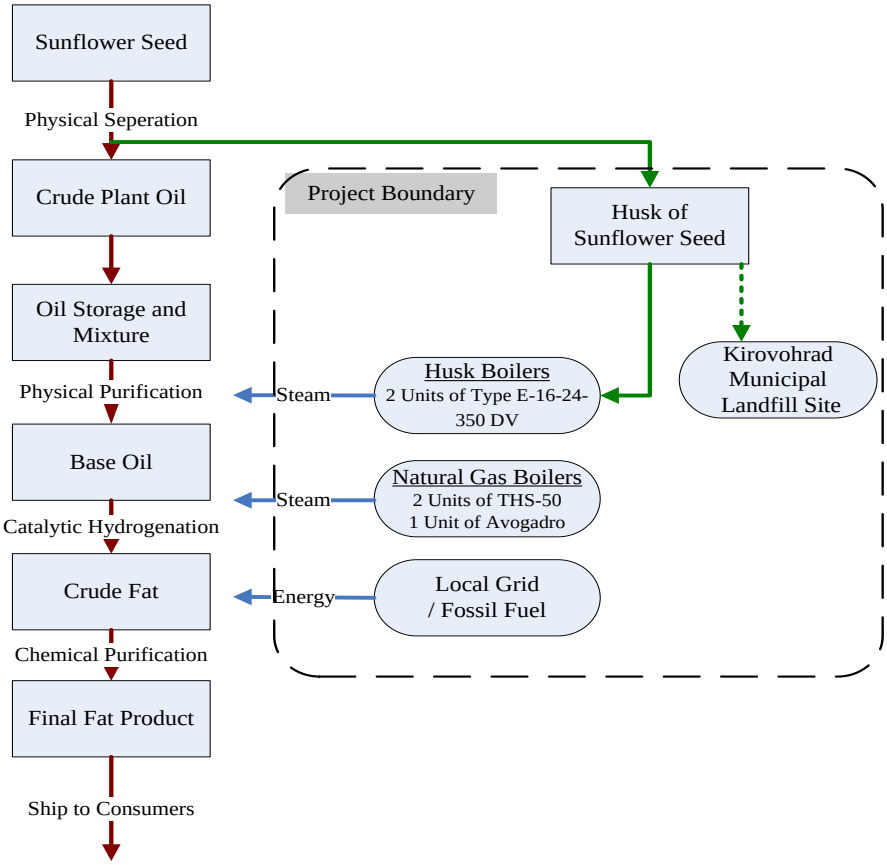

Figure 4: Project boundary

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 is set by the PDD developer, GreenStream Network, on behalf of PrJSC Modified Fats Factory on 11/11/2011.

GreenStream Network Plc
Lapinlahdenkatu 3
FI-00180 Helsinki
FINLAND
Responsible person: Yevgen Georgiyovych Groza
Title: Director, Ukraine
Tel: +358 20 743 7800
Fax: 358 20 743 7810
E-mail: yevgen.groza@greenstream.net
www.greenstream.net

GreenStream Network is not a project participant listed in Annex 1.

SECTION C. Duration of the small-scale project / crediting period

C.1. Starting date of the small-scale project:

The project starting date is 24/09/2009 when the testing operation of the two husk boilers started according to the Order #248 dated 24/09/2009.

C.2. Expected operational lifetime of the small-scale project:

20 years (240 months).

C.3. Length of the crediting period:

Total length of the crediting period is 10 years (120 months).

Kyoto crediting period starts from 24/09/2009 when the testing operation of the two husk boilers started; length of the crediting period is 3 years and 3 months (39 months).

Length of post-Kyoto crediting period is 6 years and 9 months (81 months).

SECTION D. Monitoring plan

D.1. Description of monitoring plan chosen:

In accordance with "Guidance on criteria for baseline setting and monitoring", ACM0006 "Consolidated methodology for electricity generation from biomass residues in power and heat plant, ver.11.2.0" will be applied to design the monitoring plan. The elements of ACM0006 are applicable to "biomass residue fired electricity generation in power and heat plants, including cogeneration plants", which is exactly same to the project activity. Husks are the biomass residues from the production process of oil and are the predominant fuel in the husk boilers. They are transported to the husk boilers after a very short storage. There is no significant energy quantities required to prepare the husks for fuel combustion in the project activity.

According to the Order #131 dated 15.07.2011[10] issued by the project owner's management, data monitored and required for determination are to be kept for two years after the last transfer of ERU for the project.

Baseline emissions (BE_y)

The calculation process of baseline emission will follows the steps indicated in ACM0006 ver. 11.2.0.

$$BE_y = EL_{BL,GR,y} * EF_{EG,GR,y} + \sum FF_{BL,HG,y,f} * EF_{FF,y,f} + EL_{BL,FF/GR,y} * min\,(EF_{EG,GR,y}; EF_{EG,FF,y}) + BE_{BR,y} \quad (1)$$

Where

BE_y = Baseline emission in year *y* (tCO_2)

$EL_{BL,GR,y}$ = Baseline minimum electricity generation in the grid in year *y* (MWh)

[10] The Order #131 is provided in the supporting documentation

$EF_{EG,GR,y}$ = Grid emission factor in year *y* (tCO_2/MWh)
$FF_{BL,HG,y,f}$ = Baseline fossil fuel demand for process heat in year *y* (kcal)
$EF_{FF,y,f}$ = CO_2 emission factor for fossil fuel type in year *y* (kg CO_2 / kcal)
$EL_{BL,FF/GR,y}$ = Baseline uncertain electricity generation in the grid or on-site in year *y* (MWh)
$EF_{EG,GR,y}$ = CO_2 emission factor for electricity generation with fossil fuels at the project site in the baseline in year *y* (tCO_2/MWh)
$BE_{BR,y}$ = Baseline emission due to disposal of biomass residues in year *y* (tCO_2e)
y = Year of the crediting period
f = Fossil fuel type

Step 1: Determine biomass availability, generation and capacity constraints, efficiencies and power emission factors in the baseline

Step 1.1: Determine total baseline process heat generation
The project activity will install two husk boilers which will produce steam to replace steam generation by existing natural gas boilers. $FF_{BL,HG,y,f}$ will be calculated as follows:

$$EF_{BL,HG,y,f} = \frac{Q_{husk,y} * NCV_{husk,y}}{\eta_{huskbolier}} / \eta_{Bl} \quad (2)$$

Where:
$Q_{husk,y}$ = The quantity of the husk used in the project activity during year *y* (tons/a)
$NCV_{husk,y}$ = Net caloric value of husk combusted by the project activity in year *y* (kcal/kg)
$\eta_{husk\ boiler}$ = The efficiency of the husk boilers
η_{BL} = The efficiency of the existing natural gas boilers which will service in the baseline scenario (default value: 87%)

$$\eta_{huskboiler} = \frac{H_{huskboiler}}{H_{husk}} \quad (3)$$

Where:
$H_{husk\ boiler}$ = The heat value generated by the husk boiler per hour (kcal/h)
H_{husk} = The heat value contained in the husk which is consumed in one hour (kcal/h)

Step 1.2, Step 1.3, Step 1.6 and Step 1.7 are not applicable for the project activity, because the project activity will not generate electricity.

Step 1.4 is not applicable for the project activity, because the baseline scenario does not include the use of biomass residues for the generation of power and/or heat.

Step 1.5 is not applicable for the specification of the project activity. The impact made by the efficiency of heat generators has been embedded in the determination of the E_f.

Step 2: Determine the minimum baseline electricity generation in the grid

Step 2 is not applicable for the project activity, because the project activity will not generate electricity.

Step 3: Determine the baseline biomass-based heat and power generation
Step 3 is not applicable for the project activity, because the project activity foresees no biomass-based co-generator to generate heat and power.

Step 4: Determine the baseline demand for fossil fuels to meet the balance of process heat and the corresponding electricity generation
Step 4 is not applicable for the project activity, because the natural gas in baseline is only used to generate heat.

Step 5: Determine the baseline emissions due to uncontrolled burning or decay of biomass residues

$$BE_{BR,y} = BE_{BR,\,B1/B3,y} + BE_{BR,\,B2,y} \quad (4)$$

Where

$BE_{BR,y}$ = Baseline emissions due to disposal of biomass residues in year *y* (tCO_2e)
$BE_{BR,\,B1/B3,y}$ = Baseline emissions due to aerobic decay or uncontrolled burning of biomass residues in year *y* (tCO_2e)
$BE_{BR,\,B2,y}$ = Baseline emissions due to anaerobic decay of biomass residues in year *y* (tCO_2e)

Step 5.1 is not applicable for the project activity, because the selected baseline scenario of biomass residues disposal is to be anaerobic decay.

Step 5.2: Determine $BE_{BR,\,B2,y}$
In absence of the project activity, the husks will be transported to the landfill site and disposed there. The methane emission from the anaerobic decay of the husks in the landfill site is calculated applying the "Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site, ver.05.1.0".

$$BE_{BR,B2,y} = \varphi*(1-f)*GWP_{CH4}*(1-OX)*\frac{16}{12}*F*DOC_f*MCF*\sum_{x=1}^{y}\sum W_{j,y}*DOC_j*e^{-kj(y-x)}*(1-e^{-kj}) \quad (5)$$

Where,

φ = Model correction factor to account for model uncertainties
f = Fraction of methane captured at the solid waste disposal site (SWDS) and flared, combusted or used in another manner
GWP_{CH4} = Global Warming Potential of methane
OX = Oxidation factor
F = Fraction of methane in the landfill gas
DOC_f = Fraction of degradable organic carbon that can decompose
MCF = Methane correction factor
$W_{j,y}$ = Amount of the husks prevented from disposal in the SWDS in the year *y*
DOC_j = Fraction of degradable organic carbon in the waste type *j*
k_j = Decay rate for the waste type *j*

Step 6: Calculate baseline emissions
The formula 6 of baseline emissions calculation shall be simplified as follows:

$$BE_y = \sum FF_{BL,HG,y,f} * EF_{FF,y,f} + BE_{BR,B2,y} \quad (6)$$

Project activity emissions (PE_y)

$$PE_y = PE_{FF,y} + PE_{GR,1,y} + PE_{GR,2,y} + PE_{TR,y} + PE_{BR,y} + PE_{WW,y} \quad (7)$$

Where:

PE_y = Project emissions during the year *y* (tCO_2)
$PE_{FF,y}$ = Emissions during the year *y* due to fossil fuel consumption at the project site (tCO_2)
$PE_{GR,1,y}$ = Emissions during the year *y* due to grid electricity imports to the project site (tCO_2)
$PE_{GR,2,y}$ = Emissions due to a reduction in electricity generation at the project site as compared to the baseline scenario in year *y* (tCO_2)
$PE_{TR,y}$ = Emissions during the year *y* due to transport of the biomass residues to the project activity (tCO_2)
$PE_{BR,y}$ = Emissions from the combustion of biomass residues during the year *y* (tCO_2e)
$PE_{WW,y}$ = Emission from wastewater generated from the treatment of biomass residues in the year *y* (tCO_2e)

$PE_{FF,y}$
CO_2 emission from on-site combustion of fossil fuel is calculated applying the "Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion, ver.2". The husk boilers will not utilize any auxiliary material or co-fire material in the husk boilers. However, to be conservative, the relevant parameters and calculation are accounted in the PDD in case any auxiliary materials are used occasionally.

$$PE_{FF,y} = FC_{i,j,y} * NCV_{i,y} * EF_{CO2,i,y} \quad (8)$$

Where:

$FC_{i,j,y}$ = The quantity of fuel type *i* combusted in process *j* during the year *y* (tonne/yr)
$NCV_{i,y}$ = Net caloric value of fossil fuel type *i* (TJ/Gg)
$EF_{CO2,i,y}$ = The weighted average CO_2 emission factor of fuel type *i* in year *y* ($kgCO_2/TJ$)

$PE_{GR,1,y}$
CO_2 emission from electricity consumption is calculated applying the "Tool to calculate baseline, project and/or leakage emissions from electricity consumption, ver.1". All the electricity consumption caused by the operation of husk boilers and their peripheral equipments shall be included.

$$PE_{GR,1,y} = \Sigma EC_{i,j,y} * EF_{EG,GR,y} \quad (9)$$

Where:

$EC_{p,y}$ = The quantity of electricity consumed by the project relevant activity during the year *y* (MWh/yr)

$EF_{EG,GR,y}$ = CO_2 emission factor of the electricity displaced from grid due to the project activity during the year *y* (tCO_2/MWh)

$PE_{GR,2,y}$

The project activity will not generate electricity, therefore, this emission source shall be excluded.

$PE_{TR,y}$

The transportation of husk to the husk boilers is done by conveyer. Therefore, the project activity will consume electricity, rather than fossil fuel to transport the husk. However, CO_2 emission from the transportation of husks will not be considered in the project activity. The reason is, ACM 0006 indicates that project participants shall determine CO_2 emission resulting from transportation of biomass residues to the project activity in cases where the biomass residues are not generated directly at the project site. In the proposed project activity, the husks are generated in OEP which is 145 meters away to the husk boilers. Therefore, it is conservative to exclude this emission source from the project emissions.

$PE_{BR,y}$

Methane emissions from combustion of husks in boilers are calculated as follows.

$$PE_{BR,y} = Q_{husk,y} * GWP_{CH4} * EF_{CH4,BF} * f_{CH4} * NCV_{husky} \quad (10)$$

Where:

$Q_{husk,y}$ = Quantity of husk used in the project activity during the year y (tonnes on dry-basis)

GWP_{CH4} = Global Warming Potential for methane (tCO_2/tCH_4)

$NCV_{husk,y}$ = Net caloric value of husk in the year *y* (TJ/Gg).

$EF_{CH4,BF}$ = CH_4 emission factor for the combustion of biomass residues in the project activity ($kgCH_4$/TJ)

f_{CH4} = conservativeness factor to $EF_{CH4,BF}$

$PE_{WW,y}$

This emission source is excluded from the project sources, because there is no wastewater originating from the treatment of husks. The husks combusted in boiler are transported from OEF directly without any treatment.

In summary, formula 1 shall be simplified as follows:

$$PE_y = PE_{FF,y} + PE_{GR,1,y} + PE_{BR,y} \quad (11)$$

Leakage emissions (LE_y)

The main potential source of leakage for the project activity is an increase in emissions from fossil fuel combustion or other sources due to diversion of the husks from other uses to the project activity as a result of the project activity. The potential of leakage will not be considered either from the project specification or from the common practise of the husk utilization in Ukraine. In Ukraine, the oil

extraction factory is the only possible husk consumer. And these factories have no need to import any husks from other factories. The proposed project activity will not compete with other husk user in terms of the husk utilization. Therefore, the estimated leakage of the project activity is Zero.

Emission reductions (ER_y)

Regarding the baseline scenario and the project activity, emission reduction of the project activity will be calculated as follows.

$$ER_y = BE_y - PE_y - LE_y \quad (12)$$

Where:

ER_y = Emission reductions of the project activity during the year *y* (tCO_2)
BE_y = Baseline emissions during the year *y* (tCO_2)
PE_y = Project emissions during the year *y* (tCO_2)
LE_y = Leakage emissions during the year *y* (tCO_2)

D.2. Data to be monitored:

(i) 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 are given below.

Baseline parameters:

Data / Parameter:	**$EF_{FF,y,f}$**
Data unit:	kg CO_2/Tcal
Description:	CO_2 emission factor of fuel type *i* in year *y*
Time of determination/monitoring	Determined only once and available already at the stage of determination regarding the PDD
Source of data (to be) used:	1996 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 3: Reference Manual, Chapter 1: Energy, Table 1-4, Carbon Emission Factors for Fuels from Different Studies Stationary, Pg. 1.24: http://www.ipcc-nggip.iges.or.jp/public/gl/guidelin/ch1ref2.pdf
Value of data applied:	Default value applied: 234,722
Justification of the choice of data or description of measurement methods and procedures (to be applied)	The type of fossil fuel is Natural Gas.
QA/QC procedures (to be) applied	-
Any comment:	IPCC value is applied as 15.3 ton C/TJ; 1 ton C/TJ = 44/12*1000 kgCO_2/TJ; 1 cal = 4.1868 J

Data / Parameter:	**η_{BL}**
Data unit:	
Description:	The efficiency of the existing natural gas boilers which will service in the baseline scenario

Time of determination/monitoring	Determined only once and available already at the stage of determination regarding the PDD
Source of data (to be) used:	Tool to determine the baseline efficiency of thermal or electric energy generation system, version 01, Table 1, Pg. 7
Value of data applied:	Default value applied: 87%
Justification of the choice of data or description of measurement methods and procedures (to be applied)	The existing natural gas boilers have serviced for 10 years.
QA/QC procedures (to be) applied	
Any comment:	

Data / Parameter:	**$H_{husk\ boiler}$**
Data unit:	Kcal/h
Description:	The heat value generated by the husk boiler per hour
Time of determination/monitoring	Determined only once and available already at the stage of determination regarding the PDD
Source of data (to be) used:	Calculated with the data given by the operation chart of the husk boiler
Value of data applied:	<table><tr><td>Working load</td><td>50%</td><td>75%</td><td>100%</td></tr><tr><td>$H_{husk\ boiler}$</td><td>3,524,430</td><td>5,727,200</td><td>7,048,860</td></tr></table>
Justification of the choice of data or description of measurement methods and procedures (to be applied)	<table><tr><td>Husk boiler</td><td>50%</td><td>75%</td><td>100%</td></tr><tr><td>Steam generation (ton/h)</td><td>8</td><td>13</td><td>16</td></tr><tr><td>Saturated steam pressure (kgf/cm^2)</td><td>24</td><td>24</td><td>24</td></tr></table> With help of a calculation tool, the hourly heat value generated by the husk boiler can be calculation.
QA/QC procedures (to be) applied	The calculation tool is developed by Spirax-sarco, a specialist in steam system over 100 years.
Any comment:	The calculation tool is available at: http://www.spiraxsarco.com/resources/calculators/steam-flow-and-heat-rate/steam-flow-rate-to-heat-rating.asp

Data / Parameter:	**H_{husk}**
Data unit:	kcal/h
Description:	The heat value contained in the husk which is consumed in one hour
Time of determination/monitoring	Determined only once and available already at the stage of determination regarding the PDD

Source of data (to be) used:	Calculated with the data given by the operation chart of the husk boiler
Value of data applied:	<table><tr><td>Working load</td><td>50%</td><td>75%</td><td>100%</td></tr><tr><td>H_{husk}</td><td>6,099,000</td><td>10,710,000</td><td>12,180,000</td></tr></table>
Justification of the choice of data or description of measurement methods and procedures (to be applied)	<table><tr><td>Working load</td><td>50%</td><td>75%</td><td>100%</td></tr><tr><td>Husk consumption (kg/h)</td><td>1450</td><td>2550</td><td>2900</td></tr></table> NCV of husk is 4137 kcal/kg.
QA/QC procedures (to be) applied	
Any comment:	<table><tr><td>Working load</td><td>50%</td><td>75%</td><td>100%</td><td>Mean</td></tr><tr><td>$H_{husk\ boiler}$</td><td>58.75%</td><td>54.29%</td><td>58.75%</td><td>57.27%</td></tr></table>

Data / Parameter:	**φ**
Data unit:	
Description:	Model correction factor to account for model uncertainties
Time of determination/monitoring	Determined only once and available already at the stage of determination regarding the PDD
Source of data (to be) used:	Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site, Version 05.1.0, Table "Data and parameters monitored", Pg. 3
Value of data applied:	Default value applied: 0.9
Justification of the choice of data or description of measurement methods and procedures (to be applied)	Oonk et al.(1994) have validated several landfill gas models based on 17 realized landfill gas projects. The mean relative error of multi-phase models was assessed to be 18%. Given the uncertainties associated with the model and in order to estimate emission reductions in a conservative manner, a discount of 10% is applied to the model results.
QA/QC procedures (to be) applied	
Any comment:	

Data / Parameter:	**OX**
Data unit:	
Description:	Oxidation factor
Time of determination/monitoring	Determined only once and available already at the stage of determination regarding the PDD
Source of data (to be) used:	Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site, Version 05.1.0, Table "Data and parameters monitored", Pg. 3

Value of data applied:	Default value applied: 0
Justification of the choice of data or description of measurement methods and procedures (to be applied)	The solid waste disposal sites where the husk should be disposed in absence of the project activity are not covered with oxidizing material. Thus, 0 is applied as the oxidation factor.
QA/QC procedures (to be) applied	
Any comment:	

Data / Parameter:	**DOC_f**
Data unit:	
Description:	Fraction of degradable organic carbon that can decompose
Time of determination/monitoring	Determined only once and available already at the stage of determination regarding the PDD
Source of data (to be) used:	Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site, Version 05.1.0, Table "Data and parameters monitored", Pg. 4
Value of data applied:	Default value applied: 0.5
Justification of the choice of data or description of measurement methods and procedures (to be applied)	The figure is applicable for the domestic solid waste in the host country. It is referred to the Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site, Version 05.1.0.
QA/QC procedures (to be) applied	
Any comment:	

Data / Parameter:	**MCF**
Data unit:	
Description:	Methane correction factor
Time of determination/monitoring	Determined only once and available already at the stage of determination regarding the PDD
Source of data (to be) used:	Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site, Version 05.1.0, Table "Data and parameters monitored", Pg. 4
Value of data applied:	Default value applied: 1 for Anaerobic managed solid waste disposal sites
Justification of the choice of data or description of measurement methods and procedures (to be applied)	The solid waste disposal sites where the husk should be disposed in absence of the project activity are identified as the Anaerobic managed solid waste disposal sites.
QA/QC procedures (to be) applied	
Any comment:	

Data / Parameter:	**DOC_j**
Data unit:	%
Description:	Fraction of degradable organic carbon in the waste type *j*
Time of	Determined only once and available already at the stage of

determination/monitoring	determination regarding the PDD
Source of data (to be) used:	Table 1 of Sunflower Seed Hulls, Mushroom Growers' handbook 2, Pg. 101 available at: http://www.alohamedicinals.com/book2/chapter-4-02-04.pdf
Value of data applied:	Default value applied: 39
Justification of the choice of data or description of measurement methods and procedures (to be applied)	The sunflower seed husk consists of total organic carbon (42%), ash (3%) and other compositions. The degradable organic carbon should the total organic carbon deducting the ash.
QA/QC procedures (to be) applied	
Any comment:	

Data / Parameter:	**k_j**
Data unit:	
Description:	Decay rate for the waste type *j*
Time of determination/monitoring	Determined only once and available already at the stage of determination regarding the PDD
Source of data (to be) used:	Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site, Version 05.1.0, Table "Data and parameters monitored", Pg. 6
Value of data applied:	Default value applied: 0.03 for Kirovograd
Justification of the choice of data or description of measurement methods and procedures (to be applied)	According to the information of meteorological and physical characteristic of Kirovograd Municipal Landfill Site given in Annex 2, the project is located in the Temperate because the average annual high temperature is 11.9 °C and the annual average low temperature is 3.6 °C in the project location. The evapotranspiration in the project location is less than the annual precipitation (549 mm). Therefore, the project location is indentified as wet.
QA/QC procedures (to be) applied	
Any comment:	

Data / Parameter:	**F**
Data unit:	--
Description:	Fraction of methane in the landfill gas
Time of determination/monitoring	Determined only once and available already at the stage of determination regarding the PDD
Source of data (to be) used:	Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site, Version 05.1.0, Table "Data and parameters monitored", Pg. 4
Value of data applied:	Default value applied: 0.5
Justification of the choice of data or description of measurement methods and procedures (to be applied)	Most waste in landfill site generates a gas with approximately 50% CH_4. Only material including substantial amounts of fat or oil can generate gas with substantially more than 50% CH_4. The use of the IPCC default value for the fraction of CH_4 in landfill gas (0.5) is therefore encouraged.

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

Data / Parameter:	**GWP_{CH4}**
Data unit:	tCO_2e/tCH_4
Description:	
Time of determination/monitoring	Monitored for the each commitment period
Source of data (to be) used:	Decision FCCC/CP/1999/7, page 14, Table 1
Value of data applied:	21
Justification of the choice of data or description of measurement methods and procedures (to be applied)	
QA/QC procedures (to be) applied	GWP_{CH4} shall be updated according to any future COP/MOP decisions.
Any comment:	

Project parameters:

Data / Parameter:	**$EF_{CO2,i,y}$**
Data unit:	$kgCO_2/TJ$
Description:	The weighted average CO_2 emission factor of fuel type *i* in year *y*
Time of determination/monitoring	Determined only once and available already at the stage of determination regarding the PDD
Source of data (to be) used:	1996 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 3: Reference Manual, Chapter 1: Energy, Table 1-4, Carbon Emission Factors for Fuels from Different Studies Stationary, Pg. 1.24: http://www.ipcc-nggip.iges.or.jp/public/gl/guidelin/ch1ref2.pdf
Value of data applied:	Default value applied: 56 100
Justification of the choice of data or description of measurement methods and procedures (to be applied)	The type of fossil fuel is Natural Gas.
QA/QC procedures (to be) applied	-
Any comment:	IPCC value is applied as 15.3 ton C/TJ. 1 ton C/TJ = 44/12*1000 $kgCO_2/TJ$

Data / Parameter:	**$EF_{CH4,BF}$**
Data unit:	$kgCH_4/TJ$
Description:	CH_4 emission factor for the combustion of biomass residues in the project activity

Time of determination/monitoring	Determined only once and available already at the stage of determination regarding the PDD
Source of data (to be) used:	ACM 0006 ver.11.2.0, Table 4, Pg. 49
Value of data applied:	Default value applied: 30 for husks
Justification of the choice of data or description of measurement methods and procedures (to be applied)	30 is default CH_4 emission factor of various solid waste, including municipal waste (non-biomass fraction and biomass fraction), industrial wastes, wood/wood waste. It is reliable that 30 is applied as default CH_4 emission factor of husk.
QA/QC procedures (to be) applied	
Any comment:	

Data / Parameter:	$\mathbf{f_{CH4}}$
Data unit:	$kgCO_2/TJ$
Description:	conservativeness factor to $EF_{CH4,BF}$
Time of determination/monitoring	Determined only once and available already at the stage of determination regarding the PDD
Source of data (to be) used:	ACM 0006 ver.11.2.0, Table 5, Pg. 50
Value of data applied:	Default value applied: 1.37 for husks
Justification of the choice of data or description of measurement methods and procedures (to be applied)	The assumed uncertainty of the default CH_4 emission factor of husk (30) is 300%. According the Table 5 of ACM0006 ver. 11.2.0, when the assumed uncertainty is greater than 100%, the conservativeness factor should be 1.37.
QA/QC procedures (to be) applied	
Any comment:	

(ii) 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 not available already at the stage of determination are not used within this project.

(iii) Parameters that are monitored throughout the crediting period are given below.

Baseline parameters:

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	Monitored annually
Source of data (to be) used:	On-site check in the landfill site
Value of data applied:	*Ex-ante* value: 0%
Justification of the choice of data or description of	

measurement methods and procedures (to be applied)	
QA/QC procedures (to be) applied	This parameter is decided by the status of LFG capture in the landfill site. The on-site status will be checked annually. Once there is any activity of LFG collection and destroy implemented in the landfill site, latest ACM 0002 will be used to estimate the value of F.
Any comment:	

Data / Parameter:	**$Q_{husk,y}$**
Data unit:	Tonne
Description:	Quantity of biomass residues of category n used in the project activity during the year y (tonnes on dry-basis)
Time of determination/monitoring	Monitored throughout the crediting period
Source of data (to be) used:	Log recorded by the project developer
Value of data applied:	*Ex-ante value:* 27,950 tonne/yr
Justification of the choice of data or description of measurement methods and procedures (to be applied)	The total weight of the sunflower seed which is processed in the plant will be recorded by the project developer. Following the experimental and statistical method, husk consists of 14% of the total weight of the sunflower seed. Thus, the can be calculated by multiplying 14% with the total weight of the sunflower seed.
QA/QC procedures (to be) applied	The total amount of the sunflower seed will be weighted by electronic weight hopper which will be calibrated according the manufacturer's requirement.
Any comment:	

Project parameters:

Data / Parameter:	**$NCV_{i,y}$**
Data unit:	$kcal/nm^3$
Description:	Net caloric value of fossil fuel type *i* which will be consumed by the project activity
Time of determination/monitoring	Determined only once and available already at the stage of determination regarding the PDD
Source of data (to be) used:	Ukraine's National Inventory Report of GHG Sources and Sinks 1990 to 2009, Table P2.30, Column 1.A.1.a, Pg. 399 http://unfccc.int/national_reports/annex_i_ghg_inventories/national_inventories_submissions/items/5888.php
Value of data applied:	8150
Justification of the choice of data or description of measurement methods and procedures (to be applied)	There is minor possibility that the fossil fuel will be consumed by the project activity. However, the NCV of fossil fuel that will be consumed by the project is included into the monitoring plan.
QA/QC procedures (to be) applied	

Any comment:	National Inventory Report value is applied as 34.1 GJ/1000m3; 1 cal = 4.1868 J

Data / Parameter:	**$FC_{i,j,y}$**
Data unit:	Tonne/yr
Description:	The quantity of fuel type *i* combusted in process *j* during the year *y*
Time of determination/monitoring	Monitored annually
Source of data (to be) used:	Recorded on site
Value of data applied:	*Ex-ante* value: 0
Justification of the choice of data or description of measurement methods and procedures (to be applied)	There is minor possibility that the fossil fuel will be consumed by the project activity. However, the quantity of fossil fuel that will be consumed by the project is included into the monitoring plan.
QA/QC procedures (to be) applied	
Any comment:	Data will be archived in form of electronic/paper.

Data / Parameter:	**$EC_{p,y}$**
Data unit:	MWh/yr
Description:	The quantity of electricity consumed by the project relevant activity during the year *y*
Time of determination/monitoring	Monitored continuously throughout the crediting period
Source of data (to be) used:	Recorded on site by meters and calculated by the developer
Value of data applied:	*Ex-ante* value: 1,084 MWh/yr
Justification of the choice of data or description of measurement methods and procedures (to be applied)	There is only one meter installed to record the electricity consumption of all the equipments in the boiler room with total installed capacity of 707.54 kW. Among it, the installed capacity of the electro equipments related to the project activity is 420.1 kW. Therefore, the actual electricity consumption by the project during the crediting period can be calculated as: $EC_{p,y} = EC_{boiler\_roon,y} * \frac{420.1}{707.54}$
QA/QC procedures (to be) applied	
Any comment:	Data will be archived in form of electronic/paper.

Data / Parameter:	**$EF_{EG,GR,y}$**
Data unit:	tCO_2/MWh
Description:	
Time of determination/monitoring	Monitored annually
Source of data (to be) used:	For the data during 2009-2011: National emission factor for UES of Ukraine for projects consuming electricity issued by National Environmental Investments Agency of Ukraine

	For the data after 2011: Carbon emission factor study for the national grid of Ukraine which is used for ex-ante estimation.
Value of data applied:	2009: 1.096[11] 2010: 1.093[12] 2011: 1.090[13] Afterwards: 0.896 for JI projects reducing electricity[14]
Justification of the choice of data or description of measurement methods and procedures (to be applied)	0.896 is applied to estimate the emission reduction realised after 2011. The ex-post calculation will cite the realistic value which is published by State Environmental Investments Agency of Ukraine.
QA/QC procedures (to be) applied	The data during 2009-2011 is the realistic data to present the national emission factor of Ukraine's grid. The parameter will be monitored according to the latest National emission factor for UES of Ukraine for projects issued by State Environmental Investments Agency of Ukraine.
Any comment:	

Data / Parameter:	**$NCV_{husk,y}$**
Data unit:	TJ/Gg
Description:	Net caloric value of husk in the year *y*
Time of determination/monitoring	Monitored every six months
Source of data (to be) used:	Sevastopol Laboratory Eco-standard-service
Value of data applied:	Value applied: 4137 kcal/kg
Justification of the choice of data or description of measurement methods and procedures (to be applied)	5 kg husk is used in each test.
QA/QC procedures (to be) applied	
Any comment:	Data will be archived in form of electronic/paper. The value applied is switched from 17.31 TJ/Gg.

Information on environmental impact is indicated in Section F of the PDD.

[11] National emission factor for UES of Ukraine for projects at 2009, aiming at a decrease of electricity: 1.096 kg CO2/kWh. According to NEIA Order #63 as of 15/04/2011
http://www.neia.gov.ua/nature/doccatalog/document?id=127172
[12] National emission factor for UES of Ukraine for projects at 2010, aiming at a decrease of electricity: 1.093 kg CO2/kWh, According to NEIA Order #43 as of 28/03/2011
http://www.neia.gov.ua/nature/doccatalog/document?id=126006
[13] National emission factor for UES of Ukraine for projects at 2011, aiming at a decrease of electricity: 1.090 kg CO2/kWh. According to NEIA Order #75 as of 12/05/2011
http://www.neia.gov.ua/nature/doccatalog/document?id=127498
[14] The Carbon Emission Factor Study for the National Grid of Ukraine is available at:
http://ji.unfccc.int/UserManagement/FileStorage/46JW2KL36KM0GEMI0PHDTQF6DVI514

D.3. Quality control (QC) and quality assurance (QA) procedures undertaken for data monitored:

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.
PM 1 $\mathbf{FC_{i,j,y}}$	Low	QA/QC procedure is not necessary for this parameter, because the husk boilers will not utilize any auxiliary material or co-fire material in the husk boilers. However, to be conservative, the relevant parameters and calculation are accounted in the PDD in case any auxiliary materials are used occasionally. The parameter will be recorded on site. In addition, the receipt of the purchase of the fossil fuel will be used as the back-up measurement in case the parameter is not recorded well during the project commissioning.
PM 2 $\mathbf{EC_{p,y}}$	Low	The electricity meter installed in the boiler room will be calibrated according to the manufacture's requirement. In addition to the reading of the meter, the electricity bill from grid operator will be applied to cross-check the parameter.
PM 3 $\mathbf{EF_{EG,GR,y}}$	Low	The data applied for the ex-post calculation will be cited from the National Environmental Investments Agency of Ukraine who has published the annual grid EF during 2009-2011.
PM 4 $\mathbf{NCV_{husk,y}}$	Low	5 kg husk will be combusted in each test taken in every 6 months. Paralleled with 1.000 Eco-standard-service test done by Sevastopol Laboratory, the value of this data will be compared with the historical record of the test and the IPCC default value (11.6 TJ/Gg)[15]. To keep the result conservative, the highest value between a certain test result, the average value of the historical record and the IPCC default value will be applied in the calculation of the project emission.

[15] Table 1.2, volume 2, IPCC 2006

BM 1 **f**	Low	This parameter is decided by the status of LFG capture in the landfill site. The on-site status will be checked annually. Once there is any activity of LFG collection and destroy implemented in the landfill site, latest ACM 0002 will be used to estimate the value of f. The literatures regarding the LFG technology and development in the host country will be reviewed regularly as the cross-check to confirm the baseline scenario of the treatment of husk.
BM 5 $\mathbf{Q_{husk,y}}$	Low	The amount of husk is calculated by multiplying 14% with the total weight of the sunflower seed which is processed in the plant. 14% is the experimental and statistical percentage of husk in sunflower seed. The sunflower seed will be weighted by an electronic weight hopper. The parameter will be cross-checked by multiplying the husk feed-in capacity and the working hours of the husk boilers.
BM 6 $\mathbf{GWP_{CH4}}$	Low	GWP_{CH4} shall be updated according to any future COP/MOP decisions.

The figure 5 presents the location of the monitoring parameters in the project activity.

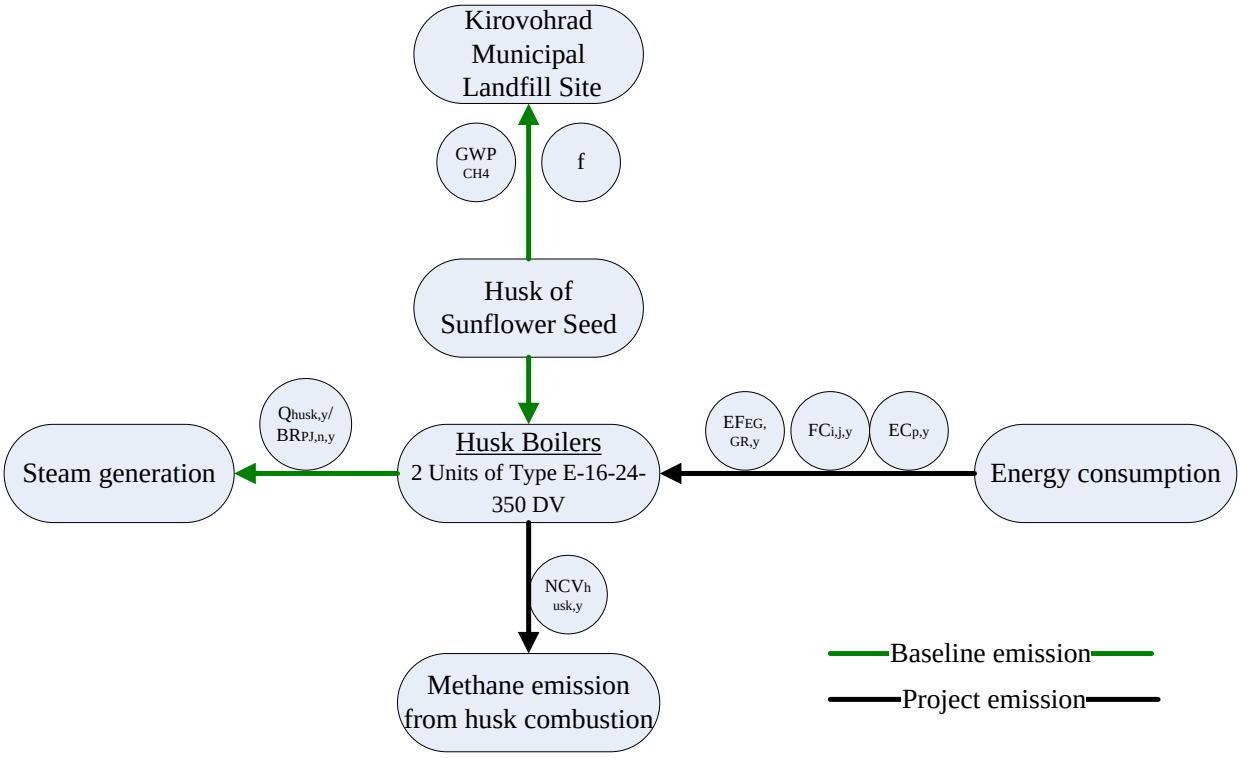

Figure 5: Monitoring flow chart

D.4. Brief description of the operational and management structure that will be applied in implementing the monitoring plan:

A monitoring team is organized to supervise the implementation and operation of the project activity from the view of JI development. See Figure 6. The members are assigned with responsibilities, including but not limited to the collection and record of monitoring data, date report, process supervision, the development of monitoring report.

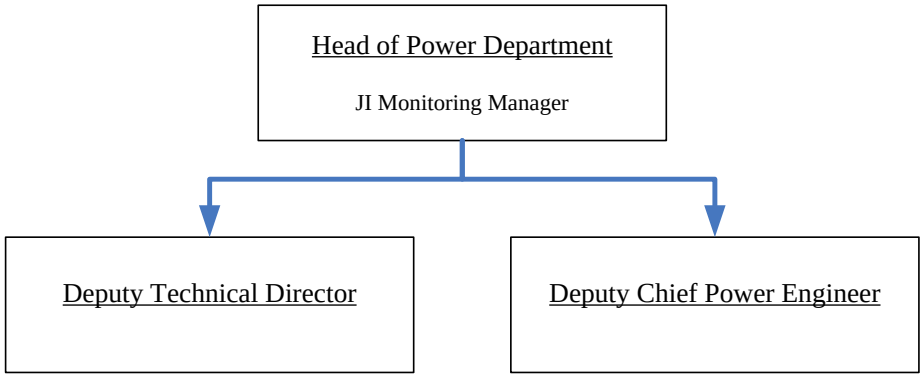

Figure 6: Monitoring structure

The monitoring parameters will be recorded following the monitoring plan. The record will be saved in electronic form and kept two years after the credit period. The JI monitoring manager will be in charge of and accountable for the generation of emission reduction, computation, internal audits. The deputy chief power engineer and the deputy technical director and will assist the JI monitoring manager for the data record and collection. The deputy chief power engineer will take responsibility to monitor the parameters in the power sector, i.e. $Q_{husk,y}$, $EC_{p,y}$. The deputy technical director will take the responsibility for the other parameters, i.e. $NCV_{husk,y}$, $BR_{PJ,n,y}$, etc.

D.5. Name of person(s)/entity(ies) establishing the monitoring plan:

The monitoring plan is set by the PDD developer, Greenstream Network, on behalf of the project participants on 11/11/2011.

GreenStream Network Plc
Lapinlahdenkatu 3
FI-00180 Helsinki
FINLAND
Responsible person: Yevgen Georgiyovych Groza
Title: Director, Ukraine
Tel: +358 20 743 7800
Fax: 358 20 743 7810
E-mail: yevgen.groza@greenstream.net
www.greenstream.net

GreenStream Network is not a project participant listed in Annex 1

SECTION E. Estimation of greenhouse gas emission reductions

E.1. Estimated project emissions and formulae used in the estimation:

The project emissions of the project activity are calculated basing on the formula 11:

$PE_y = PE_{FF,y} + PE_{GR,1,y} + PE_{BR,y}$

With the data that either can be determined once and available of determination or will be monitored throughout the crediting period, the estimated project emissions are presented in Table 8.

Table 8a: Estimated project emissions during the Kyoto Period

Year	$PE_{FF,y}$ (tCO_2)	$PE_{GR,1,y}$ (tCO_2)	$PE_{BR,y}$ (tCO_2)	PE_y (tCO_2)
2009 (24/09/2009-31/12/2009)	0	297	105	402
2010	0	1,185	418	1,603
2011	0	1,182	418	1,600
2012	0	971	418	1,389
Total during the Kyoto period	**0**	**3,635**	**1,359**	**4,994**

Table 8b: Estimated project emissions during the post-Kyoto Period

Year	$PE_{FF,y}$ (tCO_2)	$PE_{GR,1,y}$ (tCO_2)	$PE_{BR,y}$ (tCO_2)	PE_y (tCO_2)
2013	0	971	418	1,389
2014	0	971	418	1,389
2015	0	971	418	1,389
2016	0	971	418	1,389
2017	0	971	418	1,389
2018	0	971	418	1,389
2019 (01/01/2019-23/09/2019)	0	728	314	1,042
Total during the post-Kyoto period	**0**	**6,554**	**2,822**	**9,376**
Total during crediting period (2009-2019)	**0**	**10,189**	**4,181**	**14,370**

E.2. Estimated leakage and formulae used in the estimation, if applicable:

As illustrated in Section B.1, the leakage of the project activity is Zero.

E.3. Sum of E.1. and E.2.:

Table 9a: Sum of estimated project emissions and leakage during the Kyoto Period

Year	$PE_y(tCO_2)$	$L(tCO_2)$	$Sum(tCO_2)$
2009 (24/09/2009-31/12/2009)	402	0	402
2010	1,603	0	1,603
2011	1,600	0	1,600
2012	1,389	0	1,389
Total during the Kyoto period	**4,994**	**0**	**4,994**

Table 9b: Sum of estimated project emissions and leakage during the post-Kyoto Period

Year	$PE_y(tCO_2)$	$L(tCO_2)$	$Sum(tCO_2)$
2013	1,389	0	1,389
2014	1,389	0	1,389
2015	1,389	0	1,389
2016	1,389	0	1,389
2017	1,389	0	1,389
2018	1,389	0	1,389
2019 (01/01/2019-23/09/2019)	1,042	0	1,042
Total during the post-Kyoto period	**9,376**	**0**	**9,376**
Total during the crediting period (2009-2019)	**14,370**	**0**	**14,370**

E.4. Estimated baseline emissions and formulae used in the estimation:

The baseline emissions of the project activity are calculated basing on the formula 6:

$BE_y = \sum FF_{BL,HG,y,f} * EF_{FF,y,f} + BE_{BR,B2,y}$

To calculate $BE_{BR,B2,y}$, an on-site visit was taken in KERP-1128 Landfill site, which is the Kirovograd Municipal Landfill Site where the husk would be disposed in absence of the project activity. More description of the KERP-1128 Landfill site is presented in Annex 2.

With the data that either can be determined once and available of determination or will be monitored throughout the crediting period, the estimated baseline emissions are presented in Table 10.

The total length of the period of transfer of the approved anthropogenic GHG emission reductions as well as the transfer starting date and the transfer ending date are given below.

Total length of the transfer period: 10 years; transfer starting date: 24/09/2009; transfer ending date: 23/09/2019.

Table 10a: Estimated baseline emissions and emission by heat/electricity replacement during the Kyoto Period

Year	$BE_{heat,y}$ (tCO_2)	$BE_{BR,B2,y}$ (tCO_2)	BE_y (tCO_2)
2009 (24/09/2009-31/12/2009)	4,534	330	4,864
2010	18,137	3,309	21,446
2011	18,137	5,238	23,375

2012	18,137	7,111	25,248
Total during the Kyoto period	**58,945**	**15,988**	**74,933**

Table 10b: Estimated baseline emissions and emission by heat/electricity replacement during the post-Kyoto Period

Year	**$BE_{heat,y}$ (tCO_2)**	**$BE_{BR,B2,y}$ (tCO_2)**	**BE_y (tCO_2)**
2013	18,137	8,929	27,066
2014	18,137	10,692	28,829
2015	18,137	12,404	30,541
2016	18,137	14,065	32,202
2017	18,137	15,677	33,814
2018	18,137	17,241	35,378
2019 (01/01/2019-23/09/2019)	13,603	14,069	27,672
Total during the post-Kyoto period	**122,425**	**93,077**	**215,502**
Total during the crediting period (2009-2019)	**181,370**	**109,065**	**290,435**

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

Table 11a: Emission reduction during the Kyoto Period

Year	**ER_y (tCO_2)**
2009 (24/09/2009-31/12/2009)	4,462
2010	19,843
2011	21,775
2012	23,859
Total during the Kyoto period	**69,939**

Table 11b: Emission reduction during the post-Kyoto Period

Year	**ER_y (tCO_2)**
2013	25,677
2014	27,440
2015	29,152
2016	30,813
2017	32,425
2018	33,989
2019 (01/01/2019-23/09/2019)	26,630
Total during the post-Kyoto period	**206,126**

Total during the crediting period (2009-2019)	**276,065**

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

Table 12a: Emission reductions during the Kyoto Period

Year	Estimated project emissions (tonnes of CO2 equivalent)	Estimated leakage (tonnes of CO2 equivalent)	Estimated baseline emissions (tonnes of CO2 equivalent)	Estimated emission reductions (tonnes of CO2 equivalent)
2009 (24/09/09-31/12/09)	402	0	4,864	4,462
2010	1,603	0	21,446	19,843
2011	1,600	0	23,375	21,775
2012	1,389	0	25,248	23,859
Total (tonnes of CO2 equivalent)	**4,994**	0	**74,933**	**69,939**

Table 12b: Emission reductions during the post-Kyoto period

Year	Estimated project emissions (tonnes of CO2 equivalent)	Estimated leakage (tonnes of CO2 equivalent)	Estimated baseline emissions (tonnes of CO2 equivalent)	Estimated emission reductions (tonnes of CO2 equivalent)
2013	1,389	0	27,066	25,677
2014	1,389	0	28,829	27,440
2015	1,389	0	30,541	29,152
2016	1,389	0	32,202	30,813
2017	1,389	0	33,814	32,425
2018	1,389	0	35,378	33,989
2019 (01/01/2019-23/09/2019)	1,042	0	27,672	26,630
Total (tonnes of CO2 equivalent)	**9,376**	0	**215,502**	**206,126**
Total over the crediting period (2009-2019) (tonnes of CO2 equivalent)	**14,370**	0	**290,435**	**276,065**

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:

JI Project "Sunflower Husk Utilization for Steam Generation at the Oil-Extraction Factory CJSC Modified Fats Factory" will have a positive influence on the environment. As a result of project implementation sunflower husk, which is considered to be a carbon neutral fuel, will mainly be used as a fuel for boilers. Implementation of this activity will provide reduction of natural gas consumption and as a result green house gases emissions into the atmosphere will be reduced.

Project implementation will give the possibility to lead to the substantial saving of natural gas during the period of 2009-2012. Natural gas is a fossil fuel, which is imported to Ukraine that is why saving of the natural gas is important.

The environmental impact of the project is included in Environmental Impact Assessment (EIA) of the general project "Plant for oil production by oilseeds extraction". EIA performed in accordance with following regulations:

- DBN A.2.2.1-2003 "Composition and content of the environmental impact assessment (EIA) documents for designing of the plants, buildings and structures"
- The Law of Ukraine "On the environmental protection"
- The Law of Ukraine "Air protection"
- DBN A.2.2-3-2004 "Construction design composition and rules for its development, endorsement and approval"
- OND-86 "Methodology of air pollutant concentration calculation contained in emissions of enterprises"
- DSP-201-97 "State sanitary rules of populated area air protection"

and others.

The main conclusion of EIA is this project has no influence onto the geological environment, soil, microclimate, flora and fauna, reservations, surrounding social and technogenic environment. The realization of the project on processing oil seeds by way of extraction will have no adverse effect onto the environment and the health of the people living in this region, hence no environmental measures (other than provided for by the project) are worked out at this enterprise. The decisions taken regarding the employment of advanced technological processes and equipment, rational use of natural resources, environmental measures allow conclude that the object is ecologically safe.

Transboundary impact

Ukraine has ratified three Protocols to the UN Convention on Long-range Transboundary Air Pollution. Two of these Protocols are directly related to the reduction and control over the hazardous substances emissions, namely:

- The 1985 Helsinki Protocol on the Reduction of Sulphur Emissions or their Transboundary Fluxes by at least 30 per cent, entered into force as of September 2nd, 1987.
- The 1988 Sofia Protocol concerning the Control of Emissions of Nitrogen Oxides or their Transboundary Fluxes, entered into force as of February 14th, 1991.

The utilization of sunflower seed husk for steam leads to the emissions of nitrogen dioxides of 15.59 t/year and emissions of sulphuric anhydride of 38.425 t/year. In comparison with using natural gas as fuel for oil extraction plant the emissions of nitrogen dioxides decreases per 21.41 t/year. So project favours Ukraine to comply with the Sofia Protocol.

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

During the period of project implementation environment will be influenced.

Impact on the Air Quality

Implementation of this project will have a positive effect onto the air quality, as it will lead to:

1) Emission reduction of CO_2, NO_x, due to introduction of environmentally friendly technologies, which provide the possibility to use biomass as a fuel;

2) Reduction of natural gas consumption which will lead to greenhouse gas emissions reduction into the atmosphere.

Impact on the Soils

There is no impact onto the soils.

The land code of Ukraine regulates the land use. The rules for land use are also established in The National Technological Standard: DSTU 17.4.1.02.-83 "Nature Protection. Soils. Chemical Agents Classification for Pollution Control".

Impact on the Biodiversity

There is no impact on the biodiversity.

Waste Generation and Treatment

As a result of project implementation the amount of sunflower husk wastes which are brought to the landfill will be reduced. Once the project is implemented, all husk wastes generated during the sunflower husk processing will be utilized by means of using it as a fuel for boilers.

Environmental authority will monitor types of emissions to the atmosphere and industrial effluents, including the discharge density of CO, NO, S2, solid particles, the effluents of pH, t°, Fe, Cu, hardness, solid residual, sulphates, chlorides, etc. However, the project is required to meet the respective environmental standard, but not obligate to monitor these types of emissions and effluents.

SECTION G. Stakeholders' comments

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

The project owner published article regarding husk boilers at local newspaper 'Vecherniaia gazeta' #6 (1142) from the February 5, 2010 ('Povidomlennia pro namir otrimaty dozvil na vikidi zabrudnuyuchikh rechovin'). According to the Letter #755 14/ZMZH as of 07.10.2011 the project has a positive impact through environmental and the city's social improvements, and as result, the project got only a positive feedback.

Annex 1

CONTACT INFORMATION ON PROJECT PARTICIPANTS

Organisation:	PrJSC Modified Fats Factory
Street/P.O.Box:	14, Promyslovyi av
Building:	
City:	Kirovograd
State/Region:	Kirovograd Oblast
Postal code:	25014
Country:	Ukraine
Phone:	+38 0522 357 124
Fax:	+38 0522 357 124
E-mail:	modfat@creativ-group.com.ua
URL:	http://creativ-group.com.ua/
Represented by:	Sergiy Viktorovych Tymchenko
Title:	Director
Salutation:	Mr.
Last name:	Tymchenko
Middle name:	Viktorovych
First name:	Sergiy
Department:	
Phone (direct):	+38 0522 357 104
Fax (direct):	
Mobile:	
Direct e-mail:	timchenko@creativ-group.com.ua

Organisation:	UkrEximBank
Street/P.O.Box:	127, Gorkogo Str.
Building:	
City:	Kyiv
State/Region:	
Postal code:	03150
Country:	Ukraine
Phone:	+38 044 247 89 26
Fax:	+38 044 247 80 82
E-mail:	bank@eximb.com
URL:	http://www.eximb.com
Represented by:	Volodymyr G. Khrebet
Title:	Deputy Head of Division, Project Financing and International Financial Organizations Programs Department
Salutation:	Mr.
Last name:	Khrebet
Middle name:	G.
First name:	Volodymyr
Department:	Project Financing and International Financial Organizations Programs Department

Phone (direct):	+38 044 247 80 85
Fax (direct):	+38 044 247 80 82
Mobile:	
Direct e-mail:	vhrebet@hq.eximb.com

Organisation:	Stichting Carbon Finance
Street/P.O.Box:	c/- Fortis Intertrust (Netherlands) B.V., Prins Bernhardplein 200
Building:	
City:	Amsterdam
State/Region:	
Postal code:	1000 AZ
Country:	The Netherlands
Phone:	+31 20 521 4795
Fax:	+31 20 521 4836
E-mail:	Jaap.veerman@fortisintertrust.com
URL:	
Represented by:	Mr. Jaap C.M. Veerman
Title:	
Salutation:	Mr.
Last name:	Veerman
Middle name:	C.M.
First name:	Jaap
Department:	
Phone (direct):	+31 20 521 4795
Fax (direct):	+31 20 521 4836
Mobile:	
Direct e-mail:	Jaap.veerman@fortisintertrust.com

Annex 2

BASELINE INFORMATION

- Geographic and physical characteristic of Kirovograd Municipal Landfill Site, KERP-1128 Landfill site

Kirovograd is a city in central Ukraine, located on the Inhul River. The climate of Kirovograd is moderate continental. Its seasonal average temperatures are −6.9 °C in January and 20.3 °C in July. The average rainfall totals 549 mm per year, with the most in June and July.

Table 12: Climate data for Kirovograd

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Average high (°C)	-2.8	-2.0	3.7	14.0	20.7	24.6	25.9	25.2	19.4	11.7	3.6	-0.8	11.9
Average low (°C)	-8.5	-8.1	-2.9	4.7	9.9	13.8	15.0	14.1	9.1	3.7	-1.8	-5.8	3.6
Precipitation (mm)	44	32	27	36	47	58	60	50	41	35	44	45	549

(Source: http://pogoda.ru.net/climate/34300.htm)

KERP-1128 Landfill site, the Kirovograd municipal landfill site is identified to deposit 3rd and 4th hazard class of waste in Kirovograd. It locates in Zavadovka region, southeast part of Kirovograd, about 18-20.5 km far away to the location of the project activity. Similar with most of landfill site in Ukraine, there is no equipment to capture landfill gas and flare it or utilize it. The domestic solid waste is transported to the landfill site and dropped into the cells which are about 5 meters deep. There is not any covering measure after the closure of these landfill cells (see Picture 2). It is believable that there is a micro anaerobic circumstance within the waste inside these cells. Therefore, KERP-1128 Landfill site is ranked as “anaerobic managed solid waste disposal site” according the “Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site”.

Figure 7: Kirovograd Municipal Landfill Site

Annex 3

MONITORING PLAN

This section has been intentionally left blank. Please refer to Section D for the monitoring plan.

- - - - -