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

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SECTION A. General description of the project

A.1. Title of the project:

Utilization of Sunflower Seeds Husk for Heat and Power Production at Closed Joint-Stock Company (CJSC) “Pology Oil-Extraction Plant, South-East Ukraine

JI PDD version number: 1.0

Date of Completion: 10/07/2008

A.2. Description of the project:

In the period when the mission took place and the PDD was developed, the avoided methane emissions were calculated using the latest approved specific methodology, published by the CDM EB for large-scale projects ACM 0006 Version 06.

Purpose of the project:
The main project objective is the reconstruction of energy supply system of the Pology Oil-Extraction Plant (hereafter „Pology OEP“), by construction of combined heat and power plant fuelled by solid biomass (sunflower seeds hsuk). Pology OEP covered the heat demand by three gas-boilers and the power demand by the grid. The purpose of this project is the reconstruction of an energy supply system for Pology OEP so that it will be mainly based of biomass (sunflower seed husk). All the amount of husk generated by the Enterprise after extension of 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 grid, and also to avoid disposal of any amount of husk at the landfill. In result the project will reduce GHG emissions of methane through decay of biomass.

Project concept:
The project will be implemented at the Pology OEP 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 the two steam sunflower seeds husk fired boilers (as the fuel sunflower seeds husk is used, and also at two of the old gas boilers will be used as the reserve fuel) and steam turbine. The proposed project foresees that full heat demand and 50 % of power demand of the oil-extraction plant will be covered by the new sunflower seeds husk-fired Combined Heat and Power Plant CHP plant.

Following 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 sunflower seeds husk fired boiler (September 2008)

Stage 3: Construction of the steam turbine units (Octobre 2009)

Estimated results of the project

- Substitution of outdated gas fired boilers with the of installed rated thermal capacity up to 139.841 MWh/a (120.242 Gcal/a) (project design DKVr – 20 – 23 – 330 DV, DKVR-20-13, DKVR-20–23);
- Generation of ca. 10.000 MWh/yr 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 CO2 emissions due to decreasing of the natural gas consumption;
- Considerable reduction of methane emissions due to avoiding of 60.500 tons/a of sunflower seeds husk dumping and further decay at the landfill.

Other information

The plant was originally installed in 1974. During its operation specialists and workers of the plant mastered new techniques of the treatment of not only sunflower seeds but also of soybean seeds, rape seeds and ricinus seeds. Enterprise produces soy, rape and castor oils.

At the moment production capacity of Pology OEP is 950 – 1.050 t of sunflower seeds per 24 hours. The Enterprise has three old boilers for sunflower seeds husk combustion - N1, N2 and N3, nominal steam production of which is 20 t/h, 18 t/h, and 25 t/h respectively. Years of manufacture: boiler NG1 DKVR-20-23-250 – 1974, boiler NG2 DKVR-20-13 – 1974, boiler NG3 DKVR-20–23 1975. Efficiency of the boilers: N1 – 91 %, N2 – 91,5 %, N3 – 93,4 %. (Please, see Annex 3.1.4, technical characteristics "Certificate on the quality of boiler manufacture" for old boilers). The boilers were originally designed for liquid fuel combustion and later were converted for husk combustion.

At first (in 2005) management of "Pology OEP" considered the possibility of installation of new gas fired boilers instead of old fired boilers. After receiving information about JI projects, management of Pology OEP began thinking about the possibility to implement CHP plant utilizing the husk at the Enterprise. Though CHP equipment is much more expensive than gas fired boilers, the Enterprise will be able to sell ERUs to the credit buyer(s) and get additional finances for the project. That is why "Pology OEP" finally decided to reconstruct its energy supply system through realisation of JI project.

A.3. Project participants:

Name of Party involved (*) ((host) indicates a host Party)	Private and/or public entity(ies) project participants (*) (as possible)	Kindly indicate if the Party involved wishes to be considered as project participant (Yes/No)
Germany	RWE Power AG, Private Entity	No
Ukraine (Host)	JSC Pology Oil-Extraction Plant, Private Entity	No

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

Project applicant, developer is RWE Power AG. RWE Power AG 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 implemantaiton of Greenhouse Gas Reduction Projects according to the Article 6 of the Kyoto Protocol (Joint Implemantation) and Article 12 of the Kyoto Protocol (Clean Developmetn Mechanism).

The project operater is JSC Pology Oil-Extraction Plant an up-to-date high-technology enterprise with total cycle of the manufacturing: from preliminary preparation of the seeds for processing to final oil de-coloration with the help of the deodorization method and its pre-packaging into polymer containers. Products of Pology OEP, one of the biggest vegetable oil manufacturers in Europe, have entered markets of the countries of Commonwealth of Independent States. The products of above mentioned plant are able to meet competition in the world market.

A.4. Technical description of the project:

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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

Zaporozhye 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 countries.

Zaporozhye region has a developed transport system. The total length of roads is: railway - 1320 km, automobile - 7000 km (95.5% have hard cover). There are 1093 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 - Zaporozhye. The major regional industrial centers have railway links with other parts of Ukraine, CIS and European countries.

Zaporozhye 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 aluminum 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 designing institutes which are entirely capable to render the definite assistance in the realization of the innovation development state policy.

Zaporozhye region is one of the largest manufacturers of agricultural products and food stuff in Ukraine. The regional area of agricultural lands is 2248.3 thousand hectares, or 5.4% of the total Ukrainian agricultural area. The main crop of Zaporozhye 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 limited "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 labeled 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.

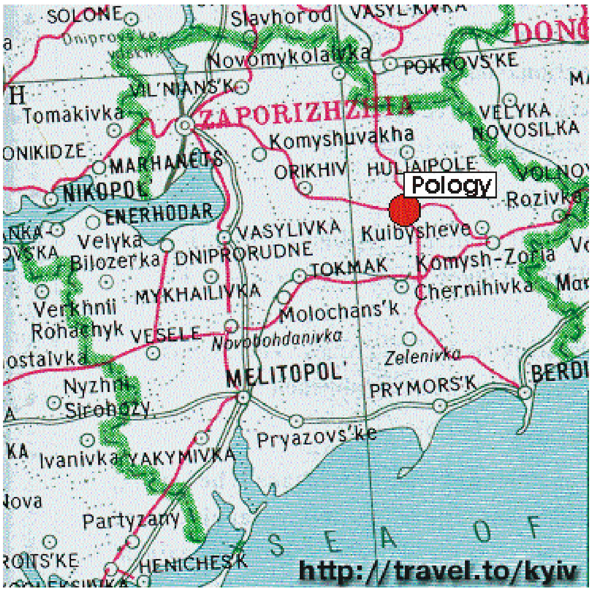
A.4.1.3. City/Town/Community etc.:

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.

“Pology OEP” is located on the land plot of 22 hectares at the South-East part of Pology city. It owns the developed infrastructure: main building, auxiliary building, cakes elevator, processed seeds elevator, extraction and refining shop. The geographic coordinates are 36,3 ° East and 47,5 ° North.

Figure: Town of Pology



IIn correspondence with the designation, the following subdivisions form the plant, namely:

- 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 of 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 namely: steam-power area, electro-area, railway shop, water supply and water purification, mechanical-repair department and industrial sewage treatment.

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

2004		**2005**		**2006**	
Overall	Related to project	Overall	Overal	Related to project	Related to project
1,009	127	1,025	1,022	134	125

In the table the permanent staff of “Pology OEP” is presented. For performing of design, construction works, installation works, insulation works, lining works the specialized companies possessing corresponding licenses and 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 Kievan 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.

Figure: Map of the 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 heat and power supply at Pology OEP. After the reconstruction heat and power supply at Pology OEP will be based mostly on combustion of biomass fuel – sunflower seed husk. Thus there will be very little consumption of fossil fuel (natural gas as a reserve fuel) and purchase the half of electricity from power grid and the half from power for own needs of CHP unit.
Presently the Enterprise has three old natural gas boilers (with consumption of mazut as additional fuel) and purchases electricity from power grid. All the boilers have exceeded their operational lifetime though they are in operating condition due to regular investments of the Enterprise into their repairs and modernisation.

Within the project boundaries one old natural gas boilers will be dismantled and sold as scrap. Two new boilers (NH1, NH2) for combustion of sunflower husk will be installed at the Enterprise. The boilers (NH1, NH2) will be operational and consume sunflower seed husk than it was before the extension of the Enterprise and reconstruction of its energy supply system. The two operational boilers (NH1 and NH2) are designed only for combustion of sunflower seeds husk. Two of the old natural gas boiler with fuel natural gas (NG2 and NG4) is only reserve fuel 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).

Two operational boilers produce 40 t steam/hr. All amount of steam (direct steam) goes to the turbine for power production.
Annual amount of heat produced is 198.590 Gcal/a. CHP plant produces annually 10.500 MWh of electricity, this is the electricity amount of 50% from the plant.

Company responsible for the CHP plant construction project as a whole is the Project. The Institute has to select standard equipment for CHP plant. As there are no standard husk fired boilers in Ukraine, special design organisation is also involved in the project design and implementation. Company responsible for designing of husk fired boilers is Special Project-Design and Technology Bureau “ZAO NPP, Ekoenergomash”, Bijsk. The Bureau has a license for such kind of work and good experience in this field. Manufacturers of the equipment are expected to be:

- husk fired boilers – ZAO NPP “Ekoenergomash” (Ukraine);
- turbo-units – 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”. After the end of warranty period of manufacturers of the equipment (as usual 1-2 years), Pology OEP itself is responsible for maintenance/repairs of the equipment. Maintenance (minor repair) is performed by specialists of the Enterprise. To perform more serious repair (for example replacement of damaged pipes) the Enterprise draws up contracts with authorised repairs organisation - 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 Annex 3.1.4

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

The Project have three missions:

- The first is the reduction of natural gas consumption comparing to baseline scenarion due to using of CO2 neutral fuel (sunflower seeds husk) to cover the heat demands of the enterprise.
- The second is the reduction of fossil fuels combustion at the grid-connected power plants, due to partly covering of Enterprise power demand of ca. 50% by the operation of new CHP plant..
- The third mission is to stop of the sunflower seeds dumping at the landfill and thus the avoidance of methane emissions due to anaerobic decomposition of the husk.

As a result of the project first stage implementation (one sunflower seeds husk steam boiler) in 2007 the CO2 emissions due to natural gas consumption and husk anaerobic decomposition will be reduced. After the implementation of the second project stage (second husk steam boilers and the turbine installation) the CO2 emission reduction from the above mentioned sources will be increased, and also the emission reduction due to decreasing of the grid electricity consumption will have place.

Without the project the heat (steam for the technological needs) demand of the Enterprise would be covered by the steam produced at the gas fired steam boiler(s). These boiler(s) would be installed instead of existing outdated boilers which use natural gas (one of the boiler use sunflower seeds husk) and heavy oil (mazut) as a fuel. In such case all the husk produced at the Enterprise would be delivered to the landfill, dumped there and decomposed in anaerobic conditions causing the considerable methane emissions into the atmosphere. 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 fuels combustion at the gridconnected power plants. After the new CHP plant is put into 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. New CHP plant will also cover partly its own electricity demand.

The CO_2 emission reduction after the proposed project implementation will mainly have place as the CO_2 emissions from husk burning are climatically neutral and therefore are considered to be zero. N_2O emission from burning of sunflower seeds husk at the boilers is not included into account as it is negligibly small compared to CO_2 emissions (see also Table 3, p.21, ACM0006) At the same time the project participants decided to include the $_{CH4}$ emissions from the husk burning into calculations according to the ACM006 Version 06 and the fact that the methane emissions reduction due to avoidance of sunflower seeds husk decomposition is included into the project boundaries.

Without the project, the specified above reduction of GHG emissions would not be achieved, since the Enterprise would be used new gas-fired boiler(s) to cover its heat demand and continued to purchase all the required electricity from the grid. The reasons why in the absence of proposed project the gas fired boilers would have been installed to cover the heat demands of the Enterprise are as follows:

- It is hardly believable that technical conditions of the old natural gas boilers would allow theirs reliable operation during the next 5-10 years, as theirs operational lifetime is in the range of 30-40 years.
- When the decision about the reconstruction was being adopted (during 2006) the natural gas price was about two times lower (75 €/1,000 m^3) then it is in the moment (152 €/1,000 m^3) . The gas fired steam boilers are the most developed technology for steam generation in the region and at the same time is the less costly one. Thus the investing in natural gas fired boilers installation was the less risky and most profitable option for the project owners in 2006. In other words installation of natural gas fired boiler(s) would prevent the risky and considerable investments into the new technology.
- No restriction on the GHG emissions are set up or expected for Ukrainian-based enterprises in the nearest future (at least until 2012).
- All the required permissions for husk land filling are available. It is unlikely that local authorities prohibit the organic wastes land filling (as it was done in EU) in the nearest future. So there are no any obstacles which the Enterprise may face while delivering the husk to the landfill. Without the proposed project it would have been possible to avoid the risks related to the absence of the experience

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

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The ex ante emissions reductions are estimated to be 277.376 tonnes CO 2 – equivalent for commitment period 2008-2012 or approximately 55.475,2 tonnes CO 2 – equivalent annually. Note that actual emissions reductions will be based on monitored data and may differ from this estimate.

Table: Summary Emission Reduction 2007-2013

Years (First Crediting Period)	**Annual estimation of emission reductions in tonnes of CO2 e**
2007	-
2008	46.224
2009	50.585,5
2010	55.205,2
2011	60.094,8
2012	65.266,5
2013	-
Total estimated reductions	277.376

(tonnes of CO_2 e)	
Total number of crediting years	5 (10)
Annual average over the crediting period of estimated reductions (tonnes of CO_2 e)	-

A.5. Project approval by the Parties involved:

The project has received the Letter of no Objection (Letter of Endorsement Ministry of Environmental Protection of Ukraine- on 16 October 2006 (see Annex 2).
The 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) and

The baseline scenario stipulates the installation of new gas-fired steam boiler(s) instead of the existing outdated boilers which use the natural gas and the heavy oil as the fuels. In such case the heat demand of the Enterprise is covered by the combustion of natural gas at the new boiler(s), the power required for the new gas boiler(s) operation and to cover the Enterprise own technological needs is purchased from the outside national power grid, and the sunflower seeds husk is dumped at the landfill.

Referencing of the approved baseline and monitoring methodology.
Justification of the baseline chosen is performed according to the "Consolidated methodology for electricity generation from biomass residues" (hereinafter ACM0006, Version 06).
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.
"Tool for demonstration and assessment of additionality, Version 04, EB36.
"Tool to determine methane emissions avoided from dumping waste at a solid waste disposal site", Version 02, EB35.
"Tool to calculate project emissions from electricity consumption", Version 1 EB 32.

CO2 emission factor for grid electricity was taken from PDD version 4.0, dated 2 February 2007 "Utilization of Coal Mine Methane at the Coal Mine named after A.F. Zasydko" developed by Global Carbon B.V. (Annex 2, chapter "Standardized emission factors for Ukrainian electricity grid)
Link:http://ji.unfccc.int/JI_Projects/DB/DA22OPURGI092XUFLIK0INB5GIYEGA/PublicPDD/GT00RJXHY4VGS7ZS16MCKJ28CMMRH2/view.html

Justification of the choice of methodology and why it is applicable to the project. As it is mentioned in the hereinafter ACM0006, Version 06, it is applicable to grid-connected and biomass residue fired electricity generation project activities, including the cogeneration plants. The term "grid-connected" does not necessarily mean that plant must be connected to the grid and deliver electricity to the grid, but mean also that the plant generates power for the site own needs in such way reducing or avoiding electricity consumption from the grid. Among the possible project activities that may be considered under the hereinafter ACM0006, Version 06, it here is one that exactly fits to the proposed project:

The installation of a new biomass residue fired power generation plant at a site where currently no power generation occurs (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.3)	Does the project activity meet the applicability requirement (Yes) or not (No)
No other biomass types than biomass residues, as defined above, 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	Yes. The project implementation itself was caused by the planed increasing of output of the Oil-Edible

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;	Plant, but not vice versa. Moreover process of treatment of sunflower seeds and generation of sunflower husk are beyond the project boundaries. New boilers are installed to utilise all biomass residues from technological process. Otherwise some amount of husk will be dumped at the landfill. So it can be clearly define 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 then 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). Even no transportation neither mechanical treatment will have place. Sunflower seeds husk is produced directly at the site and do not require any prior treatment before the 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 "Tool for the determination and assessment of additionality" (Link: http://cdm.unfccc.int/Reference/tools/index.html) to assess which of identified alternatives should be excluded from the further consideration.

For the power generation the project participants identified and selected the next most realistic and credible alternatives:

- (P1) The proposed project activity not undertaken as JI project (installation of 1,4 MW_{el} turbine generating power using the steam produced in the husk fired steam boilers).
- (P3) The generation of power in an existing captive (or newly constructed) plant using only fossil fuels (installation of 1,4 MW_{el} turbine generating power using the steam produced in the gas-fired steam boilers).
- (P4) The generation of power in existing and/or new grid-connected power plants (in other words - the purchasing electricity from the grid "continuation of existing situation").

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

- (H1) The proposed project activity not undertaken as JI project (installation of two husk-fired boilers of 40 t/h of total steam output).
- (H3) The generation of heat in an existing (or newly constructed) cogeneration plant using only fossil fuels (installation of gas fired boiler(s) of 40 t/h total steam output and the turbine for power production).
- (H4) The generation of heat in boilers using the same type of fossil fuel ("continuation of existing situation", when all heat demands of the Enterprise are covered through the gas combustion in the outdated boilers).
- (H6) The generation of heat in boilers using fossil fuels (installation the natural gas fired boilers to cover all heat demands of the Enterprise).
- (H7) The use of heat from external sources (purchasing heat from the local District Heating Utility).

For the use of biomass residues (sunflower seeds husk) the following alternatives are considered to be the most realistic and credible:

- (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 of 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-piled2 or left to decay on fields.
- (B3) The sunflower seeds husk is 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, B6) The sunflower seeds husk is sold in order to be utilized for power and/or heat generation at other plants.
- (B7) The sunflower seeds husk is used for heat generation in other existing or new boilers at other sites.

The construction and assembly works, in the project, are partly completed (one of the husk boilers is in operation already). The possibility of realization of the proposed project with JI component was being considering by the project owner during 2006, thus the assessment of identified alternatives in this PDD is made taking into account the market and policy conditions of 2006.

Formation of the "combined alternatives" from the separate alternatives presented above

As the OEP first of all require the heat (steam of specified parameters) for technological needs, and at the same time taking into account that the consumption of electricity at the OEP is relatively lower comparing to heat consumption it is reasonable to start the assessing the alternatives from determination of "how the heat would be generated in the absence of proposed project activity".

(H1) - The proposed project activity not undertaken as JI stipulates the construction of 1,4 MW_{el}+ 22 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. So we have the combined alternative (A1) = (H1) + (P1) + (B4).

(H3) - The heat generation in newly constructed gas fired CHP plant of the same as in (A1) capacity at the project site. This alternative can be combined with the (P3) and with all the alternatives for husk use except of (B4). So the combined alternative is (A2) = (H3) + (P3) + (B1…B7, except B4).

(H4) - Generation of heat in the outdated boilers from husk (continuation of existing situation). In such case the electricity would be continued to be purchased from the power grid (that corresponds to alternative P4). As for the husk use the only alternative that can be applied here is the B4. So we have the combined alternative (A3) = (H4) + (P4) + (B4).

(H6) - Generation of heat in the steam boilers using only natural gas. In such case the electricity would be continued to be purchased from the power grid (that corresponds to alternative P4). As for the husk use any alternative except the B4 can be applied here. So we have the combined alternative is A4 = (H6) + (P4) + (B1…B7, except B4).

(H7) - The purchasing required heat from the district heating system. In such case it is not feasible to install new gas-fired or husk fired installation for power production on-site or nearby. So only the alternative for power generation is the purchasing power from the grid (alternative P4). As both power and heat are purchased from the external sources, the husk use alternative could be any except B4. So the last "combined alternative" is A5 = (H7) + (P4) ,+ (B1…B7, except B4).

The justification of chosen baseline is presented in the Sub-Chapter B.2.

As it mentioned above the baseline scenario is the "combined alternative" A4. So according to the ACM0006 and chosen baseline the project activity involves the installation of a new husk fired CHP plant at a site where no power was generated prior to the implementation of the project activity. The power generated by the project plant would in the absence of the proposed project be purchased from the grid. The sunflower seeds husk would in the absence of the project be dumped under clearly anaerobic conditions (see also B.2). The heat would in the absence of the proposed project be generated in newly installed or existing natural gas fired steam boilers.

The key factors determining GHG emissions both in the baseline and in the project scenario have been singled out. These factors are as follows:

- Volume of sunflower seeds husk generated at the OEP.
- Power consumption (including for the boiler(s) own needs).
- Heat consumption by the OEP.
- Amount of fossil fuels combusted.
- Amount of sunflower seeds husk combusted.
- Amount of sunflower seeds husk dumped.

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 development plan, the Enterprise increases its production capacity between 320.000 t of sunflower seeds per year.
In the baseline scenario (without JI project) the old boilers are put out of operation, dismantled and sold as scrap. New operational gas-fired boiler installed to meet thermal energy requirements of the technological process at the Enterprise. Required amount of electric energy for own needs of boiler house and Enterprise (20.000 MWh/yr) is purchased from power grid. All generated sunflower seeds husk is disposed of at the landfill. Natural gas is widely used in Ukraine for energy production.

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, in baseline scenario, if the project scenario will not occur, we would have following situation:

1. For power generation the most realistic and credible alternative is: P4 - The generation of power in existing or at new grid-connected power plants.
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).
3. For biomass residue the most realistic alternative is B1 - The biomass residue are dumped or left to decay under clearly anaerobic conditions at the landfill (because there is no market of biomass residue in Ukraine).

Gas fired boilers are rather cheap and easy in operation and maintenance.

In baseline scenario there are four 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 – 30.318,9 tons of CO_2e per year.
2. Emission due to husk decay at the landfill – on average 17.243,9 tons of CO_2e per year.
3. Emission due to purchase of power from grid for own needs of gas boiler house during the period of sunflower seeds processing by the Enterprise – on average 18.816,0 tons of CO_2e per year.
4. CO2 emission due to purchase of power from grid during capital repairs of operational and the whole Enterprise (about 1 month per year) - on average 300 tons of CO_2e per year.

Annual baseline emission approximate 66.678,8 tons of CO_2e per year
Total baseline scenario emission for the period 2008-2012 is estimated at 331.894,1 tons of CO_2e.

In the project scenario all three old fired boilers will be replaced by two new husk boilers. They will consume almost twice as much sunflower seed husks as it was before the reconstruction and extension of production capacity of the Enterprise. Also a turbine will be installed for CHP production purposes. The biomass residue (sunflower seeds husk) is a main fuel for all two operational boilers. Two old boilers are as a reserve fuel in case of unforeseen situation at the Enterprise (e.g. unexpected absence or lack of sunflower seed husk for the period more than 12 hours). The following analysis shows why the emissions in the baseline scenario would likely exceed the emissions in project scenario. First, for heat needs in baseline scenario a natural gas is used, power is delivered from the grid and in project scenario needs of ca. 50% power and all heat are covered by new CHP plant using biomass residue as a fuel. Also in baseline scenario the biomass residues are dumped under anaerobic conditions at landfill, what leads to CH_4 emissions.

Reduction of CO_2e by JI project in comparison with baseline scenario.

1. Total replacement of natural gas combustion by biomass (sunflower seeds husk) combustion.
2. Satisfaction of ca. 50% own needs in electricity of CHP unit by power produced by CHP unit.
3. No sunflower seed husk will be disposed of at the landfill. The capacity of two boilers is enough to ensure that the all produced sunflower seed husk will be burnt.

Project additionality
Application of additionality test to the project
The baseline methodology indicates “The additionality of the project activity shall be demonstrated and assessed using the Version 4 of the “Tool for the demonstration and assessment of additionality” agreed by the Executive Board.

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

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

The identification of the most realistic and credible alternatives for power generation, heat generation, and sunflower husk use is presented in the section B.1 and the formation of “combined alternatives” is presented there as well. Below the short description of the alternatives is presented.

Alternative A1
In the Alternative A1 the old outdated gas fired steam boilers are put out of operation and dismantled. instead of them new CHP plant using the sunflower seeds husk is constructed. The CHP plant capacity is 1,4 MW_{el}+22 MW_{th}. See also section A.2 as the Alternative A1 represents the proposed project activity not undertaken as JI. CHP plant covers all heat demand of the Enterprise, 50% own CHP plant electricity own needs, while the surplus produced electricity partly covers the Enterprise electricity demand and thus reducing the consumption of electricity from the grid. All amount of husk generated is utilized by the CHP plant.

Alternative A2
In the alternative A2 the old outdated gas fired boilers are substituted by the CHP plant using the natural gas as a fuel. The capacity of new CHP plant and the concept of its operation is the same as presented in the Alternative A1. All amount of husk generated at the Enterprise would be dumped at the landfill under the anaerobic conditions (See also Justification of “What would happened with the generated sunflower seeds husk if it was not combusted in the CHP plant).

Alternative A3
Alternative A3 represents the continuation of existing situation when the heat required by the Enterprise is produced in the outdated gas fired boilers, while the required power (for gas boilers own needs and the Enterprise own needs) is purchased from the grid. The husk generated at the Enterprise is dumped at the landfill.

Alternative A4

In the Alternative 4 the old outdated gas fired steam boilers are put out of operation and dismantled and instead of them new operational gas-fired steam are installed to meet thermal energy requirements of the technological process at the Enterprise. Required amount of electricity for own needs of boiler house (20.000 MWh/yr) and the electricity for the own needs of the whole Enterprise are purchased from the power grid owned by local energy utility company. All amount of husk generated at the Enterprise would be dumped at the landfill under the anaerobic conditions (See also Justification of "What would happened with the generated sunflower seeds husk if it was not combusted in the CHP plant.

Alternative A5
Stipulates that both heat energy and electricity are purchased by the Enterprise from the external sources. Electricity is to be purchased from the power grid owned by local energy utility company while the heat is from the district heating system operated by the local utility company. But first of all it is necessary to determine what would happen with the generated sunflower seeds husk if it was not combusted at the CHP. According to the ACM0006 the following alternatives of waste husk use should be considered: (B1) the husk is dumped under mainly aerobic conditions; (B2) the husk is dumped under clearly anaerobic conditions; (B3) the husk is burnt in uncontrolled manner without utilizing it for energy purposes; (B4, B6) the husk is sold in order to be utilized for heat and/or electricity production at the other sites; (B7) the husk is used for pellets production.

Consistency of husk use alternatives with mandatory laws and regulations:

The alternatives (B1) and (B3) do not meet the Ukrainian regulation standards regarding the waste management. It is prohibited in Ukraine to burn the waste in uncontrolled manner and to leave the wastes husk and dumping of husk under aerobic conditions are excluded from the further consideration. The other alternatives meet Ukrainian standards. The husk is allowed to be dumped at the landfills (there is no special regulations that prohibit the landfilling of organic waste, like in EU). According to information obtained from the management of Pology landfill, the landfill is not going to be closed till 2012. Also the sunflower seeds husk can be sold as a fuel to other operators or used as a raw material for pellets production.

Barrier analysis for the husk use alternatives

There are no any barriers regarding the landfilling of the husk at the local landfill.
Selling the surplus husk faces the following barriers: (1) 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. So they definitely would not purchase or transport the husk from the Pology OEP in order to combust it in their heat generating installations. From other hand there is a very low level of awareness among the district heating operators about the possibility to use the husk as a by-product. Taking into account that the husk is very difficult fuel to be combusted, the utility operators would not invest in husk fired boiler-houses in the nearest future (at least till 2012). The problem is deepened due to nondeveloped 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 excluded from the further consideration as it would not overcome the next barriers: informative, technological (concerned 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 next barriers: nevertheless in Ukraine there are couples of enterprises that produce the pellets from the husk; there is still considerable lack of experience in this sector.

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

Alternative 1
This alternative is in compliance with all mandatory applicable legal regulatory requirements (at the moment all the permissions for project realization are obtained and the project is already partly completed - one husk fired boiler is installed. The Environmental Impact Assessment showed that the project can be realized.

Alternative 2
This alternative is in compliance with all mandatory applicable legal regulatory requirements. It should be admitted that the alternative 2 represents rather widespread approach which number of industrial Ukrainian enterprises have already realized at their sites. The natural gas is the most widespread and easy to utilize fuel in Ukraine. The power generating installations using the natural gas emit fewer pollutants into the atmosphere than any other technologies. The procedure of getting the permission for operation of gas fired CHP is rather simple and regulated by the law of Ukraine about the Cogeneration and utilizing the waste heat potential and by the Decrees of the National Electricity Regulatory Commission of Ukraine. As for Ukrainian legislation in the area of landfill management, the situation is the following. Presently there is a law (standard) that obliges landfills to collect methane and flare it or use for electricity generation. But this standard applies only to new landfills (which will be constructed in future) but does not properly work when applies to already constructed and managed landfills. At the moment there are no any operational methane collection system constructed at Ukrainian landfills first of all due to lack of investments and interest of the local state communal utilities that are the landfills operators. Before 2005, national standards on the operation of landfills did not envisage mandatory LFG control. In 2005, National Construction Standard DBN V.2.4-2-2005 Basics of Sites Design was introduced containing requirements on LFG collection and flaring/utilisation after the landfill closure. However, historically, the legal requirements on proper operation of landfills have not been enforced mainly due to financial barriers. Hence non-compliance with those requirements is widespread in the Host country. Due to financial state and lack of technical knowledge, this is expected to continue. Presently, common practice shows that existing landfills in Ukraine do not capture and flare or utilise their landfill gas. So the examination of current practice in wastes and landfills management though all over the country of Ukraine shows that obligations to construct the methane collection systems at the landfills are systematically not enforced (actually are not enforced at all yet) and thus the noncompliance with this requirement is widespread in the country (see step3 and step 4, PDD “Landfill methane capture and flaring at Yalta and Alushta landfills, Ukraine” Document version number: 03, June 2007).

Alternative 3
This alternative represents the continuation of existing situation when the gas is combusted in the outdated boilers and power is purchased from the outside grid. The purchase of electricity from the grid is in compliance with all regulatory requirements. Any Enterprise can buy the grid electricity if it satisfies the number of requirements set by the local power distributing company. Although the existing outdated gas fired boilers has already considerably exceeded their operational life-time, the situation when such outdated equipment is used is very widespread in Ukraine. At the moment the operating of this equipment is in compliance with regulatory standards of Ukraine.

Alternative 4
This alternative is in compliance with all regulatory standards. The installation of gas-fired steam boilers and purchasing the electricity from the power grid is a common practice in Ukraine.

Alternative 5
This alternative is in compliance with all regulatory standards. The situation when the industrial entity purchases both heat and power from the local district heating utility and power distributing company is very widespread in Ukraine.

Step 3 Barrier analysis to eliminate alternatives to the project activity that face prohibitive barriers

It was decided to conduct firstly the barrier analysis prior the investment analysis as it does not contradict to the Version 04 of the “Tool for the demonstration and assessment of additionality” and is suggested by the Approved baseline and monitoring methodology AM0036 “Fuel switch from fossil fuels to biomass residues in boilers for heat generation” (p.8). The next list of barriers that would prevent alternatives scenarios was established and presented below.

Legal-administrative barriers

- Relatively low charge for placement of sunflower seeds husk on the landfill - 4€/1,000kg (this price is taken from management of Pology OEP).
- Imperfection of state tariff policy for both heat and power.

- Ukrainian State Inspection on Energy Conservation and Boiler Inspection Body might reinforce their activities regarding outdated equipment which had considerably exceeded theirs operational life-time.
- There are no restrictions on GHG emissions for enterprises in Ukraine, and no such restrictions are expected to be introduced in the nearest future.

Technological barriers

- Absence of experience of operating facilities for power generation at the enterprise.
- Absence of experience in superheated steam supplying by the local district heating utility.

Financial barriers

- High cost of sunflower fired steam boilers which require special design and operational modes.
- The project implementation requires rather risky financial investments which include both the Enterprise equity and loans.

Relatively low charges of waste placement on the landfills in Ukraine do not prevent the realization of the alternatives 2, 4, and 5. This barrier slightly influences on alternatives 1 and 3 and could influence on project owner decision in the absence of the proposed project. But this barrier cannot be considered as those that would prevent any alternative from its realization.
Imperfection of state tariff policy for both heat and power would not prevent the alternatives 1 and 2 (as in these alternatives both heat and power are expected to be generated on-site), neither the alternatives 3 and 4 (as the Enterprise already gained the experience in purchasing electricity from the grid). This barrier would prevent the realization alternative 5. The supply of steam of specific parameters is essential for the Enterprise operation. During the last time in Ukraine has been occurred great number of disputes regarding the heat supply tariffs. The reason is that heat supply tariffs are the matter of decision of the local municipalities. There were number of low-suits related to the “non-justified” tariffs set by the municipalities. Thus it may be concluded that Pology OEP would not rely on such unpredictable and unstable heat tariffs formation policy and would not start to purchase the heat from the local utility. So the alternative 5 should be eliminated from the further assessment.
Although existing old husk fired boilers are in rather good condition, they have exceeded their operational lifetime. There was a considerable risk that at any time their operation would might be prohibited by boiler inspection body or by the Regional (State) Inspection on Energy Conservation. Thus it was not reasonable for the project owner to base a new extension modernization investment project on old boilers even taking into account their present condition and consumption of portion of generated sunflower husk after extension of the Enterprise production capacity. This barrier was considered by the project owner(s) as the most significant and influenced on their decision to start reconstruction of energy generating facilities of the Enterprise. So it is obvious that this barrier would prevent the realization of alternative 3 and thus this alternative should be eliminated from the further assessment. At the same time this barrier would not influence or prevent the realization of the rest alternatives 1, 2, 4, and 5.
The absence of experience of operating facilities for power generation at the Enterprise would make it very difficult to properly operate the new installation. In such case the risk of unexpected stoppages and increasing of downtime is considerably raises. This may lead in turn to the additional expenses due to supplement power purchasing from the grid. So this barrier is considered significant and would prevent the realization of alternatives 1 and 2.
Absence of experience in superheated steam supplying by the local district heating utility would prevent the realization of alternative 5. Although the local district heating utility possesses the steam boilers, those boilers have not been exploited for the long time, and partly were reconstructed in order to work only in hot water mode. Moreover the heat supply pipes are out of date, so the heat leakages are significant. All above mentioned reasons prove that this barrier would definitely prevent the realization of alternative 5, and thus this alternative should be excluded from the further consideration.
The exploitation of outdated gas-fired boilers would lead to the increasing of risks of unexpected stoppages in steam production and thus would cause considerable losses to the Enterprise due to the stoppages of technological process. Moreover the exploitation of outdated gas fired boilers requires the frequent investments in order to maintain and repair it. So this barrier would prevent the realization of alternative 3.
So the barrier analysis shows that only alternative 4 does not face any listed above barriers and thus should be considered as a baseline scenario.

The barriers related to the alternative 1 (which represents the proposed project activity but not registered as JI) would either impossible or inexpedient to overcome under the normal circumstances. It only made sense to overcome the aforesaid barriers with potential possibility to participate in the Kyoto Protocol mechanism. Therefore the final decision on the project implementation was adopted taking into account a potential possibility to cover part of the costs and to offset risks through the sales the generated ERUs.
In 2006, OJSC "Pology started cooperation with a Buyer (ERUs potential buyer, which partly financed the development of the PDD and determination) and a consultant (consultant, that developed the PDD and facilitated the determination). But at the moment OJSC "Pology" consider the different companies as the potential buyers, and as the JISC JI PDD form is already in force and some technological aspects of the project were changed, the PDD was redrafted by the RWE Power AG.

Step 2 Investment analysis

Though above barrier analysis shows that only one alternative would not face the barriers, and thus should be considered as a baseline scenario, in order to prove project additionality the investment analysis was conducted and its results are presented below. For the investment analysis the alternatives 1 and 4 (which represents the proposed project activity not being registered as JI) were selected.

Sub-step 2a. Determine appropriate analysis method
Project participants decide to apply the investment comparison analysis (Option II). This project envisages obtaining revenue from the heat and power sales in addition to ERUs sales. Therefore, simple cost analysis (Option I) cannot be applied, this means that either investment comparison analysis (Option II) or benchmark analysis (Option III) should be conducted.

Sub-step 2b. – Option II. Apply investment comparison analysis

The following suitable financial indicators for the proposed activity not being registered as JI and for the Alternative 4 were calculated: Net present value of the project (NPV), internal rate of return of the project (IRR), simple and discounted pay-back periods (SPB, DPB). It should be admitted that calculations were made for the case of 2006 tariffs (when the decision on undertaking the proposed project as JI was being considered) and for the case of current (year 2008) tariffs. The results of the investment comparison analysis taking into account present tariffs are presented in the Table B.1 below:

Table B.1 - Investment comparison analysis for 2008 tariffs

	NPV lt. Rechnung, €	IRR, %	Simple payback period	Discounted payback period
Project scenario with ERU sales in 2008	907.039	17%	5,7	11,3
Project scenario not being registered as JI in 2008	-228.285	14%	6,8	>15
Baseline scenario in 2008	50.688	15%	6,5	>15

- NPV value is calculated for the period of 2007-2021years.
- Economical indexes made in the Excel tables attached to the Annex 3.2.

The results of investment comparison analysis for the conditions of 2005 are presented below in the Table B.2

Table B.2 - Investment comparison analysis for 2006 tariffs

	NPV lt. Rechnung, €	IRR, %	Simple payback period	Discounted payback period
Project scenario with ERU sales in 2006	755.424	12%	7,2	12,0
Project scenario not being registered as JI in 2006	-621.225	8%	8,6	>15
Baseline scenario in 2006	62.539	15%	6,6	>15

- NPV value is calculated for the period of 2005-2019 years
- Economical indexes made in the Excel tables attached to the Annex 3.2.

As it may be concluded from the table B.1, if current tariffs are applied, then the implementation of baseline scenario in comparison with proposed project not registered as JI is slightly attractive from the point of view of investors. Both simple and discounted payback periods for baseline scenario are lower than the same indexes for the proposed project without ERUs sales. But if the revenue from the ERUs sales is included into calculations, then proposed project becomes more attractive then baseline scenario.At the same time the Table B.2 shows that if 2006 tariffs are applied then the baseline scenario has very attractive economical indexes in contrast to the proposed project not being registered as JI. The application of JI mechanism improves the project economical indexes.So from the conducting of comparison investment analysis it is obvious that the proposed project activity not registered as JI cannot be considered as the most financially attractive.

Sub-step 2b – Option III. Benchmark analysis:

Benchmark analysis was chosen for this Sub-step. The most appropriate financial indicator for any investment project is internal rate of return (IRR). The IRR is a key indicator for project investor. It canbe influenced by perceived technical and/or political risks and by the cost of money. The IRR must exceed at least host country's discount rate in order for the project to be suitable (appropriate) for the investments. According to National Bank of Ukraine the discount rate for Ukraine is 10.0%. Taking into account political risks and rate of inflation in Ukraine, the value of discount rate used in calculations is 15%. Interest rate in Ukrainian commercial banks is 14-15% for hryvna deposits. Proposed project Without ERUs sales project has the IRR = 14. 0% that is lower than the IRR of baseline scenario IRR = 15%. With ERUs sales, the IRR of the proposed project reaches the value of IRR = 17%. The value of IRR = 14.0% looks not attractive for potential investors comparing with benchmark value 15%. The value of IRR = 17% for proposed project with ERUs sales is much more financially attractive for making decision to invest into the proposed project. Concerning NPV (period of calculation 2007-2021) for proposed project it is positive only if ERUs will be generated for sale and reaches the value 907.039 €. Without registering the proposed project as JI one and selling ERUs NPV is negative -228.285 €. In the baseline scenario NPV is positive 56.389 €, but considerably lower comparing with proposed JI project. Resuming all calculations it can be clearly define that without registering proposed project as JI one and getting possibility of ERUs sales, the project is not financially attractive and baseline scenario (installation of gas fired boilers) would be implemented.

Step 3.Barrier analysis

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

a) Legal-administrative barriers

- Absence of legislation on biomass residues utilization in Ukraine;
- Relatively low charge for placement of biomass residues on landfills;
- Absence of the system of state control over formation and utilization of biomass residues;
- Imperfection of the state tariff policy for heat and power;
- 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;

b) Investment barriers

- High cost of imported equipment with delivery costs and custom duties taken into account;
- Absence of adequate sources of project funding available for the Enterprise;
- The project implementation required rather risky financial investments which included both the Enterprise equity and loans.
- Credit rating for Ukraine is BB-, (Information from Standard and Poors: May 2008)

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

c) Technological barriers

- Absence of experience of operating facilities for power generation at the enterprise;
- Project activity is the "first of its kind"- for the first time in Ukraine the project activity envisages development, construction and putting into operation CHP plant on solid biomass.

These barriers would be either impossible or inexpedient to overcome under the normal circumstances. It only made sense to overcome the aforesaid barriers with potential possibility to participate in the Kyoto Protocol mechanisms. Therefore, the decision on the project implementation was largely made with taking into account a potential possibility to cover part of the costs and to offset risks through sales of the achieved ERUs.

Step 4. Common practice analysis

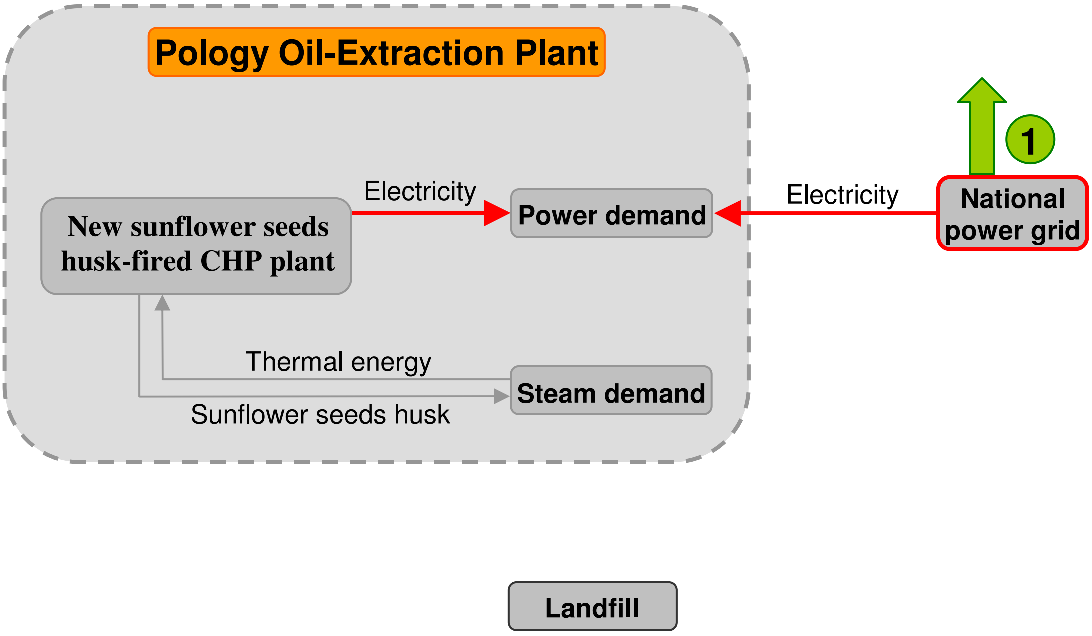
There is no serial production of husk fired boilers in Ukraine. Each boiler is specially designed and manufactured for certain enterprise. Because of that fact the construction and production of the husk fired boilers are considerably expensive in comparison with gas fired boilers, which are produced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

For the first time 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 the first CHP plant in Ukraine on 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 has higher risks in comparison with 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 showings. Taking into account all facts mentioned above proposed project is additional.

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

The proposed JI project boundary include operation of new equipment for heat and power production at the Enterprise (two husk fired boilers and turbo-generator unit - combined heat and power plant) – from fuel supply to the boilers to steam and power exit from the equipment. The only fuel for CHP plant is husk. Natural gas is used only as reserve fuel 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 process of treatment of sunflower seeds and generation of sunflower husk as well as process of consumption of energy by the Enterprise are beyond the project boundaries. The project envisages that power generated by CHP plant will be mainly used for own needs of CHP plant, while the surplus will partly cover the Enterprise demands. Graphically the project boundary is presented on the figure below.

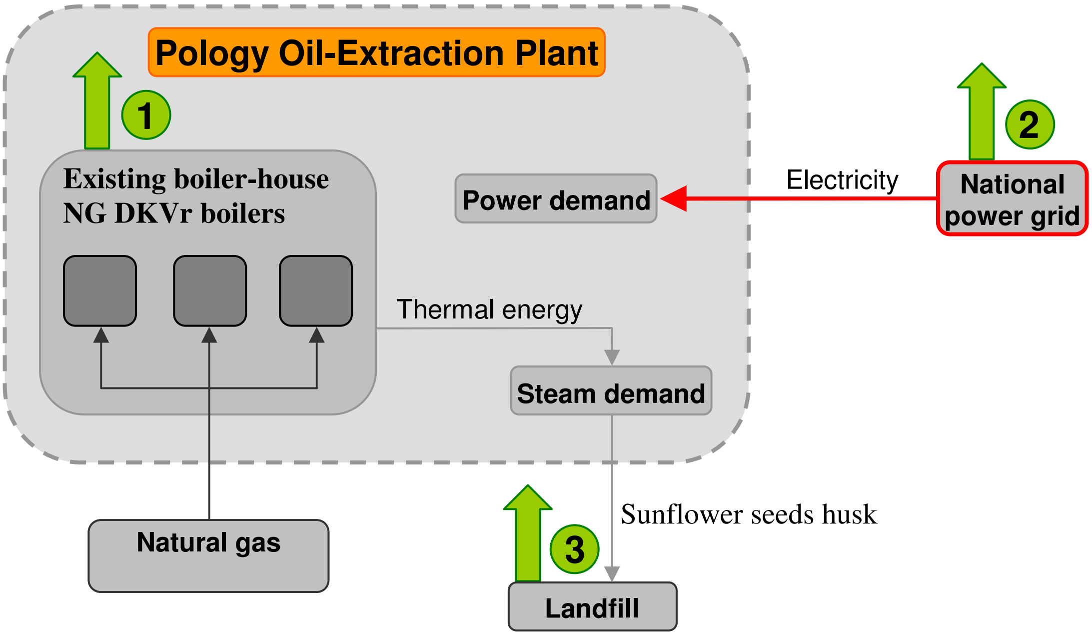
Figure 3. Graphical representation of the JI project boundary.



Detailed description of equipment to be installed within the project boundaries is presented in Annex 3.1.4 "Technical description of the project".

Such elements as landfill site, power grid and connection to natural gas supply are closely connected with the project but are not included directly in its boundary. These elements allow to connect the project scenario with baseline scenario and to compare them. In baseline scenario all generated husk is disposed of at the landfill; three gas fired boiler provide steam to the Enterprise; electricity for own needs of boiler house is purchased from power grid of local energy utility company. In the project scenario steam supply for technology purposes is based on husk combustion (two husk fired boilers); no husk is disposed of at the landfill; CHP plant totally provides itself by electricity for own needs; during 1-month period of annual capital repairs of all husk fired boilers and other equipment of the Enterprise (no generation of husk during that period) the electricity for needs of Enterprise is purchased from the grid. Baseline scenario boundary includes operation of new boiler house at the Enterprise (two gas fired operational boiler) – from fuel supply of the boilers to steam exit from the equipment. The only fuel is natural gas. In the boundary because all generated amount of sunflower seeds husk is disposed of at the landfill. The process of treatment of sunflower seeds and generation of sunflower husk are beyond the baseline scenario boundaries. The baseline scenario considers only power consumption for own needs of gas boiler house. Graphically the baseline scenario boundary is presented on the figure below.

Figure 4. Graphical representation of the baseline scenario boundary.



Such elements as power grid and connection to natural gas supply are closely connected with the baseline scenario but are not included directly in its boundary. These elements allow to connect the project scenario with baseline scenario and to compare them.

Emissions of CO_2e are broken into four items in the baseline scenario:

1. Emission due to natural gas combustion by operational gas fired boiler(s) during the period of sunflower seeds processing by the Enterprise.
2. Emission due to husk decay at the landfill.
3. Emission due to purchase of power from grid for own needs of gas boiler house during the period of sunflower seeds processing by the Enterprise.
4. CO_2 emission due to purchase of power from grid for reserve gas fired boiler during capital repairs of the whole Enterprise (about 1 month per year).

Total baseline scenario emission for the period 2008-2012 is estimated at **331.894,1** tons of CO_2e.
Reduction of CO_2e by JI project in comparison with baseline scenario.

1. Total replacement of natural gas combustion by biomass (sunflower husk) combustion.
2. Satisfaction of ca. 50%own needs in electricity of CHP unit by power produced by CHP unit.
3. No sunflower seed husk will be disposed of at the landfill. All amount of husk generated will be burned at two husk fired boilers.
4. As surplus electricity generated by new CHP plant will partly cover Enterprise power demand the CO_2 emissions reduction will occur.

Total reduction of CO_2e emission by JI project during 2008-2012 is **277.376** tons of CO_2e.

Such processes as treatment of sunflower seeds and generation of sunflower husk are beyond the project boundaries. Consequently emissions connected with these processes are also beyond the project boundary. When calculating financial showings of the CHP plant, the plant is considered as a subsidiary of Pology OEP that is as a separate object, which sales heat energy to the Enterprise. This approach is in line with selected project boundary.

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

RWE Power Aktiengesellschaft, Climate Protection
Contact Person: Tolga Acar
Rellinghauser Str. 37, 45128 Essen
T extern:+49 201 - 12 20223
email: tolga.acar@rwe.com

SECTION C. Duration of the project / crediting period

C.1. Starting date of the project:

C.2. Expected operational lifetime of the project:

20 years 0 months.

C.3. Length of the crediting period:

5 years, 2008-2012.

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, 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 06).
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. $FF_{project\ site,\ i,\ y}$	Quantity of natural gas consumed by reserve gas fired burners at the operating husk fired boiler in the case of unforeseen or unexpected situation	Gas flow meter. On-site measurements	m^3/a	m	Continuously	100%	Electronic and paper form	Accuracy of gas flow meter is 1%; once a year gas flow meter is certified by state authorized laboratory
2.$EC_{PJ,\ y}$	Quantity of power consumed by	Power meter On-site measurements	kWh	m	Continuously	100%	Electronic and paper form	Accuracy of electricity meter is 1%; once a

	husk boiler with reserve gas fired burners from power grid							year electricity meter is certified by state authorized laboratory
3. $EC_{PJ, HP\_needs, y}$	On-site electricity consumption for the new sunflower seeds husk fired CHP plant own needs in the year y	Power meter On-site measurements	kWh	m	Continuously	100%	Electronic and paper form	Accuracy of electricity meter is 1%; once a year electricity meter is certified by state authorized laboratory
4. T	Temperature of the consumed natural gas	Temperature gauge	^{o}C	m	Continuously	100%	Electronic and paper form	Temperature of the consumed natural gas will be measured to determine the density of consumed natural gas
5. P	Pressure of the consumed natural gas	Pressure gauge	Pa	m	Continuously	100%	Electronic and paper form	Pressure of consumed natural gas will be measured to determine the density of consumed natural gas
6.D_{NG}	Density of natural gas	Department of head energy engineer	tn,g/m^3	c	Weekly	100%	Electronic and paper form	Data will be used to calculate the mass flow rate of methan

7 $BF_{k, v, wet}$	Quantity of biomass residue type *k* combusted in the project plant during the year *y*	Weight meter	Tons of wet matter	m	Continuously, prepare annually an energy balance	100%	Electronic and paper form	Data will be used to calculate BF k,v
8. $BF_{k, v}$	Quantity of biomass residue type *k* combusted in the project plant during the year *y*	Department of head energy engineer	Tons of dry matter	c	Weekly	100%	Electronic and paper form	
9. W	Moisture content of the biomass residues	Heat engineering laboratory of Pology OEP	% Water unit	m	Weekly	100%	Electronic and paper form	The average value is determined at the end of the year Data will be used to calculate BF k,v
10.$EF_{CH4, BF}$	CH4 emission factor for the combustion of biomass residues in the project plant	Default values -	tCH_4/GJ	-	Quarterly	100%	Electronic and paper form	Use default value as provided in Table 4 ACM0006
11. $EG_{project\ plant,\ y}$	Net 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
12. $Q_{project\ plant,\ y}$	Net quantity of heat generated from firing	Department of head energy engineer	GJ	m, (c)	Continuously	100%	Electronic and paper form	Heat meter readings. In case if any heat

	biomass in the project plant							meter is installed then steam flow, steam temperature and pressure must be measured to calculate net quantity of heat generated.
14. NCV_{NG}	Net calorific value of the natural gas	Accurate and reliable local or national data	GJ/m^3	-	Review the appropriateness of the data annually	100%	Electronic and paper form	Default local/national net calorific values (countryspecific
15. NCV_{BR}	Net calorific value of biomass residue type	Heat engineering laboratory of Pology OEP	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
16. $EF_{grid, y}$	CO2 emission factor for grid electricity during the year *y*	PDD version 4.0, dated 2 February 2007 “Utilisation of Coal Mine named after A.F. Zasydko Methane at the Coal Mine	tCO_2/MWh			100%	Electronic and paper form	
17.$EF_{CO2, FF, NG}$	CO2 emission factor for natural gas,	IPCC default emission factor	tCO_2/GJ	-	Review the appropriateness of the data	100%	Electronic and paper form	

	combusted in the reserve gas burners				annually			

Project emissions rise from three emission source:

- Emission source 1: Purchase of electricity from power grid for own needs during about 1-month period of annual capital repairs of all husk fired boilers and other equipment of the Enterprise (no generation of husk during that period).
- Emission source 2: Emissions from on-site natural gas consumption.
- Emission source 3: Methane emissions from biomass residue combustion.

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 CO_2 emissions from on-site consumption of natural gas (fossil fuel) due to the project activity ($PEFF_y$), CO_2 emissions from consumption of electricity ($PE_{EC,\ y}$) and CH_4 emissions from the combustion of biomass residues ($PE_{Biomass,\ CH4,\ y}$), as this source is included in the project boundary:

$$PE_y = PEFF_y + PE_{EC,\ y} + GWP_{CH4} * PE_{Biomass,\ CH4,\ y}$$

Where:
$PEFF_y$ = CO₂ emissions during the year *y* due to natural gas consumption at the project site for operation of gas-fired reserve boiler (tCO_2/yr);
$PE_{EC\ ,\ y}$ = CO_2 emissions during the year *y* due to electricity consumption at the project site for the own needs of the new CHP plant (tCO_2/yr);
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* (tCO_2/yr).

a) Carbon dioxide emissions from on-site consumption of fossil fuels (*$PEFF_y$*)

CO_2 emissions caused by the on-site fossil fuel consumption ((1) when unexpected or unforeseen situations with sunflower seeds husk delivering occur or (2) due to planned using of natural gas when starting the equipment operation) in the project scenario are calculated as follows:

$$PEFF_y = FF_{project\ site,\ y} * NCV_{NG} * EF_{CO2,\ FF}$$

Where:
$FF_{project\ site,\ y}$ = Quantity of natural gas combusted at the project site during the year y;
NCV_{NG} = Net calorific value of natural has (fossil fuel) combusted at the project site;

$EF_{CO2,\ FF}$ = CO_2 emission factor for natural gas combusted at the project site, tCO_2/GJ.

b) CO_2 emissions from electricity consumption ($PE_{EC,\ y}$)

CO_2 emissions from on-site electricity consumption ($PE_{EC,\ y}$) are caused by purchase of electricity from the National power grid during about 1 month term each year while the new CHP plant is stopped due to maintenance and repair works. According to the equation (6a) of ACM0006 version 04, the CO_2 emissions from on-site electricity consumption are calculated by multiplying the electricity consumption by an appropriate grid emission factor, as follows:

$$PE_{EC,\ y} = EC_{PJ,\ y} * EF_{grid,\ y}$$

Where:
$PE_{EC,\ y}$ = CO_2 emissions from on-site electricity consumption attributable to the project activity (tCO_2/yr);
$EC_{PJ,\ y}$ = On-site electricity consumption attributable to the project activity during the year y (MWh/yr);
$EF_{grid,\ y}$ = CO_2 emission factor for grid electricity during the year y (tCO_2/MWh).

This formula also corresponds to the requirements set in Methodological tool "Tool to calculate project emissions from electricity consumption", version 1 EB 32, equation (2).

c) Methane emissions from combustion of biomass residues ($PE_{Biomass,\ CH4,\ y}$)

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:

$$PE_{Biomass,\ CH4,\ y} = EFC_{H4,BF} * BF_y * NCV_{BR}$$

Where:
BF_y = Quantity of sunflower seeds husk (biomass residue) combusted in the new CHP plant during the year y (tons of dry matter);
NCV_{BR} = Net calorific value of the biomass residue (sunflower seeds husk) (GJ/ton of dry matter);
$EFC_{H4,BF}$ = CH_4 emission factor for the combustion of sunflower seeds husk in the new CHP plant (tCH_4/GJ).

The net calorific value of dry matter of sunflower seeds husk (in MJ/kg) is following:

$$NCV_{BR} = NCV_{wet,\ 10\%} = \frac{100}{100-W}$$

Where W = moisture content of sunflower seeds husk.

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
18. EG_y , (EG_y=$EG_{project\ plant}$)	Net quantity of increased electricity generation as a result of the project activity (increment of baseline generation) during the year y	Electricity meter.Department of head energy engineer	MWh/y	m	Continuously	100%	Electronic and paper form	Accuracy of electricity meter is 1%; Once a year electricity meter is certified by state authorised laboratory.
19. $EF_{electricity,\ y}$	CO2 emission factor for the electricity displaced due to the project activity during the year y	PDD version 4.0, dated 2 February 2007 “Utilisation of Coal Mine Methane at the Coal Mine named after A.F. Zasydko”	tCO_2/MWh -			100%	Electronic and paper form	
20 $BF_{k,\ v}$	Amount of sunflower husk consumed by husk fired boilers during the year y	On-site measurements. Department of head energy engineer	Tons of dry matter	m	Continuously	100%	Electronic and paper form	

22. ε_{boiler}	Energy efficiency of the boiler that would be used in the absence of the project activity	Technical manufacture 's information		-	Once at the project start	100%	Electronic and paper form	
23. $EF_{CO2, BL, heat, i}$	Emission factor of the fossil fuel (natural gas) used for heat generation in the absence of project activity	IPCC default emission factor	tCO_2/GJ	-	Review the appropriateness of the data annually	100%	Electronic and paper form	

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

Emission reduction 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 husk (biomass residues) 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 (tCO_2/yr);
v = 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 (tCO_2/MWh).

According to ACM0006, if the produced electricity at the new CHP plant 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 ($EG_y = EG_{project\ plant, y}$).

Emission reduction due to displacement of heat

In our 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:

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

Where:
As in our case (when the baseline scenario is that all heat generated by the cogeneration project plant would in the absence of the project activity be generated in fossil fuel fired boilers) $Q_y = Q_{project\_pl<nt, y}$, then:

$ER_{heat,y}$ = Emission reductions due to displacement of heat during the year y (tCO_2/yr);
Q_y = Quantity of increased heat generation in the project plant;
$Q_{project\_pl<nt, y}$ = Net quantity of heat generated in the cogeneration project plant from firing biomass residues during the year y (GJ);
ε_{boiler} = Energy efficiency of the boiler that would be used in the absence of the project activity;
$EF_{CO2, BL, heat, i}$ = CO_2 emission factor of the fossil fuel (natural gas) used for heat generation in the absence of project activity (tCO_2/GJ).

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 biomass residues ($BE_{Biomass, y}$) is determined in two steps:

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

According to ACM0006 and chosen scenario, the total quantity of biomass residues used in the project plant is attributable to the project activity and hence $BF_{PJ, k, y} = BF_{k, y}$

Step 2: Estimation of methane emissions, consistent with the baseline scenario for the use of biomass residues. As the most likely baseline scenario for the use of the biomass residues is that the biomass residues 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”.

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 ($BE_{CH4,\ SWDC,\ y}$) due to decay of sunflower seeds husk at the landfill is calculated as follows:

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

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 (tCO2);
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 =	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.

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

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):

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

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 biomass residues from other uses to the project plant as the result of project activity. In our case the use of the biomass residues did not increase fossil fuel consumption elsewhere, because prior to implementation of the project activity biomass residue have not been collected or utilized, but have been land-filled. This practice would continue in the absence of project activity, because in there is no market emerged for the biomass residues. Please see page 15 of this PDD, section" Barrier analysis for the husk use alternatives".

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 biomass residues (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 ($ER_{hea,t\ y}$), project emissions (PE_y), emissions due to leakage (L_y) and baseline emissions due to natural decay or burning of anthropogenic sources of biomass residues ($BE_{biomass, y}$), 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* (tCO2/yr);
$ER_{electricity, y}$= Emission reduction due to displacement of electricity during the year *y* (tCO2/yr);
$ER_{hea,t\ y}$= Emission reductions due to displacement of heat during the year *y* (tCO2/yr);
$BE_{biomass, y}$= Baseline emissions due to natural decay or burning of anthropogenic sources of biomass residues during the year *y* (tCO2/yr);
PE_y = Project emissions during the year *y* (tCO2/yr);
L_y = Leakage emissions during the year *y* (tCO2/yr).

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

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, #1. $FF_{project\ site,\ i,\ y}$	Low	Flow meters will be subject to a regular maintenance and periodical calibration according to the manufacturer's recommendation to ensure accuracy.
Table D 1.1.1, #2. $EC_{PJ,\ y}$	Low	Power meters will be periodically calibrated according to the manufacturer's recommendation to ensure accuracy. Cross-check measurements results with invoices for purchased electricity if available.
Table D 1.1.1, #3. $EC_{PJ,\ HP\ needs,\ y}$	Low	Power meters will be periodically calibrated according to the manufacturer's recommendation to ensure accuracy. Cross-check measurements results with invoices for purchased electricity if available.
Table D 1.1.1, #4 T	Low	The temperature gauge should be subject to a regular maintenance and testing regime to ensure accuracy.
Table D 1.1.1, #5 P	Low	The pressure gauge should be subject to a regular maintenance and testing regime to ensure accuracy.
Table D 1.1.1, #7 $BF_{k,\ y}$	Low	Crosscheck the measurements with an annual energy balance that is based on purchased quantities and stock changes.

Table D 1.1.1, #11 $EG_{project\ plant,\ y}$	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, #12 $Q_{project\ \_plant,\ y}$	Low	Heat meters are regularly verified and regularly cross-checked with balance data. 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, #154 NCV_{BR}	Low	The laboratory equipment is regularly verified. Check consistency of measurements and local/national data with default values by the IPCC.

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 Pology OEP at the end of every reporting year. The project manager Pology OEP will prepare reports, as needed for audit and verification purposes.

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
T extern:+49 201 - 12 20223
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SECTION E. Estimation of greenhouse gas emission reductions

E.1. Estimated project emissions:

According to the used methodology ACM0006, generally the project emissions include CO_2 emissions from transportation of biomass residues to the project site (*PETy*), CO_2 emissions from on-site consumption of fossil fuels due to the project activity ($PEFF_y$), CO_2 emissions from consumption of electricity ($PE_{EC,\,y}$) and, where this emission source is included in the project boundary and relevant, CH_4 emissions from the combustion of biomass residues ($PE_{Biomass,\,CH4,\,y}$):

$$PE_y = PETy + PEFF_y + PE_{EC,\,y} + GWP_{CH4} * PE_{Biomass,\,CH4,\,y}$$

Where:

$PETy$ = CO_2 emissions during the year *y* due to transport of the biomass residues to the project plant (tCO_2/yr);

$PEFF_y$ = CO_2 emissions during the year *y* due to natural gas consumption at the project site for operation of gas-fired reserve boiler (tCO_2/yr);

$PE_{EC\,,\,y}$ = CO_2 emissions during the year *y* due to electricity consumption at the project site for the own needs of the new CHP plant (tCO_2/yr);

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* (tCO_2/yr).

Carbon dioxide emissions from the combustion of fossil fuels for transportation of biomass residues to the project plant (*PETy*)

In our case the biomass residues (sunflower seeds husk) are generated directly at the project site. Thus there is no need in vehicles exploitation for biomass fuel delivering to the site and there are no any project emissions caused by the fossil fuels combustion at vehicles.

Carbon dioxide emissions from on-site consumption of fossil fuels ($PEFF_y$)

The proper and efficient operation of new sunflower husk-fired CHP plant requires the annual maintenance and planned repair stoppages of the plant. During this time all two husk fired boilers are stopped their operation and no fossil fuels are going to be combusted. In the case of unforeseen or unexpected situation (emergency at the Enterprise that leads to unexpected absence or lack of sunflower seed husk for period more than 12 hours) project foresees the possibility to use the natural gas as a reserve fuel at one of the husk boilers. During nominal operation according to working conditions no fossil fuels are going to be co-combusted with sunflower seeds husk at new CHP plant. In such case according to equation (6) of ACM0006 version 04 and also corresponds to equation (2) in Methodological tool “Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion”, CO_2 emissions from combustion of natural gas as the reserve fuel are calculated as follow:

$$PEFF_y = FF_{project\ site,\,y} * NCV_{NG} * EF_{CO2,\,FF}$$

Where:

$FF_{project\ site,\,y}$ = Quantity of natural gas combusted at the project site during the year y;

NCV_{NG} = Net calorific value of natural has (fossil fuel) combusted at the project site;

$EF_{CO2,\,FF}$ = CO_2 emission factor for natural gas combusted at the project site, tCO_2/GJ.

The value of $FF_{project\ site,\,y}$ is taken from by ZAO NPP “Ekoenergomash”, Bijsk.

$FF_{project\ site,\,y}$ = 200,000 nm^3/yr.

The net calorific value of natural gas (NCV_{NG}) is 33.7 MJ/nm^3 (the Value is taken according to statistic data of Ukraine: Statistic book “Fuel-Energy Resources of Ukraine”, Kiev, 1998. Issued by State Committee of Statistics of Ukraine).

CO_2 emission factor $EF_{CO2, FF}$, for natural gas is 56,1 tCO_2e/TJ – the value is taken from the "2006 IPCC Guidelines for National Greenhouse Inventories, Volume 2 - Energy, Chapter 2 – Stationary Combustion" Project emissions caused by natural gas combustion of each operational year y are presented in the table E.1 below:

Table E.1-Project emissions caused by natural gas combustion

	Year				
	2008	2009	2010	2011	2012
$FF_{project\_plant,i,y}$, Quantity of natural gas to be combusted as a reserve fuel, th. nm^3/yr	200,0	200,0	200,0	200,0	200,0
NCV_{NG}, Net calorific value of natural gas, GJ/1,000 nm^3	33,7	33,7	33,7	33,7	33,7
$EF_{CO2,FF}$, CO_2 emission factor for natural gas combustion, tCO_2/TJ	56,1	56,1	56,1	56,1	56,1
PEFFy , CO_2 emissions from natural gas combustion at reserve boiler, tCO_2	**378,1**	**378,1**	**378,1**	**378,1**	**378,1**

CO_2 emissions from electricity consumption ($PE_{EC, y}$)

CO_2 emissions from on-site electricity consumption ($PE_{EC, y}$) are caused by purchase of electricity from the National power grid for own needs of CHP during operation time and about 1 month period of time each year when the new CHP plant is stopped due to maintenance and repair works. According to equation (6a) of ACM0006 and equation (2) of Methodological tool "Tool to calculate project emissions from electricity consumption", the CO_2 emissions from on-site electricity consumption are calculated by multiplying the electricity consumption by an appropriate grid emission factor, as follows:

$$PE_{EC, y} = EC_{PJ, y} * EF_{grid, y}$$

Where:

$PE_{EC, y}$ = CO_2 emissions from on-site electricity consumption attributable to the project activity (tCO_2/yr);

$EC_{PJ, y}$ = On-site electricity consumption attributable to the project activity during the year y (MWh/yr);

$EF_{grid, y}$ = CO_2 emission factor for grid electricity during the year y (tCO_2/MWh).

One site electricity consumption attributable to the project activity consists of two components:

1. $EC_{PJ, CHP\_needs, y}$ - On-site electricity consumption for new CHP own needs during the year *y*,
2. $E_{PJ, repair, y}$, - On-site electricity consumption during 1 month of capital repair during the year y.

Due to technical data from project design developer "Ekoenergomash" electricity consumption on site is:

$EC_{PJ, CHP\_needs, y}$ = 10.500 MWh/a,

$E_{PJ, repair, y}$ = 250 MWh/a.

Thus $EC_{PJ, y}$ = 10.500 + 250= 10.000 MWh/a.

CO_2 emission factor for grid electricity consumption is 0.896 tCO_2e/MWh (the justification of this value is in PDD version 4.0, dated 2 February 2007 "Utilization of Coal Mine Methane at the Coal Mine named after A.F. Zasydko"

CO_2 emissions from electricity consumption for own needs of CHP plant:

$PE_{EC, y}$ =10,750 MWh ∗ 0.896 tCO_2e/MWh = 9,632 t CO_2e/a.

Total CO_2 emissions from electricity consumption in the project scenario:

$PE_{EC, y}$ = 10,750 MWh ∗ 0.896 tCO_2e/MWh = 9,632 t CO_2e/a.

Table E.2-Project emissions caused by purchase of electricity from the national power grid

	Year				
	2008	2009	2010	2011	2012
$EC_{PJ,y}$, on-site electricity consumption, MWh	10.750,0	10.750,0	10.750,0	10.750,0	10.750,0
$EF_{grid,y}$, CO_2 emission grid factor for electtricity, tCO_2/MWh	0,896	0,896	0,896	0,896	0,896
$PE_{EC,y}$, CO_2 emission from on-site electricity consumption, tCO_2	**9.632,0**	**9.632,0**	**9.632,0**	**9.632,0**	**9.632,0**

Methane emissions from combustion of biomass residues ($PE_{Biomass,\ CH4,\ y}$)

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

$$PE_{Biomass,\ CH4,\ y} = EFC_{H4,BF} * BF_y * NCV_{BR}$$

Where:

BF_y = Quantity of sunflower seeds husk (biomass residue) combusted in the new CHP plant during the year y (tons of dry matter);

NCV_{BR} = Net calorific value of the biomass residue (sunflower seeds husk) (GJ/ton of dry matter);

$EFC_{H4,BF}$ = 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 15.4 GJ/t, and the water content of this fuel is 10% (the data of the project owner - Heat engineering laboratory of Pology OEP). Thus the net calorific value of dry matter of sunflower seeds husk is following:

$$NCV_{BR} = NCV_{wet,\ 10\%} = \frac{100}{100-W} = 15,4 * \frac{100}{100-10} = 17,1 \text{ MJ/t}$$

To determine the CH_4 emission factor, it was decided not to conduct any measurements at the plant site, but use IPCC default values, as provided in the Table 4 of ACM0006 (p.26). The uncertainty of 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 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, default emission factor for sunflower seeds husk (that corresponds to *other solid biomass residues*) is 30 kg CH_4/TJ, and 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. So in such case the CH_4 emission factor for sunflower seeds husk combustion at new CHP plant is:

$EFC_{H4,BF}$ = 1,37 * 30 = 41,1 kg/TJ.

The CH_4 emission from sunflower seeds husk combustion at new CHP plant is presented in the Table E.3 below:

Table E.3-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)	60.500	60.500	60.500	60.500	60.500
Net calorific value of sunflower seeds husk (GJ/t of dry matter)	17,1	17,1	17,1	17,1	17,1

Energy of sunflower seeds husk utilized at new CHP plant, TJ/yr	1.035,2	1.035,2	1.035,2	1.035,2	1.035,2
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	42,55	42,55	42,55	42,55	42,55
Methane emissions from sunflower seeds husk combustion at new CHP plant, tCO_2e	**893,5**	**893,5**	**893,5**	**893,5**	**893,5**

Total project greenhouse gases emissions in tCO_2 are presented in the Table E.4 below:

Table E.4-Total project greenhouse gases emissions

	Year				
	2008	2009	2010	2011	2012
PET_y , Emissions from biomass residues transportation, tCO_2	0,00	0,00	0,00	0,00	0,00
PE_{FFy} ,Emissions from on-site fossil fuels consumption, tCO_2	378,11	378,11	378,11	378,11	378,11
$PE_{EC,y}$,Emissions from on-site electricity consumption, tCO_2	9.632,00	9.632,00	9.632,00	9.632,00	9.632,00
$PE_{Biomass,CH4,y}$,Methane emissions from biomass residue combustion, tCO_2	893,50	893,50	893,50	893,50	893,50
PE_y , Total project emissions, tCO_2	**10.903,6**	**10.903,6**	**10.903,6**	**10.903,6**	**10.903,6**

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: E.1+E.2 = E.1 (see section E.1).

E.4. Estimated baseline emissions:

Baseline emissions due to grid electricity consumption

Emission reduction due to replacement of electricity are calculated by multiplying the net quantity of increased electricity generated with biomass residues as a result of the project activity (EG_y) with the CO_2 baseline emission factor for the electricity displaced due to 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 (tCO_2/yr);
v =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 (tCO_2/MWh)

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

As project activity foresees the displacement of the grid electricity which consumption would have had 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 depends on power capacity of 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 our case – 1,4 MWel), the average CO_2 emission factor of the electricity system may alternatively 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 present 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 constitute up to 50% 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 PDD "Utilisation of Coal Mine Methane at the Coal Mine named after A.F. Zasydko8" the grid electricity emission factors for JI electricity reducing projects for 2006-2012 is equal to 0.896 tCO_2/MWh):

Step 2: Determination of EG_y.

According to ACM0006, if the produced electricity at the new CHP plant 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 *y EG* corresponds to the net quantity of electricity generation in the project plant ($EG_y = EG_{project\_plant,\,y}$). In such case the emission reduction due to displacement of electricity is presented in the table E.5 below:

Table E.5 - 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	21.000,0	21.000,0	21.000,0	21.000,0	21.000,0
Emission factor, $EF_{electricity,y}$, tCO_2/MWh	0,896	0,896	0,896	0,896	0,896
Emission reduction $ER_{electricity,y}$, tCO_2/yr	**18.816,0**	**18.816,0**	**18.816,0**	**18.816,0**	**18.816,0**

Baseline emissions due to natural gas combustion for heat generation.

In our 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 fuel (natural gas) with the emission factor of this fuel (natural gas). Emissions reductions from savings of fossil fuels are determined by dividing the quantity of generated heat that displaces heat generation in fossil fuel 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 that would be used in the absence of the project activity for heat generation ($EF_{CO2,\,BL,\,heat,\,i}$), as follows:

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

Where:
$ER_{heat,y}$ = Emission reductions due to displacement of heat during the year y (tCO_2/yr);
Q_y = Quantity of increased heat generation in the project plant;

$Q_{project\_pl<nt, y}$ = Net quantity of heat generated in the cogeneration project plant from firing biomass residues during the year y (GJ);
ε_{boiler} = Energy efficiency of the boiler that would be used in the absence of the project activity;
$EF_{CO2, BL, heat, i}$ = CO_2 emission factor of the fossil fuel (natural gas) used for heat generation in the absence of project activity (tCO_2/GJ).

Emission reduction due to displacement of heat generation using fossil fuel by heat generated from biomass residues is presented in the table E.6 below:

Table E.6 - Emission reduction due to displacement of heat generation using fossil fuel by heat generated from biomass residues

	Year				
	2008	2009	2010	2011	2012
Quantity of heat generated in the CHP plant, $Q_{project\_plant,y}$,GJ/yr	502.613,0	502.613,0	502.613,0	502.613,0	502.613,0
Energy efficiency of existing steam gas-fired boiler	0,93	0,93	0,93	0,93	0,93
Emission factor of natural gas, $EF_{CO2,BL,heat,i}$, tCO_2/TJ	56,1	56,1	56,1	56,1	56,1
Emission reduction, $ER_{heat,y}$, tCO_2/yr	**30.318,9**	**30.318,9**	**30.318,9**	**30.318,9**	**30.318,9**

Baseline emissions due to natural decay or uncontrolled burning of anthropogenic sources of biomass residues

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 biomass residues used as a result of the project activity.
Step2: Estimation of methane emissions, consistent with the baseline scenario for the use of biomass residues

Step 1. Determination of the quantity of sunflower seeds husk used as a result of the project activity ($BF_{PJ, k, y}$)
According to ACM0006 and chosen scenario, the total quantity of biomass residues used in the project plant is attributable to the project activity and hence $BF_{PJ, k, y} = BF_k$

Step 2. Estimation of methane emissions, consistent with the baseline scenario for the use of biomass residues.
As the most likely baseline scenario for the use of the biomass residues is that the biomass residues 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 dumping 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 (tCO_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.

<u>Selection of proper values for calculation:</u>

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 = 0,8, 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 Pology region is justified to be Boreal wet:
8) Mean annual temperature in Pology region is +8,5 C.
9) MAP – mean annual precipitation = 550 mm/yr.
10) PET – potential evapotranspiration = 500 mm/yr. Thus MAP/PET>1,
11) As at the moment no methane is captured at existing Pology landfill, and there are no any initiatives to construct any landfill gas collection and utilization system at Pology landfill, we may apply the Fraction of methane captured at the landfill and flared, combusted and used in another manner f = 0.
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 60.500 t/a for the 2007 (when only the first line of proposed project to be completed) and 60.500 t/yr during the each year after 2007. These figures are the wet matter amount of waste sunflower seeds husk, the moisture content is 10%.

Baseline methane emissions $BE_{CH4,\ SWDC,\ y}$, , in tCO_2e due to natural decay of sunflower seeds husk at the landfill during the commitment period (2008-2012) are presented in the table E.6 below:

Table E.7 - Baseline methane emissions $BE_{CH4,\ SWDC,\ y}$, in tCO2e

	Year					
	2007	2008	2009	2010	2011	2012
Sunflower seeds husk dumped, t/y	**3.878,2**	**7.992,7**	**12.354,2**	**16.973,9**	**21.863,5**	**27.035,2**

Total baseline CO2 emissions are presented in the table E.8 below:

Table E.8 - Total baseline CO2 emissions

	Year				
	2008	2009	2010	2011	2012
Electricity purchasing from the grid	18.816,0	18.816,0	18.816,0	18.816,0	18.816,0
Natural gas combustion for heat generation	30.318,9	30.318,9	30.318,9	30.318,9	30.318,9
Sunflower seeds husk decay at the landfill	7.992,7	12.354,2	16.973,9	21.863,5	27.035,2
Total	**57.127,6**	**61.489,1**	**66.108,8**	**70.998,4**	**76.170,2**

E.5. Difference between E.4. and E.3. 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.9 below:

Table E.9 - Total emission reduction

	Year				
	2008	2009	2010	2011	2012
Project emissions	10.903,6	10.903,6	10.903,6	10.903,6	10.903,6
Baseline emissions	57.127,6	61.489,1	66.108,8	70.998,4	76.170,2
Emission reduction	**46.224,0**	**50.585,5**	**55.205,2**	**60.094,8**	**65.266,5**
Total emission reduction during commitment period (2008-2012)	**277.376**				

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

Year	Estimated project emissions (tCO_2e)	Estimated leakage (tCO_2e)	Estimated baseline emssions (tCO_2e)	Estimated emissions reductions (tCO_2e)
2008	10.903,6	0	57.127,6	46.224,0
2009	10.903,6	0	61.489,1	50.585,5
2010	10.903,6	0	66.108,8	55.205,2
2011	10.903,6	0	70.998,4	60.094,8
2012	10.903,6	0	76.170,2	65.266,5
Total (tCO_2e)	**54.518,1**	**0,0**	**331.894,1**	**277.376,0**

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, Polgy OEP" has received all the required conclusions of the state ecology examinations.
Project implementation increases biomass residues (husk) consumption as fuel while decreasing 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:

Information in the **environmental impacts.**

SECTION G. Stakeholders' comments

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

No comments yet.

Annex 1

CONTACT INFORMATION ON PROJECT PARTICIPANTS

Project Participant 1

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Represented by:	Mr. Tolga Acar
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Annex 2

Baseline information

Annex 2 Technical characteristics, economical indexes, investments costs

Annex 2.1.1.1: Technical information about the old boilers

Quality certificate for boiler fabrication NG1

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(E-20-24-250)* with double drum and water pipes with combustion for the *reduction of gas and masut.*

Norm steam pressure (fluid):	
a.) in the drum	24 Kilopond/cm²
b.) during exit of the steam superheater	23 Kilopond/cm²
norm temperature of superheated steam (fluid)	250°
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
d.)	
e.)	
Boiler volume:	
water-	10,5 m³
steam-	1,8 m³
supply-	0,88 m³

Annex 2.1.1.2: Technical information about the new husk boilers

Characteristics of the boiler DKVr-20-23-330 DV

- calculated flow rate of the utilised waste materials (fuel)	4500/4260	kg/h
- nominal steam flow rate	20 $\pm$ 25%	t/h
- steam type, superheated	330	°C
- combustion plant	-	
- fuel type	dry hackled vegetable waste (sunflower seed husk)	
- ratio between the regulation of the steam flow rate to the nominal steam flow rate	70/100	%
- feed water temperatur	100	°C_{max}
- feed water salt content	300	mg/kg
- pressure behind the boiler	330/320 (30/32)	Pa
- pressure in the heating room	20/40 (2/4)	Pa
- aerodynamical resistance	800 (80)	Pa
- temperatur of the escaping gases (calculated)	209	°C
- air surplus coefficient at the exit of the heating room	1,6/1,8	%
- water volume	12	m^3
- direct heating surface	81,7	m^2
- indirect heating surface	306	m^2

Installation and implementation of the 2nd boiler approx. till 30th November 2008
Potential 2nd boiler boiler: E-20-2,4-350 DV

Annex 2.1.2.1: Costs of project implementation (EUR) for 2006

	T. Amount
Total investment costs (excluding JI project development costs, which are presented in the line above) are about:	6.502.000 €
1. Design works:	225.000 €
2. Main equipment (husk-fired boilers DKVr-20-23-330DV + E 20-2,4-350 DV + steam turbo generating installation):	2.226.000 €
3. Auxiliary equipment (boiler settings and fittings, insulation, water preparation, automation and control, etc):	1.641.000 €
4. Transportation costs:	184.000 €
5. VAT and custom fees for imported equipment:	609.000 €
6. Construction, installation and start-adjusting costs:	1.317.000 €
7. Contingency costs (approximately 5% from total costs):	300.000 €

Annex 2.1.2.2: Costs of project implementation (EUR) for 2008

	T. Amount
Total investment costs (excluding JI project development costs, which are presented in the line above) are about:	8.360.495 €
1. Design works:	455.669 €
2. Main equipment (husk-fired boilers DKVr-20-23-330DV + E 20-2,4-350 DV + steam turbo generating installation):	2.842.185 €
3. Auxiliary equipment (boiler settings and fittings, insulation, water preparation, automation and control, etc):	1.840.448 €
4. Transportation costs:	188.710 €
5. VAT and custom fees for imported equipment:	573.523 €
6. Construction, installation and start-adjusting costs:	2.069.960 €
7. Contingency costs (approximately 5% from total costs):	390.000 €

Annex 2.1.2.3: Costs of baseline implementation (EUR) for 2006

	T. Amount
Total investment costs (excluding JI project development costs, which are presented in the line above) are about:	2.426.000 €
1. Design works:	3.000 €
2. Main equipment (gas-fired boilers):	1.240.000 €
3. Auxiliary equipment (boiler settings and fittings, insulation, water preparation, automation and control, etc):	530.000 €
4. Transportation costs:	118.000 €
5. VAT and custom fees for imported equipment:	340.000 €
6. Construction, installation and start-adjusting costs:	90.000 €
7. Contingency costs (approximately 5% from total costs):	105.000 €

Annex 2.1.2.4: Costs of baseline implementation (EUR) for 2008

	T. Amount
Total investment costs (excluding JI project development costs, which are presented in the line above) are about:	3.314.000 €
1. Design works:	89.000 €
2. Main equipment (gas-fired boilers):	1.600.000 €
3. Auxiliary equipment (boiler settings and fittings, insulation, water preparation, automation and control, etc):	870.000 €
4. Transportation costs:	140.000 €
5. VAT and custom fees for imported equipment:	420.000 €
6. Construction, installation and start-adjusting costs:	115.000 €
7. Contingency costs (approximately 5% from total costs):	80.000 €

Annex 2.1.3.1: Information about husk input in the new husk fired boilers

New Husk Boiler	Input [t/hour]	Input [t/day)	Input [t/year]
No. 1	3,05	73,2	24.449
No. 2	4,5	108	36.072
Total	7,55	181,2	60.521

Annex 2.1.3.2: Historical datas of the plant

	Steam (thermal energy) Production	Natural Gas consumption	Power (electricity) Production	Ukrainian Grid
Year	Gcal	m3	MWh	MWh
2004	125739	17006	0	24147
2005	117527	15857	0	20502
2006	117461	16018	0	21873
2007	129469	14297	0	26462

Annex 2.1.3.3 : Reference about volume of sunflower seeds and husk

	2004	2005	2006	2007
The amount of processing sunflower oil, t/year	332106	229295	339342	305864
The amount of processing sunflower oil, t/day	994,33	686,51	1015,99	915,76
The output of sunflower seeds husk (annual), t/year	57544	38876	62202	56341
The output of sunflower seeds husk, t/day	172,29	116,40	186,23	168,69
Husk content in sunflower seeds, %	17%	17%	18%	18%

Annex 2.1.4.1 : Technical discription project scenario

Proposed system:				
Technology	Value	Unit	Comments	
Net thermal capacity	27,6	MW_{th} (out)	Two boilers of 13,78 MW each	
Net electricity capacity	1,4	MW_e (out)		
Nominal operating hours	8.016	h/a		
Total nominal loading rate of boilers	100	%		
Nominal loading rate of turbine	95	%		
Boiler efficiency	88	%	Value from boiler design developers	
Thermal input (by fuel)	961.950	GJ/a	225.670	Gcal/a

Biomass inputs	t/a	Moist (%wb)	LHV (GJ/t)	Density (t/m3)	Volume (sm3/a)
Sunflower husk	60.500	10%	15,9	0,17	355.882

New Process Outputs				
Heat production	Value	Unit	Comments	
Electricity produce	10.500	MWhe/a		
Eletric consumed for own needs of CHP unit	1.500	MWhe/a		
Electircity consumed for own needs	9.000	MWhe/a	This value is taken according to data of manufacturers of CHP equipment. Data is taken from project design document developed by "Ecoenergomash"	
Heat produced (gross)	846.516	GJ/a	198.590	Gcal/a
Heat losses	0	%	As received from project design document	
Heat produced (net)	846.516	GJ/a	198.590	Gcal/a

Annex 2.1.4.2 : Technical discription baseline scenario

Technology	Value	Unit			
Net thermal capacity	20	MW_{th}			
Net electricity capacity	0	Mw_e			
Nominal operating hours	8.016	h/a			
Nominal loading rate	81	%			
Overall efficiency	91	%			
Thermal input (by fuel)	512.548	GJ/a	120.242	Gcal/a	
Fuel input	1000nm3/yr	Moist (%wb)	LHV (Gj/t)	Density (t/m3)	Volume (sm3/a)
Natural gas	16.014	-	33,7	0,000735	16.014
Heat production	Value	Unit			
Electricity produce	0	MWh_e/a			
Heat produced (gross)	466.419	GJ/a	109.420	Gcal/a	
Heat losses	4	%			
Heat produced (net)	447.761	GJ/a	105.043	Gcal/a	
Electricity purchase from the grid	Value	Unit			
For technological purposes	19.700	MWh/a			
During the overhaul period	300	MWh/a			
Annual electricity consumption	20.000	MWh/a			

Annex 2.2 Economical results of the calculations for baseline scenario and project scenario

Table B.1 - Investment comparison analysis for 2008 tariffs

	NPV lt. Rechnung, €	IRR, %	Simple payback period	Discounted payback period
Project scenario with ERU sales in 2008	907.039	17%	5,7	11,3
Project scenario not being registered as JI in 2008	-228.285	14%	6,8	>15
Baseline scenario in 2008	50.688	15%	6,5	>15

Current prices, tariffs, currency change (2008)

	UAH		Euro	
Heat supply tariff	217,0	UAH/MWh	28,6	€/MWh
Natural gas price for heat production	1.100,0	UAH/1000m3	145,1	€/1000m^3
ERU price	64,0	UAH/t CO2e	8,4	€/t CO_2e
Cost of waste disposal at the landfill	30,0	UAH/t	4,0	€/t

Table B.2 - Investment comparison analysis for 2006 tariffs

	NPV lt. Rechnung, €	IRR, %	Simple payback period	Discounted payback period
Project scenario with ERU sales in 2006	755.424	12%	7,2	12,0
Project scenario not being registered as JI in 2006	-621.225	8%	8,6	>15
Baseline scenario in 2006	62.539	15%	6,6	>15

Current prices, tariffs, currency change (2006)

	UAH		Euro	
Heat supply tariff	217,0	UAH/MWh	35,0	€/MWh
Natural gas price for heat production	520,0	UAH/1000m3	83,9	€/1000m^3
ERU price	48,0	UAH/t CO2e	7,7	€/t CO_2e
Cost of waste disposal at the landfill	19,0	UAH/t	3,1	€/t

Annex 2.3 Emissions

Annex 2.3.1: Baseline emissions

Table E.5 - 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	21.000,0	21.000,0	21.000,0	21.000,0	21.000,0
Emission factor, $EF_{electricity,y}$, tCO_2/MWh	0,896	0,896	0,896	0,896	0,896
Emission reduction $ER_{electricity,y}$, tCO_2/yr	**18.816,0**	**18.816,0**	**18.816,0**	**18.816,0**	**18.816,0**

Table E.6 - Emission reduction due to displacement of heat generation using fossil fuel by heat generated from biomass residues					
	Year				
	2008	2009	2010	2011	2012
Quantity of heat generated in the CHP plant, $Q_{project\_plant,y}$,GJ/yr	502.613,0	502.613,0	502.613,0	502.613,0	502.613,0
Energy efficiency of existing steam gas-fired boiler	0,93	0,93	0,93	0,93	0,93
Emission factor of natural gas, $EF_{CO2,BL,heat,i}$, tCO2/TJ	56,1	56,1	56,1	56,1	56,1
Emission reduction, $ER_{heat,y}$, tCO2/yr	**30.318,9**	**30.318,9**	**30.318,9**	**30.318,9**	**30.318,9**

Table E.7 - Baseline methane emissions $BE_{CH4,SWDC,y}$, in tCO2e						
	Year					
	2007	2008	2009	2010	2011	2012
Sunflower seeds husk dumped, t/y	**3.878,2**	**7.992,7**	**12.354,2**	**16.973,9**	**21.863,5**	**27.035,2**

Symbol	Value	Unit	Comment
$BE_{CH4,SWDC,y}$	see table below	tCO2e/yr	Methane emissions avoided during the year y from preventing sunflower seeds husk decay at landfill during the period from the start of the project activity to the end of the year y
φ	0,9	-	Model correstion factor
f	0	-	Fraction of methane captured at the landfill and flared, combusted or used in another manner
GWP CH4	21	tCO2e/tCH	Global Warming Potential of methane, valid for the relevant commitment period
OX	0	-	Oxidation factor (reflecting the amount of methane from landfill that is oxidized in the soil or other material covering the waste
F	0,5	-	Fraction of methane in the landfill gas
DOCf	0,5	-	Fraction of degradable organic carbon that can decompose
MCF	0,8	-	Methane correction factor
Wx	see table below	t/yr	Amount of sunflower seeds husk prevented from disposal in the landfil in the year x
DOC_j	0,5	-	
k	0,03	-	Decay rate of for the sunflower seeds husk
x	variable	-	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	variable	-	Year for which methane emissions are calculated

Year	Waste dumped, t/yr	2007	2008	2009	2010	2011	2012
2007	60.500	3.878,24	3.996,35	4.118,06	4.243,47	4.372,71	4.505,87
2008	60.500		3.996,35	4.118,06	4.243,47	4.372,71	4.505,87
2009	60.500			4.118,06	4.243,47	4.372,71	4.505,87
2010	60.500				4.243,47	4.372,71	4.505,87
2011	60.500					4.372,71	4.505,87
2012	60.500						4.505,87
2013	60.500						
2014	60.500						
Total		3.878,24	7.992,70	12.354,18	16.973,89	21.863,53	27.035,24
Total during commitment period							90.097,78

Table E.8 - Total baseline CO2 emissions						
	Year					
	2008	2009	2010	2011	2012	Total
Electricity purchasing from the grid	18.816,0	18.816,0	18.816,0	18.816,0	18.816,0	94.080,0
Natural gas combustion for heat generation	30.318,9	30.318,9	30.318,9	30.318,9	30.318,9	151.594,6
Sunflower seeds husk decay at the landfill	7.992,7	12.354,2	16.973,9	21.863,5	27.035,2	86.219,5
Total	**57.127,6**	**61.489,1**	**66.108,8**	**70.998,4**	**76.170,2**	**331.894,1**

Annex 2.3.2: Project emissions

Table E.1-Project emissions caused by natural gas combustion					
	Year				
	2008	2009	2010	2011	2012
$FF_{project\_plant,i,y}$, Quantity of natural gas to be combusted as a reserve fuel, th. nm^3/yr	200,0	200,0	200,0	200,0	200,0
NCV_{NG}, Net calorific value of natural gas, GJ/1,000 nm^3	33,7	33,7	33,7	33,7	33,7
$EF_{CO2,FF}$, CO2 emission factor for natural gas combustion, tCO_2/TJ	56,1	56,1	56,1	56,1	56,1
PEFFy , CO_2 emissions from natural gas combustion at reserve boiler, tCO_2	**378,1**	**378,1**	**378,1**	**378,1**	**378,1**

Table E.2-Project emissions caused by purchase of electricity from the national power grid					
	Year				
	2008	2009	2010	2011	2012
$EC_{PJ,y}$, on-site electricity consumption, MWh	10.750,0	10.750,0	10.750,0	10.750,0	10.750,0
$EF_{grid,y}$, CO_2 emission grid factor for electtricity, tCO_2/MWh	0,896	0,896	0,896	0,896	0,896
$PE_{EC,y}$, CO_2 emission from on-site electricity consumption, tCO_2	**9.632,0**	**9.632,0**	**9.632,0**	**9.632,0**	**9.632,0**

Table E.3-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)	60.500	60.500	60.500	60.500	60.500
Net calorific value of sunflower seeds husk (GJ/t of dry matter)	17,1	17,1	17,1	17,1	17,1
Energy of sunflower seeds husk utilized at new CHP plant, TJ/yr	1.035,2	1.035,2	1.035,2	1.035,2	1.035,2
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	42,55	42,55	42,55	42,55	42,55
Methane emissions from sunflower seeds husk combustion at new CHP plant, tCO_2e	**893,5**	**893,5**	**893,5**	**893,5**	**893,5**

Table E.4-Total project greenhouse gases emissions					
	Year				
	2008	2009	2010	2011	2012
PET_y , Emissions from biomass residues transportation, tCO_2	0,00	0,00	0,00	0,00	0,00
PE_{FFy} ,Emissions from on-site fossil fuels consumption, tCO_2	378,11	378,11	378,11	378,11	378,11
$PE_{EC,y}$,Emissions from on-site electricity consumption, tCO_2	9.632,00	9.632,00	9.632,00	9.632,00	9.632,00
$PE_{Biomass,CH4,y}$,Methane emissions from biomass residue combustion, tCO_2	893,50	893,50	893,50	893,50	893,50
PE_y , Total project emissions, tCO_2	**10.903,6**	**10.903,6**	**10.903,6**	**10.903,6**	**10.903,6**

Annex 2.3.3: Emissions reductions

Table E.9 - Total emission reduction					
	Year				
	2008	2009	2010	2011	2012
Project emissions	10.903,6	10.903,6	10.903,6	10.903,6	10.903,6
Baseline emissions	57.127,6	61.489,1	66.108,8	70.998,4	76.170,2
Emission reduction	**46.224,0**	**50.585,5**	**55.205,2**	**60.094,8**	**65.266,5**
Total emission reduction during commitment period (2008-2012)	**277.376**				

Year	Estimated project emissions (tCO_2e)	Estimated leakage (tCO_2e)	Estimated baseline emssions (tCO_2e)	Estimated emissions reductions (tCO_2e)
2008	10.903,6	0	57.127,6	46.224,0
2009	10.903,6	0	61.489,1	50.585,5
2010	10.903,6	0	66.108,8	55.205,2
2011	10.903,6	0	70.998,4	60.094,8
2012	10.903,6	0	76.170,2	65.266,5
Total (tCO_2e)	**54.518,1**	**0,0**	**331.894,1**	**277.376,0**

Annex 3

MONITORING PLAN

Refer section D for details of monitoring plan.