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

CONTENTS

Annexes

SECTION A. General description of the project

A.1. Title of the project:

Utilization of Sunflower Seeds Husk for Heat and Power Production at JSC ‘Pology Oil-Extraction Plant’

JI PDD version number: 3.0

Date of Completion: 04/05/2011

A.2. Description of the project:

a) Situation prior to the project activity:
The plant was originally installed in 1974. During its operation, specialists and workers of the plant implemented new techniques of the treatment of not only sunflower seeds but also of soybean seeds, rape seeds and ricinus seeds. The enterprise produces soy, rape and castor oils.

The production capacity of the JSC Pology Oil-Extraction Plant is 950 – 1,050 t of sunflower seeds per 24 hours. Before project implementation the enterprise had three old natural gas fired boilers NG1, NG2 and NG3, nominal steam production of which was 20 t/h, 18 t/h, and 25 t/h respectively. Years of commissioning: boiler NG1 = DKVR-20-23-250 – 1974, boiler NG2 = DE-20-24-250 – 1974, boiler NG3 = DKVR-40-23-350 – 1974. Efficiency of the boilers: NG1 – 91 %, NG2 – 91.5 %, NG3 – 93.4 %.

b) Baseline scenario:
In 2005 the management reviewed the technical condition of the gas fired boiler system as well as the estimated lifetime of the boilers. The technical inspection has shown that the existing gas fired boilers have a lifetime until 2014; therefore, there are no any requirements for replacement of existing boilers. Within the baseline scenario the existing gas fired boilers will be operated. At the enterprise there have been four sunflower seeds husk fuelled gas generators installed producing biogas, which has been supplied to the third gas boiler und used as additional fuel. While two gas generators were in operation, the other two have been used as the reserve. At the time of investment decision the lifetime of gas generators was estimated as until 2008. Afterwards they have been dismantled regarding the management decision.

c) Project scenario:
The main project objective is the reconstruction of the energy supply system of the JSC Pology Oil-Extraction Plant by constructing a combined heat and power plant fuelled by solid biomass (sunflower seeds husk). Before project implementation JSC Pology Oil-Extraction Plant covered the heat demand by three gas-boilers and the power demand was covered by the grid. All the amount of husk generated by the enterprise after extension of the production capacity will be utilised for energy production. The purpose is to satisfy own needs of the enterprise in heat and power at the expense of husk combustion and consequently to avoid as much as possible consumption of fossil fuels (e.g. natural gas) and purchasing power from the grid, and also to avoid disposal of husk at the landfill. In the result, the project will reduce GHG emissions (methane mainly) through decay of biomass and also due to substitution of fossil fuel based heat energy and electricity generation.

Project concept:
The project will be implemented at the JSC Pology Oil-Extraction Plant site and foresees the installation of CHP plant fuelled with the sunflower seeds husk produced as a by-product at the site. New CHP plant will consist of three steam sunflower seeds husk fired boilers (in which sunflower seeds husk is utilized as a fuel) and steam turbine. Two of the old gas boilers will be used as the reserve equipment and third boiler will be dismantled or will be also used as reserve equipment based on the management decision. The proposed project foresees that full heat demand and 40% - 50% of power demand of the oil-extraction plant will be covered by the new sunflower seeds husk-fired (CHP) Combined Heat and Power Plant. Within the project boundaries, three new husk fired boilers (NH1 = DKVR 20-23-330 DV, NH2 = E 20-2.4-350 DV, NH3 = E 20-2.4-350 DV) for combustion of sunflower husk will be installed at the

enterprise. The three boilers (NH1, NH2 and NH3) are designed for combustion of sunflower seeds husk only. Furthermore the construction of the steam turbine unit with 1.75 MW capacity is planned to be implemented during the last stage (stage 3) of the project. The steam turbine unit will partly cover ca. 40%- 50% of enterprise power demand and the rest amount will be bought from the national power grid.

See detailed Technical Description of the Project in the Annex 2.2 and 2.6.

Below are the main project milestones:

Stage 1: Construction of the first sunflower seeds husk fired boiler (2007), Stage 1 already completed

Stage 2: Construction of the second and third sunflower seeds husk fired boilers (February 2009 and December 2010 respectively)

Stage 3: Construction of the steam turbine unit (April, 2012)

Estimated results of the project:

- Substitution of outdated gas fired boilers;
- Generation of ca. 13,031 MWh/year of its own power utilizing the sunflower seeds husk, and thus reducing the fossil fuel consumption at electric power plants connected to the national power grid;
- Reduction of CO_2 emissions by decreasing natural gas consumption;
- Considerable reduction of methane emissions due to avoiding of sunflower seeds husk dumping and further decay at the landfill.

A.3. Project participants:

Please list project participants and Parties involved in this section and provide contact information in annex 1. Information shall be provided in the following tabular format.

Party involved *	**Legal entity project participant (as applicable)**	**Please indicate if the Party involved wishes to be considered as project participant (Yes/No)**
Germany	RWE Power AG	No
Ukraine (Host Country)	JSC Pology Oil-Extraction Plant	No

*** Please indicate if the Party involved is a host Party.**

Host Country is **Ukraine**. Ukraine ratified the Kyoto Protocol in February 2004.

RWE Power AG is a corporation incorporated under the laws of Germany, having its principal offices at Huyssenallee 2, 45128 Essen, Germany, and Stüttgenweg 2, 50935 Köln, Germany. RWE is a financing and investment company specialized in the development and implementation of Greenhouse Gas Reduction Projects according to the Article 6 of the Kyoto Protocol (Joint Implementation) and Article 12 of the Kyoto Protocol (Clean Development Mechanism).

JSC Pology Oil-Extraction Plant is an up-to-date high-technology enterprise covering the total cycle of the manufacturing: from preliminary preparation of the seeds for processing to oil de-coloration with the help of the deodorization method and its pre-packaging into polymer containers. Products of JSC Pology

Oil-Extraction Plant, one of the biggest vegetable oil manufacturers in Europe, have entered markets of the countries of the Commonwealth of Independent States. The products of the above mentioned plant are able to meet the competition in the world market.

A.4. Technical description of the project:

A.4.1. Location of the project:

A.4.1.1. Host Party(ies):

Ukraine

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

Pology Rayon / Zaporizhia Oblast

Zaporizhia region is considered to be one of the most attractive regions of Ukraine for investing due to its industrial potential, natural resources, own energy resources, highly developed scientific and technical potential, well developed transport infrastructure and developed banking system, access to the markets of Ukraine, CIS, Europe and Asia.

Zaporizhia region has developed transport system. The total length of roads is: railway – 1,320 km, automobile – 7,000 km (95.5% have hard cover). There are 1,093 km of total roads' length that have state importance. Through the region run a number of strategic routes: Odessa - Melitopol' - Novoazovsk, Kharkov - Simferopol - Sevastopol, Borispol' - Dnepropetrovsk - Zaporizhia. The major regional industrial centers have railway links with other parts of Ukraine, CIS and European countries.

Zaporizhia region is one of the Ukrainian regions that make a basis of its economic and intellectual potential. The economy is in the state of stable increase, and industry is a driving force of its development.

The basis of the regional industry is formed by metallurgy, mechanical engineering and power generating complexes, which produce 17.8% of rolled metal, 50.1% of automobiles, 26.4% of the electric energy of Ukraine and almost total amount of primary aluminium and titanium sponge. The region is the leading center of domestic aircraft engine production, carrying out of passenger automobiles, transformers and other high-technological products. The regional industrial potential fortifies itself by a significant quantity of branch scientific research, drawing and design institutes, which are entirely capable to render the definite assistance in the realization of the innovation development state policy.

Zaporizhia region is one of the largest manufacturers of agricultural products and food stuff in the Ukraine. The regional area of agricultural lands is 2,248.3 thousand hectares, or 5.4% of the total Ukrainian agricultural area. The main crop of the Zaporizhia region is sunflower. In 2005, the share of the region in the total volume of sunflower production in Ukraine was 15.3% that corresponded to the first place in Ukraine.

JSC "Pology Oil-Extraction Plant" is one of the largest Ukrainian and CIS enterprises that processes oil cultures. The specialists of the enterprise mastered the processing of sunflower, soy, rape and palmcrist seeds. On the base of these seeds, the enterprise produces high-quality soy-been, rape-been and castor oils. All the enterprise's products are labelled by the "Slavia" trade-mark, which is certified by UkrSEPRO standards and rewarded by the golden medals and such titles as "The best probe", "European quality", "The best trade-mark" at different international forums and exhibitions.

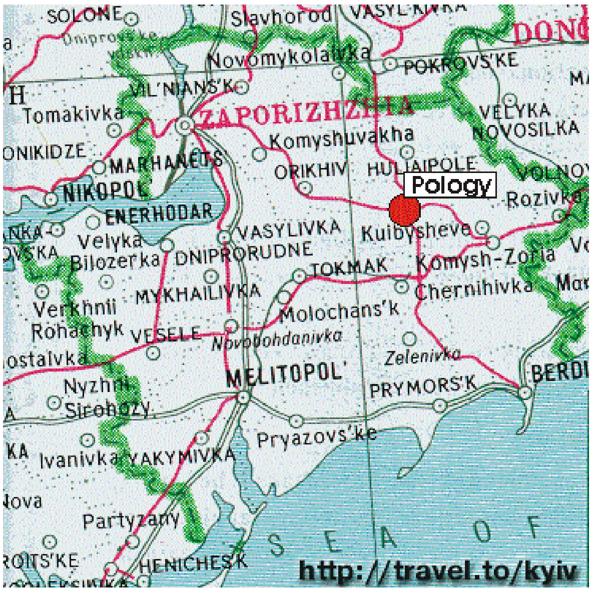
A.4.1.3. City/Town/Community etc.:

The population of Pology amounts to 25,400 inhabitants. The main economic activity is related to agriculture and some related industries – especially the extraction of sunflower oil.

Pology city is the administrative and cultural centre of Pology rayon of Zaporizhia oblast. The distance to the city of Zaporizhia (Oblast main city) is 98 km by motorway and 105 km by railway. The city is located at the left bank of the Konka river. Its territory is 15,753 km^2. The motorway of state significance Zaporizhia-Mariupol is crossing the city, and the port of Berdiansk is located 100 km far from Pology city.

JSC Pology Oil-Extraction Plant is located on the land plot of 22 hectares at the South-East part of Pology city. It owns the developed infrastructure: main and auxiliary building, cake elevator, processed seeds elevator, extraction and refining shop. The geographic coordinates from JSC Pology Oil-Extraction Plant are 36°249 ’ °East and 47°461 ’ North.

Figure 1: Town of Pology



In correspondence with the designation, the following subdivisions exist at the plant:

- Stock-preparation shop. There is a husk separation, pressing and coarse oil purification.
- Extraction workshop. There is a final oil extraction from cake grits via extraction method.
- Refinement workshop oil hydration. Entire crude oil is subject to refinement.
- Oil packaging workshop into polymeric container and mayonnaise manufacturing.

There are all required warehouses for the raw materials and finished products: 74,000 tons seeds elevator, 4,000 tons cakes elevator, oil tanks of 20,000 tons capacity. Service shops and manufacturing areas guarantee an operation of the principal production. They are the following: steam-power area, electro-area, railway shop, water supply and water purification, mechanical-repair department and industrial sewage treatment.

At the beginning of 2006, JSC Pology Oil-Extraction Plant employed about 1,022 people including 134 related to the proposed project activity. The staff resources (permanent staff) of JSC Pology Oil-Extraction Plant are presented in the table below:

2004		2005		2006	
Overall	Related to project	Over all	Related to project	Overall	Related to project
1,009	127	1,025	134	1,022	125

For performing of design, construction works, installation works, insulation works, lining works specialized companies owing licenses and working experience in above mentioned activities, will be involved.

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

Ukraine is a country in Eastern Europe. It borders Russia to the North-East, Belarus to the North, Poland, Slovakia and Hungary to the West, Romania and Moldova to the south-west, and the Black Sea and Sea of Azov to the south. The historic city of Kiev (Kyiv) is the country's capital.

From at least the ninth century, the territory of present-day Ukraine was a centre of medieval East Slavic civilization forming the state of Kiev Rus, and for the following several centuries the territory was divided between a number of regional powers. After a brief period of independence (1917–1921) following the Russian Revolution of 1917, Ukraine became one of the founding Soviet Republics in 1922. The Ukrainian Soviet Socialist Republic's territory was enlarged westward after the Second World War, and again in 1954 with the Crimea transfer. In 1945, Ukrainian SSR became one of the co-founder members of the United Nations. It became independent again after the Soviet Union's collapse in 1991.

The geographic coordinates from the plant JSC Pology Oil-Extraction Plant are 36°24 *9*’ East and 47°46 *1*’ North.

Figure 2: Map of Ukraine

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

The proposed project involves the reconstruction and modernization of the heat and power supply at JSC Pology Oil-Extraction Plant. After the reconstruction, heat and power supply at JSC Pology Oil-Extraction Plant will be mostly based on combustion of biomass (in particular sunflower seed husk). Thus, there will be minor consumption of fossil fuel (natural gas as reserve fuel) and purchase half of electricity from the power grid and half of the power for own needs from the CHP unit. Before project implementation, the enterprise had three old natural gas boilers (with consumption of mazut as additional fuel and the third boiler with biogas as additional fuel, too) and purchased electricity from power grid.

Within the project boundaries, three new husk fired boilers (NH1 = DKVR 20-23-330 DV, NH2 = E 20-2.4-350 DV and NH3 = E 20-2.4-350 DV) for combustion of sunflower husk will be installed at the enterprise. The three boilers (NH1, NH2 and NH3)) are designed for combustion of sunflower seeds husk only. The steam turbine unit will partly cover approx. 40%- 50% of the enterprise power demand, the other amount will be bought from the national power grid.

Two of the old natural gas boilers (NG1 and NG2) will be used as only reserve equipment for the case of unforeseen or unexpected situation (emergency at the enterprise that leads to unexpected absence or lack of sunflower seed husk for the period more than 12 hours). The third boiler will be dismantled or will be also used as reserve equipment based on the management decision.

The technical plan is that the three boilers will produce 60 t steam/hr – installed steam production capacity. The steam (direct steam) goes to the turbine for power production.

Company responsible for the CHP plant construction project as a whole is the JSC Pology Oil-Extraction Plant. A design institute has to select standard equipment for CHP plant, as there are no standard husk fired boilers in Ukraine. Special design and Technology Bureau “ZAO NPP, Ekoenergomash”, Bijsk is also involved in the project design and implementation. The Bureau has a license for such kind of work and most experience in this field. Manufacturers of the equipment:

- husk fired boilers – ZAO NPP “Ekoenergomash” (Ukraine);
- turbo-unit – most probability Ukrgiprosahar (Ukraine);

The equipment will be installed by specialised organisation, which has a license for such kind of work and good experience in this field. It is expected that it will be ZAO “Ukrkotlservice”. At the end of the warranty period of the equipment (usually 1-2 years), JSC Pology Oil-Extraction Plant itself will be responsible for maintenance/repairs of the equipment. Maintenance (minor repair) will be performed by specialists of the enterprise. To perform more serious repair (for example replacement of damaged pipes) the Enterprise will sign contracts with authorised repair organisation companies - ZAO “Ukrkotlservice”. In case it is necessary to replace some components or parts of the equipment, it will be done by manufacturers involving Special Project-Design and Technology Bureau “ZAO NPP, Ekoenergomash”. See detailed Technical Description of the Project in the Annexes 2.2 and 2.6.

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

In 2005 the management reviewed the technical condition of the gas fired boiler system as well as the estimated lifetime of the boilers and technical and economic possibility to install new gas or new husk fired boilers The technical inspection has shown that the existing gas fired boilers have a lifetime until 2014; therefore, the are no any requirements for replacement of existing boilers. Within the baseline scenario, the existing gas fired boilers will be operated. The technical inspection of the gas generators has shown that their lifetime is until 2008, therefore the existing gas generators must be dismantled.

In further management decisions the mechanism of the Kyoto protocol have been analysed and it was considered that the benefits from the registration as JI projects might make the installation of new husk fired boilers financial attractive.

Taking into consideration the additional benefits from the ERUs certificates management of the JSC Pology Oil-Extraction Plant finally decided in its meeting held on 19.10.2005 to reconstruct its energy supply system through realisation of JI project. Also in 2005 consultant has been contracted for developing the project in accordance with JI rules. Few months after the management decision a contract with boiler manufacturer has been signed.

As a result of the project first stage implementation (one sunflower seeds husk steam boiler) in 2007, the GHG emissions due to natural gas consumption and anaerobic husk decomposition will be reduced. After the implementation of the second and third project stages (second and third husk steam boiler and the turbine installation) the GHG emission reduction from the above mentioned sources will be increased, and also the emission reduction due to decreasing of grid electricity consumption will have place.

Without the proposed project, the power for the enterprise and for the own needs of the gas fired boiler(s) would be provided from the outside power grid, leading to fossil fuel combustion at the grid connected power plants. After the new CHP plant is in operation, the enterprise will be able to cover all its heat demand by the steam produced from the husk at the new CHP plant and partly cover its power demand. The new CHP plant will also partly cover its own electricity demand.

The CO_2 emissions after the proposed project implementation will mainly be the CO_2 emissions from husk burning, which are climatically neutral and therefore are considered to be zero. N_2O emissions from burning of sunflower seeds husk at the boilers are not taken into account as they are negligibly small compared to CO_2 emissions. At the same time, the project participants decided to include the CH_4 emissions from the husk combustion for electricity and heat generation, as well as CH_4 emissions from decay under anaerobic conditions. Before project implementation, the sunflower seeds husks were left to decay on the landfill under anaerobic conditions. According to the policies the landfilling should be approved by the local authorities. All the required permissions from local authorities are available and valid till 2011. For this reason, continuation of current practise is the most plausible scenario.

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

The ex ante emissions reductions are estimated to be 187,584 tonnes CO_2 – equivalent for commitment period 2008-2012 or approximately 37,517 tonnes CO_2 – equivalent annually. Note that actual emission reductions will be based on monitored data and may differ from this estimate.

Table: Summary Emission Reduction 2008-2012

Length of the crediting period	Years 5
Year	Estimate of annual emission reductions in tonnes of CO2 equivalent
2008	14,748
2009	33,481
2010	41,389
2011	43,486
2012	54,480
Total estimated emission reductions over the crediting period (tonnes of CO2 equivalent)	**187,584**
Annual average of estimated emission reductions over the crediting period (tonnes of CO2 equivalent)	37,517

A.5. Project approval by the Parties involved:

Ukraine ratified on the 29th of October 1996 the United Nations Framework Convention on Climate Change, signed on the 9th of May 1992 in New York City, United States of America and on the 4th of February 2004 ratified the Kyoto Protocol to United Nations Framework Convention on Climate Change, which was signed on the 11th of December 1997, in Kyoto, Japan.

SECTION B. Baseline

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

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

Referencing of the approved baseline and monitoring methodology.
Justification of the baseline chosen is made according to the "Consolidated methodology for electricity generation from biomass residues" (hereinafter ACM0006, Version 10).

URL: http://cdm.unfccc.int/methodologies/PAmethodologies/approved.html
This methodology is one of the most suitable methodologies approved for Clean Development Mechanism (CDM) projects.

Methodological tools which were used in preparing PDD.
"Combined tool to identify the baseline scenario and demonstrate additionality", Version 2.2, EB 28
"Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site", Version 05.

CO_2 emission factor for grid electricity was taken from Ukraine - Assessment of new calculation of CEF.
Link:http://ji.unfccc.int/UserManagement/FileStorage/46JW2KL36KM0GEMI0PHDTQF6DVI514

Justification of the choice of methodology and why it is applicable to the project. As it is mentioned in the hereinafter ACM0006, Version 10, it is applicable to biomass residue fired electricity generation in power and heat plants, including cogeneration plants. The project foresees installation of a new biomass residue fired power and heat generation plant at a site of JSC Pology Oil-Extraction Plant where currently no power generation plant is in operation (greenfield power projects).

The Table B-1 below explains the reason why the ACM0006 can be applied to the proposed project:

Table B-1 Comparison of proposed project activities with applicability of the methodology ACM0006

ACM0006 Applicability (p.4)	Does the project activity meet the applicability requirement (Yes) or not (No)
No other biomass types than biomass residues, as defined in the methodology, are used in the project plant and these biomass residues are the prevalent fuel used in the project plant (some fossil fuels may be co-fired);	Yes, only sunflower seeds husk will be used as the biomass residue and this husk is the prevalent fuel used in the project CHP plant, although some natural gas is going to be co-fired in emergency cases and if necessary (during the start-ups of the boilers).
For projects that use biomass residues from a production process (e.g. production of sugar or wood panel boards), the implementation of the project shall not result in an increase of the processing capacity of raw input (e.g. sugar, rice, logs, etc.) or in other substantial changes (e.g. product change) in this process;	Yes. The project implementation itself was caused by the planed increasing of output of the oil-edible plant, but not vice versa. Moreover the processing of sunflower seeds and generation of sunflower husk are beyond the project boundaries. New boilers are installed to utilise all biomass residues from the technological process. Otherwise some amount of husk will be dumped at the landfill. So it can be clearly defined that project implementation will not result in an increase of the processing capacity of oil edible plant.
The biomass residues used by the project facility should not be stored for more than one year;	Yes. The sunflower seeds husk produced at the oil- edible plant will be combusted immediately and is not going to be stored for more than one year.

No significant energy quantities, except from transportation or mechanical treatment of the biomass residues, are required to prepare the biomass residues for fuel combustion, i.e. projects that process the biomass residues prior to combustion (e.g. esterification of waste oils) are not eligible under this methodology.	Yes. No significant quantity of energy is required to prepare the biomass (sunflower seeds husk). Neither nor transportation mechanical treatment will need to take place. Sunflower seeds husk is produced directly at the territory of Pology oil-extraction plant and do not require any prior treatment before combustion.

According to the ACM0006 procedure for the selection of the most plausible baseline scenario should include separate determinations of (1) how the power would be generated in the absence of the proposed project activity, (2) what would happen to the biomass residues (sunflower seeds husk) in the absence of the proposed project activity, and (3) how the heat would be generated in the absence of the proposed project activity. So it is necessary to identify most realistic and credible alternatives for power and heat generation and sunflower seeds husk treatment separately and using the steps 2 and/or 3 of the latest approved version of the “Combined tool to identify the baseline scenario and demonstrate additionality”[1], to assess which of identified alternatives should be excluded from the further consideration.

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

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

For the power generation within the project the following alternatives are examined:
- (P1) The proposed project activity not undertaken as JI project (installation of 1.75 MW_{el} turbine generating power using the steam produced in the husk fired steam boilers).
- (P4) Generation of power in the grid (in other words - purchasing electricity from the grid “continuation of existing situation”).
- (P5) Installation of a new biomass residue fired power plant, fired with the same type and with the same annual amount of biomass residues as the project activity, but with a lower efficiency of electricity generation (e.g. an efficiency that is common practice in the relevant industry sector) than the project plant and therefore with a lower power output than in the project case.
- (P6) Installation of a new biomass residue fired power plant that is fired with the same type but with a higher annual amount of biomass residues as the project activity and that has a lower efficiency of electricity generation (e.g. an efficiency that is common practice in the relevant industry sector) than the project activity. Therefore, the power output is the same as in the project case.
- (P9) The installation of a new fossil fuel fired captive power plant at the project site.

P5 and P6 are not very realistic and credible because the power production in the turbine unit is designed for the main production, therefore not all technical variants feasible. Low turbine unit efficiency means less electricity is produced and the difference needs to be bought from the electricity grid. Thereby, the project generates more CO_2. Furthermore, within the scenario P6 additional volumes of sunflower seeds husk should be transported to the plant. Transportation of the additional sunflower seeds husk to Pology Oil-Extraction Plant is unrealistic, because there are no additional sources of sunflower seeds husk in the region of the plant Pology and the transportation for long distances (nearest supply 250 km) is not feasible.

P9 the installation of a new fossil fuel fired captive power plant at the project site could not be considered as a realistic and credible alternative because of the following reasons.

First, the altogether new captive power plant requires the dismantling of existing gas fired boilers (which can well operate by 2014) and thus requires a lot of investment as well as long construction works, which may impede the production process and altogether are not necessary.

[1] https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-02-v3.0.1.pdf/history_view

Second, the evaluation of the option to add the electricity generating turbine to the existing gas fired boilers revealed the following outcomes. Two out of the three existing natural gas fired boilers produce steam with the temperature of only 250 ºC, which is problematic to use for electricity generation. The steam with such temperature could be used for electricity generation only with the low revolution turbine installation and specific generators capable to work in conjunction with such turbine. These kinds of installations are available only for large installed capacities and faces significant technological barriers. The other existing natural gas fired boiler may produce steam with the temperature of 330 ºC, which could be used for electricity generation but leads to additional natural gas consumption (additional energy is needed to heat up the steam to allow turbine rotation). Hence, theoretically the power generation here is possible, although such factors as low electricity cost in Ukraine, and necessity to consume additional quantities of natural gas as well as the need to obtain additional limits (right to consume) for the natural gas consumption significantly question the feasibility of adding the power generation turbine to the third boiler. Moreover, all existing the natural gas fired boilers, including the one addressed are old. They still can produce steam with the parameters necessary for the production process (up to 16 bar) but the feasibility of production of the energy steam is indeed low and therefore too risky to implement in practice. Therefore, the installation of new fossil fuel fired boilers to work in conjunction with power generation equipment is not a plausible alternative scenario because of significant remaining lifetime (at least till 2014 according to technical inspection) of existing natural gas boilers and high capital expenditures for new natural gas boilers installation added to significant operational costs for fossil fuel purchase.

In conclusion, the most realistic and credible alternatives for power generation are P1 and P4.

For the heat generation the following realistic and credible alternatives were selected by the project participants:

- (H1) The proposed project activity not undertaken as JI project (installation of three husk-fired boilers of 60 t/h total steam output – installed steam production capacity).
- (H4) Generation of heat in boilers using the same type of biomass.
- (H6) The generation of heat in boilers using fossil fuels.
- (H7) Use of heat from external sources (purchasing heat from the local District Heating Utility).

In the context of scenario H6 it was assumed that existing natural gas fired boilers will continue operation, as the technical inspection showed that the existing gas fired boilers have a lifetime until 2014. Thus, the existed natural gas fired boilers would have operated till 2014 and after that would have been substituted with the new natural gas fired boilers.

H7 is not plausible because only one district heating station exists in the Pology City. This district heating station can only cover the demand of 70% of the inhabitants in Pology. At the moment the district heating station have economical problems and therefore the station can not produce heat. The habitants of Pology will buy boilers for their heat demand. Within a 3 km ratio around the Pology Oil-Extraction Plant there is no available heat supply source. For this reason, scenario H7 is not a realistic and credible alternative.

H4 is considered in the analysis due to conservativeness purposes but is not plausible because of the following reasons. First, the sunflower seed husk available at the Pology plant has not been enough to produce the quantities of the biogas sufficient to cover the enterprise heat energy needs. Thus, in 2004-2007 50 % of the total amount of the seed husk was utilized to produce the biogas (the latter was then co-fired with the natural gas to produce steam at a modified boiler) which, upon burning, covered only 8-11 % of the overall steam demand of the enterprise. Hence, only up to 22 % the general enterprise need in heat energy could have been covered through the sunflower seed biogas based on the sunflower seed husk quantities available on site. Taking into account the location of the Pology plant (at least 100 km to the nearest town or city) and the bulky nature of the seed husk, its purchase and transportation to Pology to produce biogas and thus to cover the heat energy needs have not been feasible at all.

Second, increasing the capacity of producing sunflower seed biogas has required not only the modernization of the other two natural has fired boilers to enable the co-firing of natural gas and the sunflower seed biogas, but also the introduction of the large scale industrial sunflower seed husk biogas generation facility with a number of degasification reactors, storage facilities, transportation infrastructure etc. Such scenario would inevitably bring significant financial and, more importantly, technological (and know-how) hurdles.

To the contrary, the choice of utilization of the natural gas to cover the Pology plant heat energy needs, has had no of the mentioned hurdles. It has been available in the necessary quantities, required no modification of the heat energy generation equipment and being the reliable and easy to use fuel.

Therefore, the baseline scenario constitutes the utilization of the natural gas as the major fuel to cover the enterprise energy needs and partial use of the sunflower seed biogas for the same purpose. H4 though would be taken into account as a possible baseline option.

Thus, the most realistic and credible alternatives for heat generation are H1, H4 and H6.

For the use of biomass residues (sunflower seeds husk) the following alternatives are examined:
- (B1) The sunflower seeds husk is dumped or left to decay under the mainly aerobic conditions. This applies, for example, to dumping and decay of husk on fields.
- (B2) The sunflower seeds husk is dumped or left to decay under clearly anaerobic conditions. This applies, for example, to deep landfills with more than 5 meters. This does not apply to biomass residues that are stock-piled or left to decay on fields.
- (B3) The biomass residues are burnt in an uncontrolled manner without utilizing it for energy purposes.
- (B4) The sunflower seeds husk is used for heat and/or electricity generation at the project site.
- (B5) The biomass residues are used for power generation, including cogeneration, in other existing or new grid-connected power plants.
- (B6) The biomass residues are used for heat generation in other existing or new boilers at other sites
- (B7) The biomass residues are used for other energy purposes, such as the generation of biofuels

The landfilling in Ukraine is regulated by the law number 3073-III from March 2002.

B2 is a realistic and credible scenario, because all the required permissions for landfilling are available and valid till 2011. After 2011 Pology Oil Extraction Plant may apply for an extension of the landfill permission. It is recognized that the dumping decay takes places under an anaerobic conditions. The current landfill is in line with the current legislation.

The alternatives B1 and B3 are not realistic and credible scenarios, because they do not meet the Ukrainian regulation standards, specifically the law number 3073-III from March 2002 regarding the waste management. It is prohibited in Ukraine to burn the waste in uncontrolled manner or to leave the waste husk as well as dumping of husk under aerobic conditions. Thus, these alternatives are excluded from further consideration.

There are no barriers regarding the landfilling of the husk at the local landfill.

Selling the surplus husk as per B5 and B6 is not realistic and credible, because in Ukraine, there are no power and/or heat capacities to utilize the sunflower seeds husk, except the oil-extraction plants (two Cargill plants in Donetsk and Kherson region, Vinnitsa oil-extraction plant, etc). But these oil-extraction plants have own husk as a by-product and face the problem with the utilization of the husk themselves. So they definitely would not purchase or transport the husk from the JSC Pology Oil-Extraction Plant in order to combust it in their heat generating installations. In other hand there is a very low level of awareness among the district heating operators about the possibility to use the husk as an alternative fuel, taking into account that the husk is very difficult fuel to be combusted. In Ukraine there is no experience of husk transportation or waste wood fuel transportation. So it may be concluded that the alternative of selling husk for its further combustion for heat and/or power production should be excluded from further consideration as it would not overcome the following barriers: informative, technological (concerning husk transportation, ash management, flue gas cleaning, problems with husk combustion, etc). The use of husk as a raw material for pellets production directly at the project site faces the next barriers which is still the considerable lack of experience in this sector: Even so in Ukraine there is a couple of enterprises trying to produce pellets from the husk.

The alternative B7 is not a realistic and credible scenario, because the management reviewed, at the end of 2005, the technical condition of gas generator and its lifetime. The technical inspection of the gas generator has shown that gas generator has a lifetime until 2008.

In conclusion, the most realistic and credible alternatives for the use of biomass residues are B2 and B4.

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

All identified realistic and credible alternatives for power and heat generation and for the use of biomass are in compliance with all mandatory applicable legal regulatory requirements. Within the analysis of the used biomass residues, the alternatives B1 and B3 have been excluded from further consideration because there are not consistent with the mandatory laws and regulations (for further consideration please see Sup-Step 1a).

All realistic and credible alternative scenarios for the project activity:

Alternative 1 (A1) = P1 + H1 + B4
The proposed project activity not undertaken as JI stipulates the construction of 1.75 MW_{el}+ 44.07 MW_{th} CHP plant using the sunflower seeds husk as a fuel. This alternative (H1) corresponds to alternative (P1) - power generation at the CHP plant using the sunflower seeds husk, and to alternative (B4) - when the husk is used for heat and electricity production at the project site.

Alternative 2 (A2) = P4 + H4/H6 + B2
Generation of heat in the existing gas fired boilers and using gas from biogas generator equipment.. In such case the electricity would be continued to be purchased from the power grid (that corresponds to alternative P4). Continuation of current practise (alternative B2).

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

Due to the methodology, realistic and credible alternatives should be separately determined regarding:

- How **power** would be generated in the absence of the JI project activity;
- What would happen to the **biomass residues** in the absence of the project activity; and
- In case of cogeneration projects: how the **heat** would be generated in the absence of the project activity.

In our case of the identified alternative scenario, if the project scenario will not occur, there would be the following situation (See also Section B.1 for the justification of alternative scenarios):

1. For power generation, the most realistic and credible alternative is: P4 - The generation of power in the grid. (in other words - the purchasing electricity from the grid "continuation of existing situation").
2. For heat generation, the most realistic and credible alternative is: H6 – The generation of heat in boilers using fossil fuel (in baseline scenario this is natural gas) and to a certain extent (H4) - generation of heat using the same type of biomass.
3. For biomass residue, the most realistic alternative is B2 - The sunflower seeds husk are dumped or left to decay under clearly anaerobic conditions. This applies, for example, to deep landfills with more than 5 meters. This does not apply to biomass residues that are stock-piled or left to decay on fields

The baseline scenario alternative 2 (A2) in the PDD is like scenario 2 of the applied methodology ACM0006. Description of the situation in the Methodology: "The project activity involves the installation of a new biomass residue fired power and heat plant at a site where no power was generated prior to the implementation of the project activity. The power generated by the project plant is fed into the grid or would in the absence of the project activity be purchased from the grid. The biomass residues would in the absence of the project activity be dumped or left to decay or burnt in an uncontrolled manner without utilizing it for energy purposes. In case of cogeneration plants, the heat would in the absence of the project activity be generated in boilers fired with fossil fuels, or by other means not involving the biomass residues. This may apply, for example, where prior to the project implementation heat has been generated in boilers using fossil fuels."

In the baseline scenario, there are three sources of greenhouses gases emissions:
1. Emission due to natural gas combustion by operational gas fired boiler during the period of sunflower seeds processing by the enterprise.
2. Emission due to husk decay at the landfill.
3. Emission due to electricity consumption from the power grid of Ukraine.

Technical project design

Prior to the start of the project activity heat energy was generated using three natural gas fired boilers. Technical characteristics of the boilers as well as historical data on the types and quantities of fuels used are presented in the tables below. Besides natural gas the third boiler also used some amount of biogas from gas generators.

Historical data of the Natural Gas boilers (DKVR-20-2,3-250)

Natural Gasboiler 1	Value	2004	2005	2006	2007	Data Source
Type	DKVR-20-2,3-250					Technical document
Capacity	MW	20				Technical document
Natural gas	1000 m^3	2,572	2,375	2,400	2,858	Monthly report
Steam energy	Gcal	17,943	16,568	16,743	19,938	Daily report

Efficiency: 91%

Historical data of the Natural Gas boilers (DE-20-2,4-250)

Natural Gasboiler 2	Value	2004	2005	2006	2007	Data Source
Type	DE-20-2,4-250					Technical document
Capacity	MW	20				Technical document
Natural gas	1000 m^3	3,429	3,186	3,205	3,573	Monthly report
Steam energy	Gcal	23,928	22,087	22,359	24,926	Daily report

Efficiency: 91.5%

Historical data of the Natural Gas boilers (DKVR-40-2,3-350)

Natural Gasboiler 3	Value	2004	2005	2006	2007	Data Source
Type	DKVR-40-2,3-350					Technical document
Capacity	MW	20				Technical document
Natural gas	1000 m^3	11,055	10,296	10,413	7,866	Monthly report
Husk/Biogas	m^3	11,962	12,538	11,678	14,399	Monthly report
Steam energy (Natural gas)	Gcal	77,763	71,827	72,685	54,875	Daily report
Steam energy (Biogas)	Gcal	10,233	10,725	9,990	12,317	Daily report
Steam energy	Gcal	87,996	82,552	82,675	67,192	Daily report

Efficiency: 93.4%

Technical data of gas generator

Rated output on husk , kg/h	1250
Rated output of air, nm^3/h	2000
Rated output of dry generator gas, nm^3/h	3000
Calorific value of generator gas, MJ/nm^3	5,0-7,0
Temperature of generator gas, ^oC	250-350

Normative heat power of gas generator (on gas combustion), MW	4,4
Adjustment range of heat power of gas generator,%	20-110
Thermal efficiency,%	0,85

Two of the old gas boilers will be used as the reserve equipment and third boiler will be dismantled or will be also used as reserve equipment based on the management decision. Within the project realisation three SSH fired boilers and a turbine unit will be installed for CHP production purposes. The biomass residue (sunflower seeds husk) is the main fuel for the three new boilers. See also annexes 2.2 and 2.6 for technical details of the project scenario,

Step 2 Investment analysis

Step 2b: Option II. Apply investment comparison analysis

Net present value of costs (NPVC) was calculated for the project scenario with and without ERU sales and for the baseline. It should be admitted that calculations were made for the case of 2005 tariffs (when the decision for the proposed project as JI has been undertaken). The results of the investment comparison analysis taking into account mentioned tariffs are presented in the Table 2.1 below.

Table 2.1 – Results of NPVC calculation

	NPVC, UAH	NPVC, €
Project scenario not being registered as JI	-98 835 155	-16 228 353
Baseline scenario	-87 839 141	-14 422 850

- NPVC value is calculated for the period of 2007-2027.
- Economical indexes and all relevant information are in the Excel tables attached to the Annex 2.7**.**
- Revenues from the sale of edible oil for the Pology Oil-Extraction Plant would be equal in both baseline and project scenario. Thus it is appropriate to evaluate the financial case for the baseline and project scenario on the cost and net present value basis.
- The steam output for the Pology Oil-Extraction Plant would be equal in both baseline and project scenario. It is not an ambition to produce more oil in the project scenario as in the baseline scenario. The heat demand is in both scenarios constant. Therefore the same amount of heat delivered to the plant can be assumed for baseline and project scenario.

Table 2.2 – Results of sensitivity analysis

Sensitivity analysis		Baseline scenario (UAH)	Project scenario w/o JI (UAH)
Variation Natural Gas tariff	+10%	-93 258 459	-98 835 155
	-10%	-82 419 822	-98 835 155
Variation Electricity tariff	+10%	-89 511 782	-99 219 013
	-10%	-86 166 500	-98 451 297
Variation Investment cost	+10%	-88 141 422	-106 158 145
	-10%	-87 536 859	-91 512 164
Variation of electricity generation	+10%	-91 033 489	-98 835 155
	-10%	-84 949 016	-98 835 155
Variation of the NG* consumption in BL**	+10%	-93 258 459	-98 835 155
	-10%	-82 419 822	-98 835 155

*Natural Gas, **Baseline scenario

Based on the results of the investment analysis it has been concluded that continuation of the current practice is more attractive as the project activity and hence can be considered as the baseline scenario.

Step 3.Barrier analysis

Additionality of the proposed project can be also proven by the applying of the barriers analysis. These barriers are quite obvious and can be summarized as follows:

The selection of the project scenario has faced two significant barriers:

- A lack of technical expertise and know how in the installation and operation of the sunflower seed husk cogeneration technology in Ukraine.
- And the significant capital outlay required implementing the project scenario compared with the baseline scenario.

a) Investment barriers

- High cost of imported equipment with delivery costs and custom duties are taken into account;
- Absence of adequate sources of project funding available for the enterprise;
- The project implementation requires rather risky financial investments, which included both, the enterprise equity and loans.
- Credit rating for Ukraine is CCC+, (Information from Standard and Poors: June 2009)

Link:http://www2.standardandpoors.com/portal/site/sp/en/us/page.siteselection/site_selection/0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0.html ;

b) Technological barriers

- Absence of experience of operating facilities for power generation at the enterprise;

c) Other barriers

- Absence of legislation on biomass residues utilization in Ukraine;
- There are no restrictions on CO_2 emissions for enterprises in Ukraine; no such restrictions are expected to be introduced;
- There are all the required permissions for operating the equipment and the landfill, including those of the ecological nature, approved by the relevant supervisory bodies;

Step 4. Common practice analysis

Utilizing Sunflower seed husk for combined heat and power production has not been the common practice in Ukraine at the time of the project development.

There is no serial production of the husk fired boilers in Ukraine. Each boiler is individually designed and manufactured for a specific use. Because of that fact the construction and production of the husk fired boilers are considerably expensive in comparison to the gas fired boilers, which are produced as serial equipment. Combustion of husk for combined heat and power generation is not applied in Ukraine yet. Usually edible oil plants dispose husk at a landfill or combust it in boilers originally designed for other kinds of fuel, mainly for saturated steam production. The very few examples of Ukrainian enterprises which combust sunflower seeds husk for heat production only are: Zaporozhskiy Fat-and-Oil Industrial Complex, Poltavskiy Oil-Extraction Plant, Dnepropetrovskiy Oil-Extraction Plant and Chumak Oil-Extraction Plant.

In Ukraine the project envisages development, construction and putting into operation of high pressure boilers for superheated steam production and the turbine for electricity production. It is one of the first CHP plants in Ukraine on a solid biomass. It will be quite unique practice in Ukraine, at least for some period of time. For an investor, such project is much more expensive and involves higher risks in comparison to the baseline scenario. Realization of the project as a JI project with sales of ERUs makes it more attractive for a potential investor, decreases project risks and improves apparently its financial feasibility. Taking into account all facts mentioned above, the proposed project is additional.

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

Project boundaries include sources of all significant greenhouse gases emissions, which are under control of the project owner and could be attributed to the project activity. For the project scenario such emission sources include: sunflower seed husk fired boilers used for steam generation and turbogenerator, which will generate electricity (together they constitute a cogeneration unit). The drawing of project boundaries for the project scenario is presented on fig. 3.1., where the project boundaries are indicated by solid line. For the baseline scenario project boundaries include natural gas fired boilers for heat energy generation. Besides, extended project boundaries for the baseline scenario include thermal power stations of the united energy system of Ukraine, which generate electric power, and solid waste polygon, where the anaerobic decay of sunflower seed husk would have taken place. The drawing of project boundaries for the baseline scenario is presented on fig. 3.2., where the project boundaries are indicated by solid line and extended project boundaries are indicated by dotted line.

The process of treatment and generation of sunflower husk as well as process of consumption of energy by the enterprise is beyond the project boundaries.

The drawings of project boundaries are presented below.

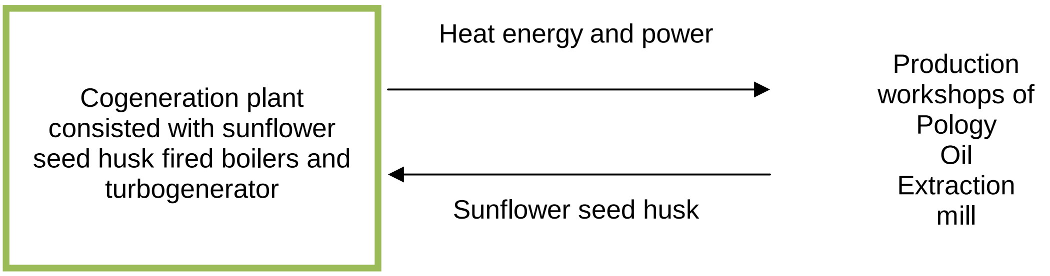


Figure 3.1: Drawing of the JI project boundary – project scenario**.**

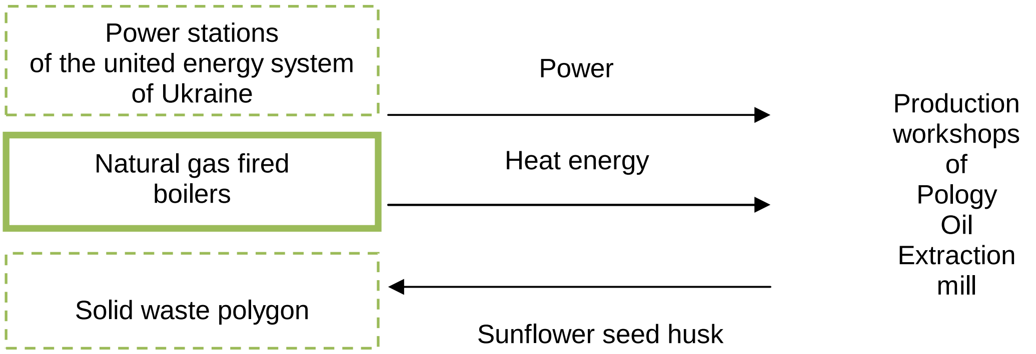


Figure 3.2: Drawing of the JI project boundary – baseline scenario**.**

Table B-3. Overview on emissions sources included in or excluded from the project boundary

	Source	**Gas**		**Justification/Explanation**
Baseline	Electricity consumption from the united energy system of Ukraine	CO_2	Included	Main emission source.
		CH_4	Excluded	Excluded for simplification. This is conservative
		N_2O	Excluded	Excluded for simplification. This is conservative
	Natural gas consumption for heat energy generation	CO_2	Included	Main emission source.
		CH_4	Excluded	Excluded for simplification. This is conservative
		N_2O	Excluded	Excluded for simplification. This is conservative
	Decay of sunflower seed husk at the solid waste polygon	CO_2	Excluded	Assumed that CO_2 emissions from surplus biomass residues do not lead to changes of

				carbon pools in the LULUCF sector
		CH_4	Included	Main emission source.
		N_2O	Excluded	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	Combustion of sunflower seed husks for electricity and / or heat production	CO_2	Excluded	Assumed that CO_2 emissions from surplus biomass residues do not lead to changes of carbon pools in the LULUCF sector
		CH_4	Included	Included, because CH_4 emissions from decay of sunflower seed husk under the baseline scenario are included to the project boundary.
		N_2O	Excluded	For simplification, this emission source is assumed to be very small

The baseline scenario foresees that the sunflower seed husks would be dumped under anaerobic conditions (case B2) and would be further decayed. Emissions from transportation of biomass residues, storage of biomass residues and waste water generated during biomass treatment, which should be considered according to the methodology, are not included to the project boundaries as transportation of biomass residues out of the project site as well as storage of biomass residues or waste water generation is not foreseen within the project activity. Also emissions due to on-site fossil fuel and electricity consumption due to the project activity are not included to the project boundaries as the boilers in project scenario will operate using only sunflower seed husks and electricity consumption for own need of cogeneration unit will be accounted for during calculation of baseline greenhouse gases emissions due to electricity generation.

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

Date of completing: 04/05/2011.

Both persons are project participants.

CJSC Pology Oil Extraction Plant
Contact Person: Mr. Ostroushko Valeriy Leonidovich
36 Lomonosov street, Pology City, Zaporizhia Region
70601 Ukraine
Email: tehno@mezpology.zp.ua

RWE Power Aktiengesellschaft, Climate Protection
Contact Person: Tolga Acar
Huyssenallee 2, 45128 Essen , Germany
Email: tolga.acar@rwe.com

SECTION C. Duration of the project / crediting period

C.1. Starting date of the project:

Project start date is 19.05.2006 when the contract for the supply of first SSH boiler was signed by the project owner. The management decision on project was taken on 19.10.2005.

Start date of project realization is 11th of September, 2006, when the construction and assembling works within the project have been started.

C.2. Expected operational lifetime of the project:

20 years 0 months.

C.3. Length of the crediting period:

5 years, 01.01.2008 – 31.12.2012

SECTION D. Monitoring plan

D.1. Description of monitoring plan chosen:

The project is a grid connected biomass fired renewable electricity generation green-field power project. The fuel used is a by-product, an agricultural residue from existing agricultural activities.

The conditions are similar to approved consolidated monitoring methodology ACM0006 "Consolidated methodology for electricity generation from biomass residues" (hereinafter ACM0006, Version 10).
URL: http://cdm.unfccc.int/methodologies/PAmethodologies/approved.html

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

D.1.1.1. Data to be collected in order to monitor emissions from the project, and how these data will be archived:

ID number *(Please use numbers to ease cross-referencing to D.2.)*	Data variable	Source of data	Data unit	Measured (m), calculated (c), estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment
1. $BF_{k,\ v,\ wet}$	Quantity of sunflower seeds husks combusted in the project plant during the year *y*	Frequency converter	Tonnes of wet matter	m	Continuously	100%	Electronic and paper form	The measurement will be done by using frequency converter for recording of consumption of husk supply to the boiler. The quantity will be crosschecked with the heat generation
2. BF_y	Quantity of sunflower seeds husks combusted in	Department of head energy engineer	Tons of dry matter	c	Weekly	100%	Electronic and paper form	

	the project plant during the year *y*							
3. W	Moisture content of the sunflower seeds husks	On-site measurements. Enterprise laboratory	%	m	Monthly	100%	Electronic and paper form	The technological process of sunflower seed processing has continuous mode and thus the moisture content could not be monitored for each batch of biomass as required by methodology. However, sunflower seeds husks used in the project are from the same technological process as the sunflower seeds are dried before processing till the standard humidity value. Thus, the water content of the SSH does not vary significantly and is about 10% according to the data of plant laboratory.
4.$EF_{CH4, BF}$	CH4 emission factor for the combustion of sunflower	Default values	tCH_4/GJ	-	Quarterly	100%	Electronic and paper form	Use default value as provided in Table 4 ACM0006

	seeds husks in the project plant							
5. NCV_{BR}	Net calorific value of sunflower seeds husks	Expertise independent laboratory	GJ/ton	m	Quarterly	100%	Electronic and paper form	The average value is determined at the end of the year and must be determined on the basis of dry biomass

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

Project emissions include CH_4 emissions from the combustion of sunflower seeds husks ($PE_{Biomass, CH4, y}$), as this source is included in the project boundary:

$PE_y = GWP_{CH4} * PE_{Biomass, CH4, y}$

Where:
PE_y – Project emissionsduring year *y* (tonnes CO_2/year)
GWP_{CH4} - Global Warming Potential for methane valid for the relevant commitment period;
$PE_{Biomass, CH4, y}$ - Emissions from the combustion of sunflower seeds husk at the new CHP plant during the year *y* (tonnes CH_4/year).

The following sources are not included in the project emissions;

1. CO_2 emissions from transportation of biomass residues to the project site (PETy) are not considered because the sunflower seeds husk generated directly at the territory of Pology oil-extraction mill.

2. CO_2 emissions from on-site consumption of fossil fuels due to the project activity (PEFFy) are not considered because the boiler house does not need power for start-up and co-firing.
3. CO_2 emissions from consumption of electricity (PEEC,y) are not considered, because there is no mechanical treatment of the husk. The auxiliary electricity consumption by the gas fired boilers will be considered in the calculation of the net quantity of electricity generation in the project plant (EGproject plant,y)
4. CH_4 emissions from waste water are not considered because the sunflower seeds husk does not need to be cleaned before it goes to the boilers.

Methane emissions from combustion of sunflower seeds husks ($PE_{Biomass, CH4, y}$)

The project participants decided to include this source in the project boundary. The emissions caused by sunflower seeds husk combustion at new CHP

plant according to the equation (6) of ACM0006 are calculated as follows:
$PE_{Biomass, CH4, y} = EF_{CH4,BF} * BF_y * NCV_{BR}$

Where:
$PE_{Biomass, CH4, y}$ - emissions due to combustion of sunflower seed husk by new cogeneration plant during year y (tonnes CH_4/year);
BF_y = Quantity of sunflower seeds husk combusted in the new CHP plant during the year y (tons of dry matter);
NCV_{BR} = Net calorific value of the sunflower seeds husk (GJ/ton of dry matter);
$EF_{CH4,BF}$ = CH_4 emission factor for the combustion of sunflower seeds husk in the new CHP plant (tCH_4/GJ).

The Quantity of sunflower seed husk combusted in the project plant (BF_y) will be measured by frequency converter. Quantity of revolutions (in Hertz) of the dosage sluice will be measured. The frequency will be recorded every 20-180 seconds in electronic form on server. The consumption of sunflower seed husk will be determined subject to dosage sluice load factor of the particular furnace (fire-chamber) in accordance with the manufactures monitoring procedures. Each biomass boiler has two furnaces (fire-chambers). Hence the total consumption of the boiler is determined as the sum of the two furnaces.

The Quantity of sunflower seed husk combusted in the project plant (BF_y) will be determined on wet basis. The moisture content will be determined by an expertise of an independent laboratory. Moisture content will be used to determine quantity of dry biomass.

$BF_y = BF_{k, v, wet} – (BF_{k, v, wet} * W)$,

where,
BF_y - Quantity of sunflower seeds husk combusted in the new CHP plant during the year y (tons of dry matter);
$BF_{k, v, wet}$ - Quantity of sunflower seeds husk combusted in the new CHP plant during the year y (tons of wet matter);
W - sunflower seeds husk water content (%).

To determine the CH_4 emission factor, it was decided not to conduct any measurements at the plant site, but to use IPCC default values, as provided in the Table 4 of ACM0006 (p.27). The uncertainty about the CH_4 emission factor is in many cases relatively high. In order to reflect this and for the purpose of providing conservative estimates of emission reductions, a conservativeness factor must be applied to the CH_4 emission factor. The level of the conservativeness factor depends on the uncertainty range of the estimate for the CH_4 emission factor. According to the *Table 4. Default CH_4 emissions factors for combustion of biomass residues* of ACM0006, the default emission factor for sunflower seeds husk (that corresponds to *other solid biomass residues*) is 30 kg CH_4/TJ, and the assumed uncertainty is 300%. For such value of uncertainty, the conservativeness factor to be applied according to the *Table 5 Conservativeness factors* of ACM0006 is 1,37. In such case, the CH_4 emission factor for sunflower seeds husk combustion at new CHP plant is:

$EF_{CH4,BF}$ = 1.37 * 30 = 41.1 kg/TJ.

The net caloric value of the sunflower seeds husk are metered quarterly by an independent certified laboratory. The moisture content is measured once per 10 day by internal laboratory of the enterprise.

D.1.1.3. Relevant data necessary for determining the baseline of anthropogenic emissions of greenhouse gases by sources within the project boundary, and how such data will be collected and archived:								
ID number *(Please use numbers to ease cross-referencing to D.2.)*	Data variable	Source of data	Data unit	Measured (m), calculated (c), estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment
6. $EF_{CO2, BL, heat, i}$	Emission factor for combustion of the fossil fuel (natural gas) used for heat generation in the absence of project activity	IPCC default emission factor	tonnes CO_2/GJ	-	Review the appropriateness of the data annually	100%	Electronic and paper form	*The value is 0.0561* tonnes CO_2/GJ (carbon emission factor for natural gas 15.3 tC/TJ reported in Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories (Table 1-2 on Page 1.6 of the Workbook) has been multiplied by 44/12 and divided by 1000 to be converted to tonnes CO_2/GJ).

e7. $EF_{CO2, BS, electricity}$	CO2 emission factor for grid electricity	Ukraine - Assessment of new calculation of CEF	tonnes CO2/GJ	-	Review the appropriateness of the data annually	100%	Electronic and paper form	*CO2 emission factor for grid electricity was taken from Ukraine - Assessment of new calculation of CEF.(0,896). The value of the parameter will be changed if other values of emission factors for electricity of national grid are appropriately approved.*
8. $EG_{project\ plant,\ y}$	Quantity of electricity generated in the project plant	Department of head energy engineer	MWh/y	m	Continuously	100%	Electronic and paper form	*Power meter readings*
9. $EG_{consumption,\ y}$	Electricity consumption of the boilers and steam turbine	Department of head energy engineer	MWh/y	m	Continuously	100%	Electronic and paper form	*Power meter readings*
10. EG_y	Net electricity generation	Department of head energy engineer	MWh/y	c	Continuously	100%	Electronic and paper form	*Calculated as a difference between* $EG_{project\ plant} – Eg_{consumptio}n$ *=EGy*

11.$Q_{project\ plant}$	Net quantity of heat generated in the cogeneration project plant from firing sunflower seeds husks during the year	Flow meter	GJ	M	Continuously	100%	Electronic and paper form	Data will be used to determine the avoided natural gas based steam generation

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

Baseline emissions are calculated according to the provisions and using the definitions of the methodology ACM0006 “Consolidated methodology for electricity generation from biomass residues” (further ACM0006, Version 10). Thus, baseline emissions due to electricity consumption are calculated below as emission reductions due to displacement of electricity and baseline emission due to natural gas consumption are calculated as emission reductions due to displacement of heat energy. Besides baseline emissions due to natural decay of sunflower seed husks at the landfill are also calculated. Together emission reductions due to displacement of electricity, emission reductions due to displacement of heat energy and baseline emissions due to natural decay of sunflower seed husks are referred below as total baseline emissions.

Emission reduction due to displacement of electricity

Emission reduction due to replacement of electricity is calculated by multiplying the net quantity of increased electricity generated with sunflower seeds husk as a result of the project activity (EG_y) with the CO_2 baseline emission factor for the electricity displaced due to the project ($ER_{electricity,\ y}$), as follows:

$$ER_{electricity,\ y} = EG_y * EF_{electricity,\ y}$$

Where:
$ER_{electricity,\ y}$ = Emission reductions due to displacement of electricity during the year y (tonnes CO_2/year);
EG_y = Net quantity of increased electricity generation as a result of the project activity (increment of baseline generation) during the year y (MWh);
$EF_{electricity,\ y}$ = CO_2 emission factor for the electricity displaced due to the project activity during the year y (tonnes CO_2/MWh).

According to ACM0006, if the produced electricity at the new CHP plant is to be consumed on-site and substitutes the grid electricity that would have been purchased from the grid in the absence of proposed project activity, then quantity of EG_y corresponds to the net quantity of electricity generation in the project plant ($EG_y = EG_{project\ plant,\ y} - EG_{consumption,y}$). Power meters PM 500 Merlin Gerin №5 and №6 are used to meter electricity used to cover in-house needs in the boilerhouse. For the turbine plant a separate transformer with a separate metering unit will be installed for metering of generated and consumed power (to cover in-house needs). The type of the metering unit is not defined at the moment.

The accuracy class of the power meters PM 500 Merlin Gerin:

Value	**Range**	**Accuracy**
Voltage	140 to 480 V AC	0.5 %
Current	0.1 to 2 x In	0.5 %
Power	PF = 0.5 L to 0.8 C	1 % of value
Power factor	0.5 < PF < 1	1 %
Frequency	45 to 65 Hz	0.1 %
THD Current and ph-N voltage	Up to 31st harmonic	0.2 % (absolute)
ph-ph voltage		0.4 % (absolute)
Energy Active		IEC 61036 class 1
Reactive		IEC 61268 class 2

Calibration of the meters will be carried out in accordance with the manufacturer requirements

Emission reduction due to displacement of heat

In this case when the cogeneration plant is going to be put into operation, it is necessary to determine the emission reduction due to displacement of heat ($ER_{heat,y}$).

As the identified baseline scenario is the generation of heat in steam boilers using the fossil fuels (natural gas), baseline emissions are calculated by multiplying the savings of fossil fuels (natural gas) with the emission factor of these fuels (natural gas). Emissions reductions from savings of fossil fuels (natural gas) are determined by dividing the quantity of generated heat that displaces heat generation in fossil fuel (natural gas) fired boilers (Q_y) by the efficiency of the boiler that would be used in the absence of the project activity (ε_{boiler}), and by multiplying with the CO_2 emission factor of the fuel type (natural gas) that would be used in the absence of the project activity for heat generation ($EF_{CO2, BL, heat, i}$), as follows:

$$ER_{heat,y} = \frac{Q_y * EF_{CO2, BL, heat}}{\varepsilon_{boiler}}$$

Where:

$ER_{heat,y}$ = Emission reductions due to displacement of heat during the year y (tonnes CO_2/year);
ε_{boiler} = Energy efficiency of the boiler that would be used in the absence of the project activity; The highest efficiency value (93.4%) among the three natural gas fired boilers has been assumed for conservativeness purpose.
$EF_{CO2, BL, heat, i}$ = CO_2 emission factor of the fossil fuel (natural gas) used for heat generation in the absence of project activity (tonnes CO_2/GJ).
Q_y = Quantity of increased heat generation in the project plant; Determination of Q_y will draw upon formula (28) of the methodology.

$$Q_y = MIN\begin{Bmatrix} Q_{project\ plant,y} \\ Q_{total,y} - \frac{Q_{historic,3yr}}{3} \end{Bmatrix}$$

$Q_{project\_plant,\ y}$ = Net quantity of heat generated in the cogeneration project plant from firing sunflower seeds husks during the year y (GJ);

$Q_{total} = Q_{project\_plant,\ y}$,

$Q_{historic,\ 3year}$ – Steam generated based on the biogas degasification equipment within three years before the project starting date (2005-2007).

The metering of the steam generation by the husk boilers is conducted by the vortex flow meters EB 210. There is a possibility to carry out the metering of values in order to control the values of the husk consumption meter. For this purpose, there are evaluators installed on the boilers.

The accuracy class of the power meters EB 210:

Liquid ± 0.75 % in flow range from 0,06Qmax till Qmax; ± 1.35 % in flow range from Qmin till 0,06Qmax;;

Gas/Steam ± 1.5% in flow range from 0,1Qmax till Qmax; ± 2.5 % in flow range from Qmin till 0,1Qmax.

Calibration of the meters will be carried out in accordance with the manufacturer requirements (every 3 years)

Baseline emissions due to natural decay of sunflower seeds husk at the landfill

As project participants decided to include this emission reduction source into the project boundaries then baseline emissions due to decay of the sunflower seeds husks ($BE_{Biomass,\ y}$) is determined in two steps:

Step 1: Determination of the quantity of sunflower seeds husks used as a result of the project activity ($BF_{PJ,\ k,\ y}$).
Step 2: Estimation of methane emissions, consistent with the baseline scenario for the use of sunflower seeds husks.

Step 1: The determination of $BF_{PJ,\ k,\ y}$ *will draw upon the formula 44 of the methodology*

$$BF_{PJ,k,y} = MIN\left\{ \begin{array}{c} BF_{k,y} \\ BF_{all\ plants,k,y} - \frac{BF_{historic,k,3yr}}{3} \end{array} \right\}$$

Where

$BF_{PJ,k,y}$ = Incremental quantity of sunflower seeds husks used as a result of the project activity in the project plant during the year y, which would have been sent to landfill under the baseline scenario (tons of dry matter)

$BF_{k,y}$ = Quantity of sunflower seeds husks combusted in the project plant during the year y (tons of dry matter)

$BF_{all\ plants,\ k,\ y} = BF_{k,y}$

$BF_{historic,k,3y} / 3$ = Average quantity of sunflower seed husk used for heat generation within the three years prior to the starting date of the project activity.

Step 2: Estimation of methane emissions, consistent with the baseline scenario for the use of sunflower seeds husks. As the most likely baseline scenario for the use of the sunflower seeds husks is that the sunflower seeds husks would decay under clearly anaerobic conditions, the baseline emissions is calculated using the latest approved version of the “Tool to determine methane emissions avoided from dumping waste at a solid waste disposal site”[2].

The amount of methane that would in the absence of the project activity generated from disposal of sunflower seeds husk at the solid waste disposal site is calculated with a multi-phase model. The calculation is based on the first order decay (FOD) model. The model calculates the methane generation based on the actual waste (sunflower seeds husk) streams disposed in each year x, starting with the first year after the start of the project activity until the end of the year y, for which baseline emissions are calculated.

The amount of methane produced in the year y ($BE_{biomass,\ y}$) due to decay of sunflower seeds husk at the landfill is calculated as follows:

$$BE_{biomass,\ y} = \varphi * (1 - f) * GWP_{CH4} * (1-OX) * 16/12 * F * DOCf * MCF * \sum_{x=1}^{Y} Wx * DOC * e^{-kj * (y-x)} * (1 - e^{-kj})$$

Where:

$BE_{biomass,\ y}$ = Methane emissions avoided during the year y from preventing sunflower seeds husk at the landfill during the period from the start of the project activity to the end of the year y (tonnes CO2);

φ = Model correction factor to account for model uncertainties;

f = Fraction of the methane captured at the landfill and flared, combusted or used in another manner;

[2] http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-04-v4.pdf/history_view

GWP_{CH4} =	Global warming potential of methane, valid for the relevant commitment period;
OX =	Oxidation factor (reflecting the amount of methane from landfill that is oxidized in the soil or other material covering the waste);
F =	Fraction of methane in the landfill gas;
DOCf =	Fraction of degradable organic carbon that can decompose;
MCF =	Methane correction factor;
Wx =	Amount of sunflower seeds husk prevented from disposal in the landfill in the year x (tons) (equals $BF_{PJ, k, y}$);
DOC =	Sunflower seeds husk fraction of degradable organic carbon (by weight);
k =	Decay rate for the sunflower seeds husk;
x =	Year during the crediting period: x runs from the first year of the first crediting period (x=1) to the year y for which avoided emissions are calculated;
y =	Year for which methane emissions are calculated.

For further details please refer to the elaboration of the particular values carried out in section E.4.

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

D.1.2.1. Data to be collected in order to monitor emission reductions from the project, and how these data will be archived:

ID number *(Please use numbers to ease cross-referencing to D.2.)*	Data variable	Source of data	Data unit	Measured (m), calculated (c), estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment

This section is left blank for purpose.

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

This section is left blank for purpose.

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

D.1.3.1. If applicable, please describe the data and information that will be collected in order to monitor leakage effects of the project:

ID number *(Please use numbers to ease cross-referencing to D.2.)*	Data variable	Source of data	Data unit	Measured (m), calculated (c), estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment

This section is left blank for purpose.

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

The main potential source of leakage for this project activity is an increase in emissions from fossil fuel combustion or other sources due to diversion of sunflower seeds husks from other uses to the project plant as the result of project activity. In this case the use of the sunflower seeds husks did not increase fossil fuel consumption elsewhere, because prior to implementation of the project activity sunflower seeds husks have not been collected or utilized, but have been landfilled. This practice would continue in the absence of project activity, because there has no market emerged for the sunflower seeds husks. Please see section ”Barrier analysis for the husk use alternatives**”.**

The sunflower seeds husks have not been collected or utilized (e.g. as fuel, fertilizer or feedstock), but have been dumped at the landfill prior to the implementation of the project activity. The technical inspection of the existing gas boilers has shown that the existing gas fired boilers have a lifetime until 2014. Within the baseline scenario the existing gas fired boilers will be operated. All the required permissions for landfilling are available and valid till 2011. For the time period after 2011 Pology Oil Extraction Plant may apply for the extension of the landfill permission. It is respected that the dumping is made under anaerobic conditions. The currently landfill is in line to the currently legislation. Therefore, this practice would continue in the absence of the JI project activity. In Ukraine there are no any power and/or heat capacities to utilize the sunflower seeds husk, except the oil-extraction plants (two Cargill plants in Donetsk and Kherson region, Vinnitsa oil-extraction plant, etc). But these oil-extraction plants have own husk as a by-product and face the problem with the utilization of the husk. Transportation of the sunflower seeds husk is unrealistic, because the nearest distances to the other oil-extraction plant is 250 km. So they definitely would not purchase or transport the husk from the JSC Pology Oil-Extraction Plant in order to combust it in their heat generating installations. The problem is deepened due to non-developed market of alternative fuels transportation. In Ukraine there is no experience of husk transportation neither even of waste wood fuel transportation. So it may be concluded that the alternative of selling husk for its further combustion for heat and/or power production should be excluded from further consideration as it would not overcome the following barriers: technological (concerned with the husk transportation, ash management, flue gas cleaning, problems with husk combustion, etc). The use of husk as a raw material for pellets production directly at project site faces the following barriers: in Ukraine there are only few enterprises that produce the pellets from the husk; there is still considerable lack of experience in this sector. All the sunflower seeds husks used for the project activity comes directly from the plant and this volume is enough to cover the heat demand of the plant.

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

The project reduces CO_2 emissions through substitution of power purchased from the grid and heat generation with natural gas by energy generation with sunflower seeds husk. The emission ER_y by the project activity during a given year *y* is the difference between the emission reductions through substitution of electricity purchased from the grid ($ER_{electricity,\ y}$), the emission reductions through substitution of heat generation with natural gas ($ER_{hea,t\ y}$), baseline emissions due to natural decay of sunflower seeds husks ($BE_{biomass,\ y}$) and project emissions (PE_y) and emissions due to leakage (L_y) as follows:

$$ER_y = ER_{electricity,\ y} + ER_{hea,t\ y} + BE_{biomass,\ y} - PE_y - L_y$$

Where:

ER_y = Emissions reductions of the project activity during the year *y* (tonnes CO2/year);
$ER_{electricity,\ y}$= Emission reduction due to displacement of electricity during the year *y* (tonnes CO2/year);
$ER_{hea,t\ y}$= Emission reductions due to displacement of heat during the year *y* (tonnes CO2/year);
$BE_{biomass,\ y}$= Baseline emissions due to natural decay of sunflower seeds husks during the year *y* (tonnes CO2/year);
PE_y = Project emissions during the year *y* (tonnes CO2/year);
L_y = Leakage emissions during the year *y* (tonnes CO2/year).

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

Not applicable.

D.2. Quality control (QC) and quality assurance (QA) procedures undertaken for data monitored:		
Data *(Indicate table and ID number)*	Uncertainty level of data (high/medium/low)	Explain QA/QC procedures planned for these data, or why such procedures are not necessary.
Table D 1.1.1, $BF_{k, v}$	Low	Crosscheck the measurements with an annual energy balance that is based on purchased quantities and stock changes. The Quantity of sunflower seed husk combusted in the project plant (BF_y) will be measured by frequency converter. Quantity of revolutions (in Hertz) of the dosage sluice will be measured. The frequency will be recorded every 20-180 seconds in electronic form on server. The consumption of sunflower seed husk will be determined subject to dosage sluice load factor of the particular furnace (fire-chamber) in accordance with the manufactures monitoring procedures. Each biomass boiler has two furnaces (fire-chambers). Hence the total consumption of the boiler is determined as the sum of the two furnaces.
Table D 1.1.3, $EG_{project\ plant,\ y}$	Low	Power meters will be periodically calibrated according to the manufacturer's recommendation to ensure accuracy. The consistency of metered net electricity generation should be cross-checked with the receipts from electricity sales (if available) and the quantity of fuels fired (e.g. check whether the electricity generation divided by the quantity of fuels fired results in a reasonable efficiency that is comparable to previous years).
Table D 1.1.1, NCV_{BR}	Low	The laboratory equipment is regularly verified. Check consistency of measurements and local/national data with default values by the IPCC.
Table D 1.1.1, Power-, steam-, husk-meter	Low	Power-, steam-, husk-meters will be periodically calibrated according to the manufacturer's recommendation to ensure accuracy.

Detail information on installed monitoring equipment is presented in Annex 3.

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

Collection of information required for calculations of reductions of GHG emissions as a result of the project is performed in accordance with the procedure common for the enterprise. Initial data will be submitted by the environmental department, by the production manager, and by the head energy engineer.
A transparent system for collection and storage of measured data in the electronic form are established. Calculations of emission reduction will be prepared by specialists of JSC Pology Oil-Extraction Plant at the end of every reporting year. The project manager at JSC Pology Oil-Extraction Plant will prepare reports, as needed for audit and verification. All data monitored and required for determination according to paragraph 37 of the JI guidelines will be kept for two years after the last transfer of ERUs for the project.

As mentioned above the proposed project activity also includes training courses for operation and also for accurate monitoring. The supplier of the measurement equipment will carry out an on-site training course for operation and maintenance of the measurement equipment prior to the start of the crediting period.

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

RWE Power Aktiengesellschaft, Climate Protection
Contact Person: Tolga Acar
Rellinghauser Str. 37, 45128 Essen
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SECTION E. Estimation of greenhouse gas emission reductions

E.1. Estimated project emissions:

According to the applied methodology ACM0006, the project emissions include CH_4 emissions from the combustion of sunflower seeds husks ($PE_{Biomass, CH4, y}$):

$$PE_y = GWP_{CH4} * PE_{Biomass, CH4, y}$$

Where:
PE_y – project emissions (tonnes CO2/year),
GWP_{CH4} = Global Warming Potential for methane valid for the relevant commitment period;
$PE_{Biomass, CH4, y}$ = Emissions from the combustion of sunflower seeds husk at the new CHP plant during the year *y* (tonnes CH_4/year).

Methane emissions from combustion of sunflower seeds husks ($PE_{Biomass, CH4, y}$)

The project participants decided to include this source in the project boundary. The CH_4 emissions caused by sunflower seeds husk combustion at the new CHP plant according to the equation (6) of ACM0006 are calculated as follows:

$$PE_{Biomass, CH4, y} = EF_{CH4,BF} * BF_y * NCV_{BR}$$

Where:
BF_y = Quantity of sunflower seeds husk combusted in the new CHP plant during the year y (tons of dry matter);
NCV_{BR} = Net calorific value of the sunflower seeds husk (GJ/ton of dry matter);
$EF_{CH4,BF}$ = CH_4 emission factor for the combustion of sunflower seeds husk in the new CHP plant (tCH_4/GJ).

The net calorific value of sunflower seeds husk to be combusted in the new CHP plant is 13,0 GJ/t, and the water content of this fuel is 10% (the data of the project owner - Heat engineering laboratory of JSC Pology Oil-Extraction Plant). Thus the net calorific value of dry matter of sunflower seeds husk is the following:

$$NCV_{BR} = NCV_{wet,} * \frac{100}{100-W} = 13.0 * \frac{100}{100-10} = 14.4 \text{ GJ/t}$$

Notwithstanding that GOST 27313-95 “Solid mineral fuel” presents slightly different formula for recalculation of net calorific value of wet and dry fuel, which takes into account evaporation energy of water, the above presented formula has been used for preliminary calculation of greenhouse gases emission reductions, as it leads to more conservative estimates.

To determine the CH_4 emission factor, it was decided not to conduct any measurements at the plant site, but to use IPCC default values, as provided in the Table 4 of ACM0006 (p.27). The uncertainty about the CH_4 emission factor is in many cases relatively high. In order to reflect this and for the purpose of providing conservative estimates of emission reductions, a conservativeness factor must be applied to the CH_4 emission factor. The level of the conservativeness factor depends on the uncertainty range of the estimate for the CH_4 emission factor. According to the *Table 4. Default CH_4 emissions factors for combustion of biomass residues* of ACM0006, the default emission factor for sunflower seeds husk (that corresponds to *other solid biomass residues*) is 30 kg CH_4/TJ, and the assumed uncertainty is 300%. For such value of uncertainty, the conservativeness factor to be applied according to the *Table 5 Conservativeness factors* of ACM0006 is 1.37. In such case, the CH_4 emission factor for sunflower seeds husk combustion at new CHP plant is:

$$EF_{CH4,BF} = 1.37 * 30 = 41.1 \text{ kg/TJ}.$$

The CH_4 emission from sunflower seeds husk combustion at new CHP plant is presented in the Table E.1.1 below:

Table E.1.1-The CH_4 emission from sunflower seeds husk combustion at new CHP plant

	Year				
	2008	2009	2010	2011	2012
Quantity of sunflower seeds husk utilized at new CHP plant (t of dry matter)	20 782	43 778	51 443	51 443	51 443
Net calorific value of sunflower seeds husk (GJ/t of dry matter)	14,4	14,4	14,4	14,4	14,4
Energy content of sunflower seeds husk utilized at new CHP plant, GJ/year	299 696	631 325	741 868	741 868	741 868
CH_4 emissions factor of sunflower seeds husk, tCH_4/TJ	0,0411	0,0411	0,0411	0,0411	0,0411
Methane emissions from sunflower seeds husk combustion at new CHP plant, tCH_4	12,32	25,95	30,49	30,49	30,49
Methane emissions from sunflower seeds husk combustion at new CHP plant, tonnes CO_2e	**259**	**545**	**640**	**640**	**640**

The amount of SSH combusted was estimated based on the capacity of the installed boilers (24449 tonnes per year for the first boiler installed in 2007 and 36072 tonnes per year for the second boiler installed in April 2009) taking into account the timeline of boilers installation, the fact that under normal conditions only two boilers will be operational and the third one will be in reserve and assuming load factor of 85%.

Total project greenhouse gases emissions in tonnes CO_2 are presented in the Table E.1.2 below:

Table E.1.2-Total project greenhouse gases emissions

	Year				
	2008	2009	2010	2011	2012
$PE_{Biomass,CH4,y}$,Methane emissions from sunflower seeds husks combustion, tonnes CO_2	259	545	640	640	640
PE_y , Total project emissions, tonnes CO_2	**259**	**545**	**640**	**640**	**640**

E.2. Estimated leakage:

As indicated in the section B.2 “Barrier analysis for the husk use alternatives” the leakages under the project may be neglected, and therefore, were taken equal to zero.

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

Since leakages can be neglected the sum is: E.1 (see section E.1).

E.4. Estimated baseline emissions:

Baseline emissions are calculated according to the provisions and using the definitions of the methodology ACM0006 “Consolidated methodology for electricity generation from biomass residues” (further ACM0006, Version 10). Thus, baseline emissions due to electricity consumption are calculated below as emission reductions due to displacement of electricity and baseline emission due to natural gas consumption are calculated as emission reductions due to displacement of heat energy. Besides baseline emissions due to natural decay of sunflower seed husks at the landfill are also calculated. Together emission reductions due to displacement of electricity, emission reductions due to displacement of heat energy and baseline emissions due to natural decay of sunflower seed husks are referred below as total baseline emissions.

Emission reductions due to displacement of electricity

Emission reduction due to replacement of electricity are calculated by multiplying the net quantity of increased electricity generated with sunflower seeds husks as a result of the project activity (EG_y) with the CO_2 baseline emission factor for the electricity displaced by the project ($EF_{electricity,\ y}$), as follows:

$$ER_{electricity,\ y} = EG_y * EF_{electricity,\ y}$$

Where:

$ER_{electricity,\ y}$ = Emission reductions due to displacement of electricity during the year y (tonnes CO_2/year);

EG_y = Net quantity of increased electricity generation as a result of the project activity (increment of baseline generation) during the year y (MWh);

$EF_{electricity,\ y}$ = CO_2 emission factor for the electricity displaced due to the project activity during the year y (tonnes CO_2/MWh)

Step 1: Determination of the emission factor for displacement of electricity $EF_{electricity,\ y}$

As the project activity foresees the displacement of the grid electricity, which consumption would have taken place in the case of the absence of proposed project activity, the emission factor for the displacement electricity should correspond to the grid emission factor ($EF_{electricity,\ y}$ = $EF_{grid,\ y}$) and $EF_{grid,\ y}$, shall be determined depending on the power capacity of the new CHP plant. According to ACM0006 if the power generation capacity of the project plant is less or equal to 15 MW (as it is in this case – 1.75 MWel), the average CO_2 emission factor of the electricity system may alternatively be used by the project participants.

But as it was proved in the standardization of emission factors for the Ukrainian electricity grid the average Operational Margin (OM) calculation in order to calculate the grid electricity emission factor would not represent a realistic picture and distort the results, since nuclear power plants always work in the base load due to the technical limitations (and therefore cannot be displaced) and constituted up to 40% of the overall electricity generation during the past 5 years. Therefore the Simple Margin (SM) approach was used to calculate the grid emission factor in Ukraine. According to Ukraine - Assessment of new calculation of CEF from TÜV-Süd

The value of the parameter will be changed if other values of emission factors for electricity of national grid are appropriately approved.

Step 2: Determination of EG_y.

According to ACM0006, if the produced electricity at the new CHP plant is to be consumed on-site and substitutes the grid electricity that would have been purchased from the grid in the absence of the proposed project activity, then the quantity of EG_y corresponds to the net quantity of electricity generation in the project plant ($EG_y = EG_{project\_plant,\ y} – EG_{consumption}$). The annual net quantity of electricity generation in the project plant is 13 031 MWh but assuming the start of turbine operation in April, 2012 the net quantity of electricity generation in the project plant in 2012 is assumed to be equal 10 000 MWh (expected net electricity generation during 9 months based on annual net quantity of electricity generation in the project plant of 13 031 MWh). In such case the emission reduction due to displacement of electricity is presented in the table E.4.1 below:

Table E.4.1 - Emission reduction due to displacement of electricity

	Year				
	2008	2009	2010	2011	2012
Quantity of electricity generation in the CHP plant, $EG_{project\_plant,y}$, MWh	0	0	0	0	10 000
Emission factor, $EF_{electricity,y}$, tonnes CO_2/MWh	0,896	0,896	0,896	0,896	0,896
Emission reduction $ER_{electricity,y}$, tonnes CO_2/year	**0**	**0**	**0**	**0**	**8 960**

Emission reductions due to displacement of heat.

In this case when the cogeneration plant is going to be put into operation, it is necessary to determine the emission reduction due to displacement of heat ($ER_{heat,y}$).

$ER_{heat,y} = (Q_y \cdot EF_{CO2,\ BL,\ heat,\ i}) / \varepsilon_{boiler}$

Where:

$ER_{heat,y}$ = Emission reductions due to displacement of heat during the year y (tonnes CO_2/year);
ε_{boiler} = Energy efficiency of the boiler that would be used in the absence of the project activity; The highest efficiency value (93.4%) among the three natural gas fired boilers has been assumed for conservativeness purpose.
$EF_{CO2,\ BL,\ heat,\ i}$ = CO_2 emission factor of the fossil fuel (natural gas) used for heat generation in the absence of project activity (tonnes CO_2/GJ).
Q_y = Quantity of increased heat generation in the project plant; Determination of Q_y will draw upon formula (28) of the methodology.

$$Q_y = MIN \left\{ \begin{array}{c} Q_{project\ plant,y} \\ Q_{total,y} - \dfrac{Q_{historic,3yr}}{3} \end{array} \right\}$$

$Q_{project\_plant,\ y}$ = Net quantity of heat generated in the cogeneration project plant from firing sunflower seeds husks during the year y (GJ);

$Q_{total} = Q_{project\_plant,\ y}$,

$Q_{historic,\ 3year}$ – Steam generated based on the biogas degasification equipment within three years before the project starting date (2005-2007). The average value of biogas based steam generation for the years 2005-2007 is 46 099 GJ per annum.

Heat generation and consumption is assumed to be equal both in the baseline and project scenarios. The amount of heat energy generated (see table E.4.2) has been assumed based on the forecasted Enterprise's production outputs, SSH combustion volumes and SSH net calorific value (14.4 GJ/t).

The forecasted Enterprise's production outputs have been planned to be increased from about 300 000 tonnes of sunflower oil (average during 2004-2007) to about 380 000 tonnes starting from 2010 according to the production plans of the Enterprise. Moreover, the Enterprise has also commissioned new oil odor-control treatment line in 2010 to improve the quality of the products, which also increases heat energy demand.

SSH combustion volumes were derived based on the above mentioned heat energy generation increase as well as taking into account the capacity of the installed boilers (24449 tonnes per year for the first boiler installed in 2007 and 36072 tonnes per year for the second boiler installed in April 2009), the timeline of boilers installation and the fact that under normal conditions only two boilers will be operational and the third one will be in reserve and assuming load factor of 85% as explained above.

Natural gas consumption under the baseline scenario that would be displaced by heat generation using SSH under the project scenario has been calculated based on the abovementioned heat generation/consumption volumes, natural gas net calorific value as well as the efficiency of natural gas fired boilers, which lead to the increase in natural gas consumption under the baseline (from about 15.5 million m^3 average during 2004-2007 to about 19.1 million m^3 starting from 2010).

Quantity of increased heat generation in the project plan is calculated based on the data of quantity of heat generated in the CHP plant minus average value of generators' gas based steam generation for the years 2005-2007 (46 099 GJ) as it is reflected in the table E.4.2 beneath.

Actual emission reductions will be calculated based on the monitoring data.

Emission reduction due to displacement of heat generation using fossil fuel by heat generated from sunflower seeds husks is presented in the table E.4.2 below:

Table E.4.2 - Emission reduction due to displacement of heat generation using fossil fuel by heat generated from sunflower seeds husks

	Year				
	2008	2009	2010	2011	2012
Quantity of heat generated in the CHP plant, $Q_{project\_plant,y}$,GJ/year	263 733	555 566	652 844	652 844	652 844
Quantity of increased heat generation in the project plant, Q_y, GJ/year	217 633	509 466	606 744	606 744	606 744
Energy efficiency of existing steam gas-fired boiler	0,93	0,93	0,93	0,93	0,93
Natural gas consumption, 1000m^3	6 853	16 043	19 106	19 106	19 106
Emission factor of natural gas, $EF_{CO2,BL,heat,i}$, tonnes CO_2/TJ	56,1	56,1	56,1	56,1	56,1
Emission reduction, $ER_{heat,y}$, tonnes CO_2/year	**13 072**	**30 601**	**36 444**	**36 444**	**36 444**

Baseline emissions due to natural decay of sunflower seeds husks

As project participants decided to include this emission reduction source into the project boundaries then baseline emissions due to decay of the sunflower seeds husk ($BE_{biomass, y}$) is determined in two steps:

Step 1: Determination of the quantity of sunflower seeds husks used as a result of the project activity.

Step2: Estimation of methane emissions, consistent with the baseline scenario for the use of sunflower seeds husks

Step 1. Determination of the quantity of sunflower seeds husk used as a result of the project activity ($BF_{PJ,k,y}$)

$$BF_{PJ,k,y} = MIN\left\{ \begin{array}{c} BF_{k,y} \\ BF_{all\ plants,k,y} - \frac{BF_{historic,k,3yr}}{3} \end{array} \right\}$$

Where
$BF_{PJ,k,y}$ = Incremental quantity of sunflower seeds husks used as a result of the project activity in the project plant during the year y (tons of dry matter)
$BF_{k,y}$ = Quantity of sunflower seeds husks combusted in the project plant during the year y (tons of dry matter)
$BF_{all\ plants,\ k,\ y}$ = $BF_{k,y}$
$BF_{historic,k,3y}$ / 3 = Average quantity of sunflower seed husk used for heat generation within the three years prior to the starting date of the project activity. The average value of sunflower seed husk used by gas generators for the years 2005-2007 is 27 150 tonnes per annum.

Step 2. Estimation of methane emissions, consistent with the baseline scenario for the use of sunflower seeds husks.
As the most likely baseline scenario for the use of the sunflower seeds husks is that the sunflower seeds husks would decay under clearly anaerobic conditions, the baseline emissions are calculated using the latest approved version of the "Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site". The amount of methane that would in the absence of the project activity been generated from disposal of sunflower seeds husk at the solid waste disposal site is calculated with a multi-phase model. The calculation is based on the first order decay (FOD) model. The model calculates the methane generation based on the actual waste (sunflower seeds husk) streams disposed in each year x, starting with the first year after the start of the project activity until the end of the year y, for which baseline emissions are calculated. The amount of methane produced in the year y ($BE_{CH4,\ SWDC,\ y}$) due to decay of sunflower seeds husk at the landfill is calculated as follows:

$$BE_{CH4,\ SWDC,\ y} = \varphi * (1 - f) * GWP_{CH4} * (1-OX) * 16/12 * F * DOCf * MCF * \Sigma\, Wx * DOC * e^{-kj * (y-x)} * (1 - e^{-kj})$$

Where:

$BE_{CH4,\ SWDC,\ y}$ =	Methane emissions avoided during the year y from preventing sunflower seeds husk at the landfill during the period from the start of the project activity to the end of the year y (tonnes CO_2);
φ =	Model correction factor to account for model uncertainties;
f =	Fraction of the methane captured at the landfill and flared, combusted or used in another manner;
GWP_{CH4} =	Global warming potential of methane, valid for the relevant commitment period;
OX =	Oxidation factor (reflecting the amount of methane from landfill that is oxidized in the soil or other material covering the waste);
F =	Fraction of methane in the landfill gas;
DOCf =	Fraction of degradable organic carbon that can decompose;
MCF =	Methane correction factor;

Wx = Amount of sunflower seeds husk prevented from disposal in the landfill in the year x (tons);
DOC_j = Sunflower seeds husk fraction of degradable organic carbon (by weight);
k = Decay rate for the sunflower seeds husk;
x = Year during the crediting period: x runs from the first year of the first crediting period (x=1) to the year y for which avoided emissions are calculated;
y = Year for which methane emissions are calculated.

Selection of proper values for calculation:

1) Model correction factor to account for the model uncertainties φ =0.9. Such value is applied in order to estimate emission reductions in a conservative manner – a discount of 10% is applied to the model results;
2) Oxidation factor OX = 0 as the waste disposal site (landfill) where the sunflower seeds husk would have been dumped in the absence of proposed project activity is not covered with any oxidizing material such as soil or compost;
3) Fraction of methane in landfill gas F=0.5, according to IPCC guidelines for National Greenhouse Gas Inventories;
4) Fraction of degradable organic carbon that can decompose *DOCf* = 0.5, according to IPCC Guidelines for National Greenhouse Gas Inventories;
5) Methane correction Factor MCF = 1.0, as the Pology landfill is classified as unmanaged deep solid waste disposal sites. Its depth reaches 6-9 m that is more than 5 meters but landfill does not have cover material, neither mechanical compacting or leveling of the waste;
6) Fraction of degradable organic carbon in the sunflower seeds husk DOC_j = 0.5 according to the IPCC 2006 Guidelines for National Greenhouse Gas Inventories (Volume 5, Table 2.4). As sunflower seeds husk cannot be clearly attributed to one of the waste types in the IPCC Guidelines, the DOC for dry wood was selected by project participants to be applied in calculations, as the dry wood waste has the most similar characteristics to husk.
7) Decay rate for the sunflower seeds husk k = 0.03. According to the Table 3.3 of Volume 5 of IPCC Guidelines for National Gas Inventories. The default k value for wood, wood products and straw was selected for calculation as this type of waste has the most similar characteristics to sunflower seeds husk. The climate of the Pology region is justified to be Boreal wet:
8) Average annual temperature in Pology region is +8,5 C.
9) MAP – mean annual precipitation = 550 mm/year.
10) PET – potential evapotranspiration = 500 mm/year. Thus MAP/PET>1,
11) As at the moment no methane is captured at existing Pology landfill, and there are no initiatives to construct any landfill gas collection and utilization systems at the Pology landfill, the fraction of methane captured at the landfill and flared, combusted and used in another manner f = 0 is applied.
12) Global Warming Potential of methane GWP_{CH4} = 21. This value is valid for the first commitment period due to the Decision under UNFCCC and the Kyoto Protocol.
13) Amount of sunflower seeds husk prevented from disposal at the landfill is calculated based on the expected amount sunflower seeds husk used by installed boilers. For years 2009-2012 the volume of SSH has been decreased by average amount of SSH utilized by gas generators during 2005-2007.

Baseline methane emissions $BE_{CH4,\ SWDC,\ y}$, , in tonnes CO_2e due to natural decay of sunflower seeds husk at the landfill during the crediting period (2008-2012) are presented in the table E.4.3 below:

Table E.4.3 - Baseline methane emissions $BE_{CH4,\ SWDC,\ y}$, in tonnes CO2e

	Year				
	2008	2009	2010	2011	2012
Sunflower seeds husk dumped, tonnes	20 782	16 628	24 293	24 293	24 293
Emissions due to sunflower seeds husk decay, tonnes CO_2	**1 935**	**3 425**	**5 586**	**7 682**	**9 717**

Total baseline CO2 emissions are presented in the table E.4.4 below.

Baseline emissions are calculated according to the provisions and using the definitions of the methodology ACM0006 "Consolidated methodology for electricity generation from biomass residues" (further ACM0006, Version 10). Thus, baseline emissions due to electricity consumption are calculated below as emission reductions due to displacement of electricity and baseline emission due to natural gas consumption are calculated as emission reductions due to displacement of heat energy. Besides baseline emissions due to natural decay of sunflower seed husks at the landfill are also calculated. Together emission reductions due to displacement of electricity, emission reductions due to displacement of heat energy and baseline emissions due to natural decay of sunflower seed husks are referred below as total baseline emissions.

Table E.4.4 - Total baseline CO_2 emissions

	Year				
	2008	2009	2010	2011	2012
Electricity consumption from the grid, tonnes CO_2	0	0	0	0	8 960
Natural gas combustion for heat generation, tonnes CO_2	13 072	30 601	36 444	36 444	36 444
Sunflower seeds husk decay at the landfill, tonnes CO_2	1 935	3 425	5 586	7 682	9 717
Total, tonnes CO_2	**15 007**	**34 026**	**42 029**	**44 126**	**55 120**

E.5. Difference between E.4. and E.1. representing the emission reductions of the project:

The difference between baseline emissions (E.4) and project emissions (E.1) are presented in the table E.5 below:

Table E.5 - Total emission reduction

	Year				
	2008	2009	2010	2011	2012
Project emissions, tonnes CO_2	259	545	640	640	640
Baseline emissions, tonnes CO_2	15 007	34 026	42 029	44 126	55 120
Emission reduction, tonnes CO_2	**14 748**	**33 481**	**41 389**	**43 486**	**54 480**
Total emission reduction during commitment period (2008-2012)	**187 584**				

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

Year	Estimated project emissions (tonnes of CO_2 equivalent)	Estimated leakage (tonnes of CO_2 equivalent)	Estimated baseline emissions (tonnes of CO_2 equivalent)	Estimated emissions reductions (tonnes of CO_2 equivalent)
2008	259	0	15 007	14 748
2009	545	0	34 026	33 481
2010	640	0	42 029	41 389
2011	640	0	44 126	43 486
2012	640	0	55 120	54 480
Total (tonnes of CO_2	**2 724**	**0**	**190 309**	**187 584**

equivalent)				

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:

Before the start of the project implementation, JSC Pology Oil-Extraction Plant has received all the required approvals of the state ecology examinations.

Project implementation increases sunflower seeds husks consumption as fuel, while decreasing the consumption of fuel oil (natural gas).

This results in the reduction of GHG emissions into the atmosphere.

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

For all equipment environmental impact analysis exists. The environmental impacts of the project are positive. All relevant information is in the environmental impact analysis.

For information, the environmental impact of the project will be assessed by the Ukrainian authorities in the following way and will be assessed before obtaining a construction permit. The general principles of evaluating the environmental impact procedure in Ukraine are described by the national laws

- on environmental protection; Link: http://www.ecolife.org.ua/laws/ua/laws/1995/01.php and
- on environmental expertise; Link: http://zakon.rada.gov.ua/cgi-bin/laws/main.cgi?nreg=1264-12

According to the national legislation, every project or new activity that can be potentially harmful to the environment, must be evaluate regarding its environmental impact.

These environmental impacts are analysed during the development of the detailed project design in order to obtain a construction permit. The documents must provide a list of viable project alternatives, a description of the current state of the local environment, description of the main pollutants, risk evaluation and an action plan for pollution minimisation. The final documents have to be presented as a separate volume of the project documentation for the evaluation by a state expert company.

The national procedure for receiving the construction permit is described below:
1. Approval by the local authorities
2. Setting requirements for the project
3. Project design phase
4. Construction design
5. Receiving the construction permit

The EIA was conducted by an independent authorised organisation in the accordance with the national regulations of Ukraine. The air and the sound were the subject of evaluation. On this basis the permission for the operation of the equipment was received. Before the installation of the third boiler the separate environmental impact assessment on its installation has been made in accordance with the national regulations of Ukraine; all relevant approvals were received.

One of the mandatory parts of the state evaluation procedure is the stakeholder consultation process. All interested parties can submit their comments regarding the project to the company performing the evaluation process. National regulations do not formulate how the stakeholder consultations have to be held. However, JSC Pology Oil-Extraction Plant is committed to actively publish the information about potential impacts of the project (including the environmental impact) and will take into account the comments from all stakeholders.

SECTION G. Stakeholders' comments

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

The project was presented to the regional authorities. JSC Pology Oil-Extraction Plant published information about the project to stakeholders as described in section F.1. The Oblast administration has received the materials regarding the proposed project and came to the conclusion that the proposed project activity will have positive effect on the local environment.

All comments received by JSC Pology Oil-Extraction Plant were positive towards the implementation of the project.

Annex 1

CONTACT INFORMATION ON PROJECT PARTICIPANTS

Annex 1.1: Project Participants

Project Participant 1

Organisation:	JSC Pology Oil Extraction Plant
Street/P.O.Box:	36 Lomonosov street
Building:	
City:	Pology City
State/Region:	Zaporizhia Region
Postal code:	70601
Country:	Ukraine
Phone:	
Fax:	
E-mail:	tehno@mezpology.zp.ua
URL:	http://www.mezpology.zp.ua
Represented by:	Mr. Ostroushko Valeriy Leonidovich
Title:	Head of the Board, Technical Director
Salutation:	
Last name:	Leonidovich
Middle name:	Valeriy
First name:	Ostroushko
Department:	
Phone (direct):	+38 (06165) 23722
Fax (direct):	+38 (06165) 23220
Mobile:	
Personal e-mail:	tehno@mezpology.zp.ua

Entry number at Uniform State Register of Enterprises and Organizations of Ukraine – 00384147.

Economic activity types according to Ukrainian Classification for Economic Activities: 15.41.0 - manufacturing of crude oils and fats; 15.42.0 - manufacturing of refined oils and fats; 51.11.0 - mediation in trade of agricultural raw materials, live animals, textile raw materials and semi-finished products; 51.21.0 – wholesale of grain, seeds and feeds for animals; 51.39.0 - non-specialized wholesale of food, beverages and tobacco; 70.20.0 – renting of own immovables.

Project Participant 2

Organization:	RWE Power Aktiengesellschaft
Street/P.O.Box:	Huyssenallee 2
Building:	/
City:	Essen
State/Region:	/
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Telephone:	+49 (0)201 12-24770
FAX:	+49 (0)201 12-20216
E-Mail:	antonio.aguilera@rwe.com
URL:	http://www.rwe.com
Represented by:	Antonio Aguilera Lagos
Title:	Head of Carbon Credit Purchase
Salutation:	/
Last Name:	Aguilera Lagos

Middle Name:	/
First Name:	Antonio
Department:	Climate Protection
Mobile:	/
Direct FAX:	+49 (0)201 12-20216
Direct tel:	+49 (0)201 12-24770
Personal E-Mail:	antonio.aguilera@rwe.com

CONTACT INFORMATION ON PROJECT DESIGN DOCUMENT DEVELOPER

Organization:	LLC 'KT-Energy'
Street/P.O.Box:	Biloruska str.
Building:	15-B/22
City:	Kyiv
State/Region:	
Postfix/ZIP:	04119
Country:	Ukraine
Telephone:	+38 (044) 493 83 32
FAX:	+38 (044) 493 83 32
E-Mail:	info@kt-energy.com.ua
URL:	
Represented by:	
Title:	Director
Salutation:	Mr.
Last Name:	Tomlyak
Middle Name:	Oleksadrovych
First Name:	Kyryl
Department:	
Mobile:	
Direct FAX:	
Direct tel:	
Personal E-Mail:	ktomlyak@ kt-energy.com.ua

LLC "KT-Energy" is not a participant of this joint implementation project.

Annex 2

Baseline information

Annex 2 Technical characteristics

Annex 2.1: Technical information about the old boilers

a)

The boiler with the fabrication number *7730* has been manufactured in D*ecember 1974* by Biyskiy Kotelniy Zavod (factory name), Biysk city, P. Merlina 63.
Type, system: DKVR *20-23-250* with double drum and water pipes with combustion for the *reduction of gas and masut.*

a) Norm steam pressure (fluid):	
in the drum	24 Kilopond/cm²
during exit of the steam superheater	23 Kilopond/cm²
b) normal temperature of superheated steam (fluid)	250°
c) steam performance (thermal turnover, kcal/h)	20 t/h

Heating surface:

a.) boiler itself (convective)	285 m²
b.) screen (radiation)	73.5 m²
c.) steam superheater	34.0 m²

Boiler volume:

Water:	10.5 m³
Steam:	1.8 m³
Supply:	0.88 m³

b)
NG1 (Natural gas fired boiler) = DKVR-20-23-250 –1974; Efficiency of the boiler: NG1 – 91 %,

NG2 (Natural gas fired boiler) = DE-20-24-250 – 1974; Efficiency of the boiler: NG1 – 91.5 %,

NG3 (Natural gas fired boiler) = DKVR-40-23-350 – 1974; Efficiency of the boiler: NG1 – 93.4 %.

Annex 2.2: Technical information about the new husk boilers

Data	NH1 = DKVR 20-23-330 DV	NH2 = E-20-2.4-350 DV	NH2 = E-20-2.4-350 DV
Fuel type	dry hackled vegetable waste (sunflower seed husk)	dry hackled vegetable waste (sunflower seed husk)	dry hackled vegetable waste (sunflower seed husk)
Steam type, superheated	330 ℃	350 ℃	350 ℃
Feed water temperature	100 ℃ $_{max}$	100 ℃ $_{max}$	100 ℃ $_{max}$
Pressure behind the boiler	30/32 Pa	23,6 Pa	23,6 Pa
Temperature of the escaping gases (calculated)	209℃	330℃	330℃
Air surplus coefficient at the exit of the heating room	1.6/1.8%	1.6/1.8%	1.6/1.8%
Water volume	12 m^3	15.1 m^3	15.1 m^3
Direct heating surface	81.7 m^2	107 m^2	107 m^2
Indirect heating surface	306 m^2	490 m^2	490 m^2

Annex 2.3: Information about husk input in the new husk fired boilers

New Husk Boiler	Maximum Input [t/hour]	Maximum Input [t/day]	Maximum Input [t/year]
NH 1	3,05	73,2	24 449
NH 2	4,50	108,0	36 072
NH 3	4,50	108,0	36 072

The data corresponds to the maximum sunflower seed husk input in the each SSH fired boiler. Actual SSH consumption during the year could be lower as boilers could operate under lower than installed capacity and it is assumed that only two boilers will be operated simultaneously and the third boiler will be used as a reserved equipment.

Annex 2.4: Historical data of the plant

	Natural Gas consumption	Husk Input Generator	Biogas based steam generation	Electricity Generation	Power from Ukrainian Grid
Year	m^3	t	GJ	MWh	MWh
2004	17 006	28 800	42844	0	24 147
2005	15 857	18 565	44903	0	20 502
2006	16 018	24 419	41826	0	21 873
2007	13 308	38 466	51569	0	26 462
Average for the period 2005-2007	15 061	27 150	46 099	0	22 946

Annex 2.5: Reference about volume of sunflower seeds and husk

	2004	2005	2006	2007
Amount of processing sunflower oil, tonnes/year	332,106	229,295	339,342	305,864
Amount of processing sunflower oil, tonnes /day	994.33	686.51	1015.99	915.76
Output of sunflower seeds husk (annual), tonnes /year	57,544	38,876	62,202	56,341
Output of sunflower seeds husk, tonnes /day	172.29	116.40	186.23	168.69
Husk content in sunflower seeds, %	17%	17%	18%	18%

Annex 2.6: Technical description project scenario

Proposed system:			
Technology	**Value**	**Unit**	**Comments**
Net thermal capacity	44,07	MW	NH1 – 11.5 Gkal/hour or 13.37 MW, NH2 and NH3 – 13.2 Gkal/hour or 15.35 MW each
Net electricity capacity	1,75	MW	
Nominal operating hours	8 016	h/a	Annual operating hours
Total nominal loading rate of boilers	100	%	
Nominal loading rate of turbine	95	%	
Boiler efficiency	88	%	Value from boiler design developers
Annual biomass input	51 443	tonnes	Annual biomass input under the assumption of two boilers simultaneous operation during 334 days under the average load of 85%
Net calorific value of sunflower seed husk	13,0	GJ/tonne	Average net calorific value of SSH. Data provided by the enterprise.
Humidity of sunflower seed husk	10%	%	Average humidity of SSH. Data provided by the enterprise.
Annual thermal input (by fuel)	741 868	GJ/a	Calculated based on the data presented above
Annual electricity generation	14 931	MWh/a	This value is taken according to data of manufacturers of CHP equipment. Data is taken from project design document developed by "Ecoenergomash"
Annual electricity consumption for own needs of CHP unit	1 900	MWh/a	
Annual net electricity generation	13 031	MWh/a	
Annual heat generation (gross)	652 844	GJ/a	153 155 Gcal/a
Heat losses	0	%	As received from project design document
Annual heat generation (net)	652 844	GJ/a	153 155 Gcal/a

Annex 2.7 Calculation NPV

	NPVC, UAH	NPVC, €
Project scenario not being registered as JI	-98 835 155	-16 228 353
Baseline scenario	-87 839 141	-14 422 850

Operating costs for proposed project have been assumed based on own estimations of the enterprise. Operating costs for water were calculated based on the cost of water extraction for the enterprise and the wages for personnel and wage deductions were estimated based on the staffing table of the steam and energy workshop of the enterprise. Materials costs are calculated based on average costs of maintenance works at steam and energy workshop and adjusted for the total value of fixed assets.

Estimated annual operating costs for proposed project (UAH)	Boilers operating (heat production)	Power production	Total	
Water for steam generation	301,413	0	301,413	UAH
Wages for personnel, Wage deductions (social fund, pension fund, etc)	494,700	205,957	700,656	UAH
Material costs	454,366	152,448	606,815	UAH
Other costs (maintenance, etc.)	1,931,348	455,830	2,387,178	UAH
Total	3,181,827	814,235	3,996,063	UAH

Annual operating costs for continuation of current (UAH)	Boilers operating (heat production)	Gas generator (heat production)	Total	
Water for steam generation	81,676	20,419	102,095	UAH
Wages for personnel, Wage deductions (social fund, pension fund, etc)	203,130	50,782	253,912	UAH
Material costs	303,786	75,946	379,732	UAH
Other costs (maintenance, etc.)	677,940	169,485	847,426	UAH
Total	1,266,532	316,633	1,583,165	UAH

The price of electricity and natural gas was assumed based on the actual price for the industrial enterprises in 2005 (time of making the decision about project realisation) and the assumed escallation rate equal to the average inflation rate in Ukraine in 2001-2005. The price of electricity of 233.3 UAH/MWh is based on the data of annual report of National Electricity Regulation Comission for the year 2005[3]. The price of natural gas of 361.2 UAH/1000 m^3 is based on the data of Naftogas of Ukraine[4]. The average inflation rate in Ukraine for the period of 2001-2005 is 7.26% based on the data of the State Statistical Committee[5]. Cost of waste disposal at the landfill is assumed as per the landfill lease agreement with local administration and own estimation of the transportation cost.

Prices for tariffs		
Power supply tariff	233.3	UAH/MWh
Natural gas price for heat production	361.2	UAH/1000m3
Cost of waste disposal at the landfill	602,300	UAH/year

[3] Available at http://uazakon.com/documents/date_8w/pg_iacbwj.htm

[4] Available at http://www.gasukraine.com.ua/clients/gasukraine/gasukraine.nsf/%28print%29/A704C9AA8A195AE0C225746F00444416

[5] http://www.ukrstat.gov.ua/. See section for Statistical information, Consumer price indices in 1991–2010 (to previous mouth).

Fuel and power consumption data used in financial analysis are the same as used in the calculation of emission reductions and is estimated based on actual and forecasted values of fuel and power consumption as well as on the technical characteristics of the equipment (see also Section E for details).

Initial estimation of investment needed for the realization of the project was made in the Feasibility study of the project. However, due to the decision regarding installation of the third SSH boiler (additionally to the two SSH boilers initially planned) and the changes in market price of the main equipment the investments needed for the realization of the project were re-estimated. The data used in the financial analysis include the cost of the main equipment, design works, transportation as well as assembling works for each project stage.

Financial data project scenario		
Total Investment	118 530 254	UAH
Own contribution	72 468 245	UAH
Loan	46 062 009	UAH
Own contribution	61%	%
Loan	39%	%
Investment for heat generation - first two boilers (Investment Step 1)	32 614 065	UAH
Investment for heat generation - third boiler (Investment Step 2)	24 500 177	UAH
Investment for electricity generation (Investment Step 3)	61 416 012	UAH
Loan for Investment Step 3	46 062 009	
Interest rate for Investment Step 3	18,0	%
Loan period for Investment Step 3	5,0	years
Discount rate	20,0	%

Financial data for baseline scenario		
Total Investment	22 717 622	UAH
Own contribution	13 889 333	UAH
Loan	8 828 289	UAH
Investment gas boilers	21 203 114	UAH
Investment gas generator	1 514 508	UAH

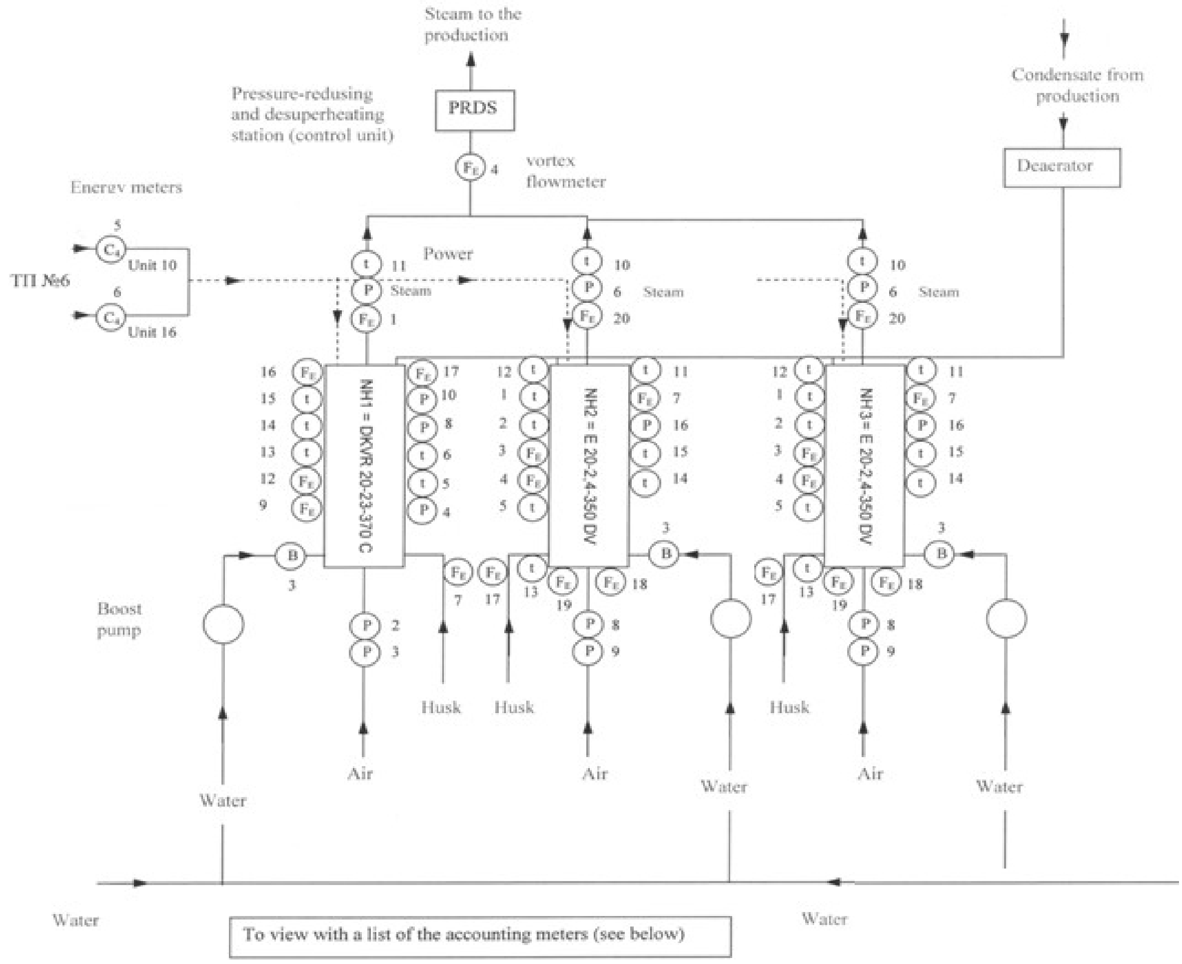
ERU-Price		
Price for ERU	75	UAH/ERU

Annex 3

MONITORING PLAN

The implementation of the monitoring plan is to ensure that real, measurable, long-term Greenhouse Gas Emission Reduction can be monitored, recorded and reported. It is a crucial procedure to identity the final ERUs of the proposed project. This monitoring plan for the proposed project activity will be implemented by the project owner, Pology Oil-Extraction Plant.

1. What data will be monitored?
The detailed installation of the meters is illustrated in the following figure;



List of the accounting meters at the boiler house JSC"Pology OEP"

<u>Boiler NH1 = DKVR 20-23-330 DV</u>

1 TPM-202	Steam and water consumption
2 TPM-201	Pressure after blower fan1
3 TPM-201	Pressure after blower fan 2
4 TPM-202	Pressure in the boiler drum
5 TPM-202	Temperature opposite gas discharging windows 1
6 TPM-202	Temperature opposite gas discharging windows 2
7 TPM-201	Husk level in the silo
8 TPM-201	Steam pressure after superheater
9 TPM-201	Ash level in the silo 2

10 TPM-201 Rarefication in the afterburner
11 TPM-201 Steam temperature
12 TPM-201 Ash level in the silo 1
13 TPM-200 Temperature of furnace gases before and after superheater
14 TPM-200 1 Temperature in furnace 1
15 TPM-200 Temperature in furnace 2
16 TPM-202 Water level in the boiler drum
17 TPM-202 Rarefication in the furnace 1 and 2

Boiler NH2 = E 20-2.4-350 DV
1 TPM-202 temperature opposite gas discharging windows 1
2 TPM-202 temperature opposite gas discharging windows 2
3 TPM-202 Rarefication in the furnace 1 and 2
4 TPM-201 Rarefication in the afterburner
5 TPM-138 Husk temperature in the silo and loading points (pipes)
6 TPM-202 Pressure in the boiler drum
7 TPM-202 Water level in the boiler drum
8 TPM-201 Pressure after blasting fans 1
9 TPM-201 Pressure after blasting fans 2
10 TPM-202 Temperature in the boiler drum and after superheater
11 TPM-202 Temperature in the furnace 1
12 TPM-202 Temperature in the furnace 2
13 TPM-202 Temperature of furnace gases before and after superheater
14 TPM-202 Temperature of furnace gases behind the boiler and of the economizer of the 1st grade
15 TPM-202 Temperature of the furnace gases of the economizer of the 2nd grade and before the smoke exhauster
16 TPM-201 Steam pressure after superheater
17 TPM-201 Husk level in the silo
18 TPM-202 Husk level in the silo 1
19 TPM-202 Husk level in the silo 2
20 TPM-202 Steam and water consumption

1 LGK-200 Utility meter (gas) (commercial accounting)
2 LGK-150 Utility meter (gas) (commercial accounting)
3 EB-210 Vortex flow meter for recording of water consumption delivered to the boiler
4 EB-210 Vortex flow meter for recording of produced steam consumption
5 САЗУ670М Energy accounting meter TP №6 unit №10
6 САЗУ670М Energy accounting meter TP №6 unit №16
7 FR-E500 Frequency converter for recording of consumption of husk supply to the boiler

Boiler NH3 = E 20-2.4-350 DV
1 TPM-202 temperature opposite gas discharging windows 1
2 TPM-202 temperature opposite gas discharging windows 2
3 TPM-202 Rarefication in the furnace 1 and 2
4 TPM-201 Rarefication in the afterburner
5 TPM-138 Husk temperature in the silo and loading points (pipes)
6 TPM-202 Pressure in the boiler drum
7 TPM-202 Water level in the boiler drum
8 TPM-201 Pressure after blasting fans 1
9 TPM-201 Pressure after blasting fans 2
10 TPM-202 Temperature in the boiler drum and after superheater
11 TPM-202 Temperature in the furnace 1
12 TPM-202 Temperature in the furnace 2
13 TPM-202 Temperature of furnace gases before and after superheater
14 TPM-202 Temperature of furnace gases behind the boiler and of the economizer of the 1st grade
15 TPM-202 Temperature of the furnace gases of the economizer of the 2nd grade and before the smoke exhauster
16 TPM-201 Steam pressure after superheater