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

CONTENTS

Annexes

SECTION A. General description of the project

A.1. Title of the project:

Waste heaps dismantling with the aim of decreasing the greenhouse gases emissions into the atmosphere.

Sectoral scope: 8. Mining/mineral production

Version of the document: 2.2

Date of the document: 12th of January 2010.

A.2. Description of the project:

The Donbas region of Ukraine is an area of massive coal production. The coal is predominately found at the average depth of 400-800 m and the average thickness of coal-bed is 0.6-1.2 m. The extraction method is mainly by mining. Most of the mines operate at the depth of 400-800 m, but there are 35 mines in the area that extract coal from 1000-1300 m. The coal-beds in the Donetsk basin are interleaved with rock and usually are found every 20-40 m. Mining activities in such conditions require a large amount of matter being extracted and brought to the surface. Coal is separated from rock, and the non-coal matter is dumped in large waste heaps of tailings found almost everywhere in Donbas.

The separation process at the mines was not very efficient, and it was not deemed economically feasible to attempt to extract 100% of coal from the rock that was mined. As a result the waste heaps of Donbas contain a considerable amount of coal. Over time the waste heaps, containing coal, are vulnerable to spontaneous ignition and self-sustained burning[1]. Waste heaps that are currently burning, or at risk of spontaneous ignition, are sources of uncontrolled greenhouse gas and hazardous substances emissions.

Despite the dangers caused by the burning waste heaps, it is common in the area of Donbas to not extinguish the fires immediately. The owners, whom are responsible for the waste heaps, receive relatively small fines for the air pollution, therefore there is little incentive for them to deal with the problem, and extinguishing those heaps that are currently alight can be postponed indefinitely.

In the baseline scenario it is assumed that this common practice will continue and waste heaps will be burning and emitting GHG into the atmosphere until the coal is consumed. Whereas using improved extraction techniques, proposed in this project, the residual coal can be extracted from the waste heaps and the coal can be used to for the energy needs of local consumers. The reclaimed coal will replace coal that would have otherwise been mined, causing fugitive emissions of methane during the mining process.

This Project is aimed at coal extraction from the mine’s waste heaps near the town of Snizhne, Donetsk Region, Ukraine. This will prevent greenhouse gas emissions into the atmosphere during combustion of the heaps and will contribute an additional amount of coal, without the need for mining. The Project includes the installation of coal extraction units and the grading of the extracted coal. Extracted coal is then sold for heat and power production.

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[1] *Geology of Coal Fires: Case Studies from Around the World,* Glenn B. Stracher, Geological Society of America, 2007, p. 47

Therefore, in the project scenario the coal extracted from the waste heaps will partly substitute the coal from the mine, decreasing fugitive methane emissions, and reduce emissions GHG emissions due to waste heap combustion by extracted all the combustible material from the waste heaps.

Results of the project implementation are shown in a picture below:


Before After

Once the waste heap has been processed and coal is extracted, the land released from under the waste heap is remediated and returned to the community. The residue after processing, which is mainly barren rock, is used to shape terrain of abandoned open-cast mining sites so that such areas may be used again for development purposes. The picture below illustrates the transformation of the terrain with the rock from processed waste heap.

Before

After

The technological process is environmentally sound and does not require the use of hazardous materials. Waste heaps are processed with semi-steep separators that use water in a closed cycle as an operating fluid.

The first stage of the project implementation was the construction of the "Snizhnyans'ka-1" unit in 2004. The second stage of the project includes the construction of the "Snizhnyans'ka-2" unit.

A.3. Project participants:

Table 1 Project participants

Party involved	Legal entity project participant (as applicable)	Please indicate if the Party involved wishes to be considered as project participant (Yes/No)
Ukraine (Host party)	• Limited society "Anthracite"	No
Netherlands	• Global Carbon BV	No

Limited society "Anthracite" is the project host. Global Carbon BV is developer of this JI project.

A.4. Technical description of the project:

A.4.1. Location of the project:

Waste heaps in the legal exploitation of the limited society "Anthracite".

A.4.1.1. Host Party(ies):

Ukraine

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

Donetsk region

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

Town of Snizhne

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

Figure 1 Map of Ukraine and location of the town of Snizhne

The physical location of the project is at the coal mining waste heaps and industrial sites of the limited society "Anthracite", located in the vicinity of the town of Snizhne, Donetsk region, Ukraine. The location of the Donetsk region and the town of Snizhne are shown in the figure above. The geographic coordinates of the town of Snizhne are 48°20'24.57"N 38° 2'11.54"E. The town of Snizhne was founded in 1784. The population is around 58 496 inhabitants (2001).

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

The project will implement the technological scheme which consists of the following steps:

1) The selected waste heaps are prepared for dismantlement. Access roads are prepared and access to the top is organized.
2) The top of the waste heap is degraded layer-by-layer with the bulldozers. This job is done only during daylight hours and layers are not larger than 10 m thick counting from the top. Bulldozers slide the rock to the slope, from where it goes all the way down by gravity. Excavators can be used instead of the bulldozers to dismantle the waste heap. In this case the dismantling is done by arranging terraces not higher than 6-10 m.
3) The slopes of the waste heaps are fitted with chutes in order to transport the rock from the dismantling area to the bottom of the waste heap. Dismantling of the waste heaps results in the high volume of dust emission. Dust is settled by regular water sprinkling.

4) The loading area is organized at the bottom of the waste heap. Here the rock is loaded by the excavators into the lorry trucks. Trucks take the rock to the coal extraction unit by existing public roads.
5) The coal extraction unit is located close to one of the waste heaps. The rock is delivered here by trucks and is fed into the unit for the extraction process.
6) The extraction process consists of several operations: separation of the coal containing rock into the classes by size and extraction of the "below 80 mm" class by the receiving bin grates; beneficiation of the "0-80 mm" class on a semi-steep (also known as steeply inclined) separator KNS-138 (1st stage of beneficiation); dehydration of the obtained concentrate on a separation screen with extraction of "0-1 mm" class, "1-13 mm" class and "13-80 mm" class; "13-80 mm" class concentrate is the end product and is transported to the storage facility; beneficiation of the "1-13 mm" class by a semi-steep separator KNS-60/75 (2nd stage beneficiation); dehydration of the obtained concentrate on a separation screen with extraction of "0-13 mm" class and transporting this concentrate to storage. Other classes of concentrate produced by first two stages of beneficiation undergo further beneficiation, are condensed and processed in cyclone separators, separation screens and dehydrators and are returned to earlier stages of beneficiation. Water is purified and returned into the cycle.
7) The processed rock is loaded into the trucks and transported to:
    a) Existing waste heap of a nearby mine. This waste heap is under control of the operating mine and can receive extra rock. Storing the processed rock in this waste heap will not lead to possible fires as virtually all of the combustible matter has been extracted.
    b) Abandoned clay open-pit extraction operation. Processed rock is transported to the pit and used to fill the open pit. Filling the open pit will require preparation of temporary roads. The rock will be stored here in compressed layers of 1 m thick. After the open pit is filled the upper layer is tilled and grass is planted.

Most of the equipment utilized by the project such as trucks, excavators, bulldozers is of a standard type used for industrial applications worldwide. The project activity will use a limited number of individually ordered equipment.

The core elements of the coal extraction facility are the semi-steep separators. Such separator is a gravity-based coal beneficiation machine used mostly for large and intermediate coal size classes. Beneficiation process runs in a backflow confined channel, mounted at a steep (52-56˚) angle. The following figure demonstrates the process.

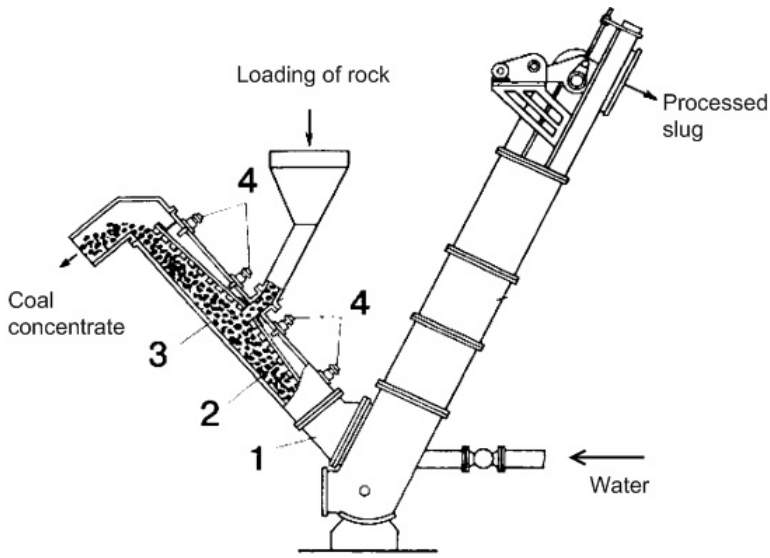

Figure 2 Semi-steep separator[2]

The coal containing rock is loaded into the central channel (1) through the top and water is simultaneously fed into the channel from the bottom. Heavy fractions (2) settle in the bottom and are removed by the elevator. Lighter fractions (3) with coal are pushed upwards by water stream and are offloaded through the top opening. Special regulators (4) are used to control the process.

The first stage of the project implementation which is the construction of "Snizhnyans'ka-1" unit was completed in 2004. Initial number of waste heaps will be processed by this unit. The second stage, which includes construction of "Snizhnyans'ka-2" unit and the processing of another wave of waste heaps, is scheduled to commence operation in 2010 pending to possibility to obtain incentives from the JI mechanism.

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 proposed project is aimed at the extraction of coal from the waste heaps of underground coal mines. Waste heaps are frequently spontaneously igniting and burning, causing emissions of hazardous substances and green-house gases. The fraction of coal in the waste heaps can be as high as 28-32%[3], so the risk of spontaneous self-heating and burning is very high. The survey[4] shows that 78% of waste heaps in the Donetsk Region are, or have been burning at some point in time. If a waste heap has started burning, even if the fire is extinguished, it will continue burning after a while unless the fire is extinguished regularly. Burning waste heaps in Ukraine are very often not taken care of properly, especially when there is no immediate danger to population and property, i.e. if the waste heap is located at a considerable distance from a populated area, or is at the early stages of self-heating. The monitoring of the waste heaps condition is not done on a systematic and timely basis and information is frequently

[2] *Small Mining Encyclopedia*, Vol. 1 /Edited by V.S. Biletsky. – Donetsk: Donbas, 2004. – p.595.

[3] *Geology of Coal Fires: Case Studies from Around the World*, Glenn B. Stracher, Geological Society of America, 2007, p. 47

[4] *Report on the fire risk of Donetsk Region's waste heaps*, Scientific Research Institute "Respirator", Donetsk, 2009

missing[2]. The only way to prevent a waste heap from burning is to extract all the combustible matter, which is generally residual coal from the mining process. This project will reduce the emissions by extracting coal from the waste heap matter and using the remaining rock for land engineering.

Coal extracted from the waste heaps will substitute the coal from the mines and will be used mainly for energy production purposes at coal-fired power plants. Coal mining is a source of the fugitive emissions of methane, therefore, the project activity will reduce methane emissions by reducing the amount of coal required to be mined.

Emission reductions due to the implementation of this project will come from two major sources:

- Removing the source of green-house gas emissions from the combustion of waste heaps by the extraction of coal from the waste-heaps;
- Reduced fugitive emissions of methane due to the replacement of coal that would have been mined, by the project.

Waste heaps are sources of uncontrolled green-house gas emissions, hazardous substances emissions, particle emissions, ground water contamination. Addressing problems of waste heaps is costly and is not addressed in a systematic way in Ukraine. Efforts to stop burning of waste heaps and break them down completely are in line with the existing environmental legislation of Ukraine. The proposed project is positively evaluated by local authorities.

Detailed description on the baseline setting and full additionality test can be found in section B of this PDD.

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

Table 2 Estimated amount of emission reductions before the crediting period

	Years
Length of the period before 2008, for which emission reductions are estimated	3
Year	Estimate of annual emission reductions in tonnes of CO_2 equivalent
Year 2005	128 447
Year 2006	144 427
Year 2007	115 260
Total estimated emission reductions over the period indicated (tonnes of CO_2 equivalent)	388 134
Annual average of estimated emission reductions over the period indicated (tonnes of CO_2 equivalent)	129 378

Table 3 Estimated amount of emission reductions during the crediting period

	Years
Length of the crediting period	5
Year	Estimate of annual emission reductions in tonnes of CO_2 equivalent
Year 2008	93 598
Year 2009	80 655
Year 2010	38 236
Year 2011	125 395
Year 2012	116 058
Total estimated emission reductions over the crediting period (tonnes of CO_2 equivalent)	453 942
Annual average of estimated emission reductions over the crediting period (tonnes of CO_2 equivalent)	90 788

Table 4 Estimated amount of emission reductions after the crediting period

	Years
Period after 2012, for which emission reductions are estimated	5
Year	Estimate of annual emission reductions in tonnes of CO_2 equivalent
Year 2013	116 058
Year 2014	116 058
Year 2015	116 058
Year 2016	116 058
Year 2017	116 058
Total estimated emission reductions over the period indicated (tonnes of CO_2 equivalent)	580 288
Annual average of estimated emission reductions over the period indicated (tonnes of CO_2 equivalent)	116 058

A.5. Project approval by the Parties involved:

The project has been officially presented for endorsement to the Ukrainian authorities. Letter of Endorsement # 911/23/7 has been issued by the National Environmental Investment Agency of Ukraine on the 12th of August 2008 for this project.

SECTION B. Baseline

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

In accordance with «Guidance On Criteria For Baseline Setting And Monitoring» version 02[5] (hereinafter referred to as JISC Guidance) approved by Joint Implementation Supervisory Committee project participants can establish baseline greenhouse gas emission calculation methodology on a project specific basis in line with Annex B of Joint Implementation Guidelines[6] (Decision 9/CMP.1 Conference of the Parties serving as the Meeting of the Parties to the Kyoto Protocol 30th of March 2006 – hereinafter referred to as JI Guidelines). All documents are available at http://ji.unfccc.int/Ref/Docs.html. The following step by step approach is applied in order to describe and justify the baseline chosen.

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

According to the Article 20 of JISC Guidance a baseline is the scenario that reasonably represents the anthropogenic emissions by sources or net anthropogenic removals by sinks of GHGs that would occur in the absence of the project.

The baseline for this project is established on a project specific basis in accordance with the Article 18 of JISC Guidance. No multi-project emission factor or sectoral baseline is applicable as the project under consideration is pioneering both in its sector (extraction of coal from the waste heaps in Ukraine) and in the area of joint implementation projects.

In accordance with the Article 9 of JISC Guidance, option A for establishment of the baseline is selected:

(a) An approach for baseline setting and monitoring developed in accordance with appendix B of the JI guidelines (JI specific approach);

Taking into account the JI specific approach selected for baseline establishment above, in accordance with the Article 24 of JISC Guidance, baseline will be identified:

By listing and describing plausible future scenarios on the basis of conservative assumptions and selecting the most plausible one.

The most plausible future scenario will be identified by checking that all alternatives are consistent with mandatory applicable laws and regulations and by performing a barrier analysis. Should only two alternatives remain, of which one alternative should represent the project scenario with the JI incentive, the CDM Tool "Tool for the demonstration and assessment of additionality" shall be used to prove that the project scenario cannot regarded at the most plausible one.

Step 2. Application of the approach chosen

Plausible future scenarios will be identified in order to establish a baseline.

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[5] http://ji.unfccc.int/Ref/Documents/Baseline_setting_and_monitoring.pdf

[6] http://unfccc.int/resource/docs/2005/cmp1/eng/08a02.pdf#page=2

Sub step 2a. Identifying and listing plausible future scenarios.

Scenario 1. Continuation of existing situation

In the current situation waste heaps are not utilised. Spontaneous self-heating and subsequent burning of waste heaps is very common and measures to extinguish fire are taken sporadically. Burning waste heaps are sources of uncontrolled greenhouse gas emissions. Coal is not extracted from the waste heaps. Coal is produced by underground mines of the region and used for energy production or other purposes. Coal mining activities cause emissions of fugitive methane and also the formation of new waste-heaps.

Scenario 2. Direct energy production from the heat energy of burning waste heap

Waste heaps are not extinguished and not monitored properly. Some burning heaps are used to produce energy by direct insertion of heat exchangers into the waste heap[7]. This captures a certain amount of heat energy for direct use or conversion into electricity. The coal is not extracted from the waste heaps. Coal is produced by underground mines of the region and used for energy production or other purposes. Mining activities, resulting in fugitive gas release, and the formation of more waste-heaps.

Scenario 3. Production of construction materials from waste heap matter

Waste heaps are being processed in order to produce construction materials (bricks, panels, etc.). Coal in the waste heap matter is burnt during the agglomeration process[8]. Coal is produced by underground mines of the region and used for energy production or other purposes. Mining activities, resulting in fugitive gas release, and the formation of more waste-heaps.

Scenario 4. Coal extraction from waste heaps without JI incentives

This scenario is similar to the project activity only in this case the project does not benefit from the possible development as a joint implementation project. In this scenario waste heaps are processed in order to extract coal and used it the energy sector. Less coal is produced by underground mines of the region.

Scenario 5. Systematic monitoring of waste heaps condition and regular fire prevention and extinguishing measures

Waste heaps are systematically monitored and their thermal condition is researched. Regular fire prevention measures are taken. In case of a burning waste heap, the fire is extinguished and measures are taken to prevent burning in the future. Coal is not extracted from the waste heaps. Coal is produced by underground mines of the region and used for energy production or other purposes. Mining activities, resulting in fugitive gas release, and the formation of more waste-heaps.

Sub step 2b. Consistency with mandatory applicable laws and regulations.

Existing Ukrainian laws and regulations treat waste heaps as sources of possible dangerous emissions into the atmosphere. In general burning waste heaps should be extinguished and measures must be taken to prevent fires in the future. However, due to the large numbers of waste heaps and their substantial

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[7] *Method to utilize energy of the burning waste heaps*, Melnikov S.A., Zhukov Y.P., Gavrilenko B.V., Shulga A.Y., State Committee Of Ukraine For Energy Saving, 2004 (http://www.necin.kiev.ua/rus/publications/terikon.htm)

[8] *Opportunities for international best practice use in coal mining waste heap utilization of Donbas*, Matveeva N.G., Ecology: Collection of Scientific Papers, Eastern Ukrainian National University, Lugansk, #1 2007

sizes, combined with the limited resources of the owners, they typically do not even undertake the minimum required regular monitoring. Even when informed of a burning waste heap, and measures have to be taken under existing legislation, it is more typical to accept the fine for air contamination, rather than take action to extinguish the burning waste heap itself[9].

In such circumstances it is safe to say that all scenarios do not contradict existing laws and regulations.

Sub step 2c. Barrier analysis

Scenario 1. Continuation of existing situation

This scenario does not anticipate any activities and therefore does not face any barriers.

Scenario 2. Direct energy production from the heat energy of burning waste heap

Technological barrier: This scenario is based on the highly experimental technology, which has not been implemented even in a pilot project. It is also not suitable for all waste heaps as the project owner will have to balance the energy resource availability (i.e. waste heap location) and the location of the energy user. On-site generation of electricity addresses this problem but requires additional interconnection engineering. In general this technology has yet to prove its viability. In addition it does not allow the control and management of the emitted gases.

Investment barrier: Investment into unproven technology carries a high risk. In case of Ukraine, which carries a high country risk, investment into such unproven energy projects are less likely to attract investors than some other opportunities in the energy sector with higher returns. The pioneering character of the project may appeal to development programmes and governmental incentives but cost of the produced energy is likely to be much higher than alternatives.

Scenario 3. Production of construction materials from waste heap matter

Technological barrier: This scenario is based on known technology, however, this technology is not currently available in Ukraine and there is no evidence that such projects will be implemented in the near future. It is also not suitable for all types of waste heaps as the content of waste heap has to be predictable in order for project owner to be able to produce quality materials. High contents of sulphur and moisture can reduce the suitability of the waste heap for processing. A large scale deep exploration of the waste heap has to be performed before the project can start.

Scenario 4. Coal extraction from waste heaps without JI incentives

Investment barrier: This scenario is financially unattractive and faces barriers. Please refer to section B.2 for details.

Scenario 5. Systematic monitoring of waste heaps condition and regular fire prevention and extinguishing measures

Investment barrier: This scenario does not represent any revenues but anticipates additional costs for waste heaps owners. Monitoring of the waste heap status is not done systematically and in general actions are left to the discretion of the individual owners. Waste heaps are mostly owned by mines or

[9] *Sverdlovsk – Territory of disaster*, XXI vek, 2007 (http://xxi.com.ua/region/7_26_2.htm)

regional coal mining associations[10]. Coal mines in Ukraine suffer from limited investment resulting often in safety problems due to complicated mining conditions and financial constraints, with miners' salaries often being delayed by few months.[11] Waste heaps in this situation are considered as additional burdens and mines often do not even perform minimum required maintenance. Spontaneous self-heating and subsequent burning of waste heaps is very common and among 594 surveyed waste heaps in Donetsk region alone, only 20 are known not to have been burning[7] at sometime, exact data are not always available. From a commercial view point the fines that are usually levied by the authorities are considerably lower than costs of all the measures outlined by this scenario.

Sub step 2d. Baseline identification

All scenarios, except Scenario 1 - Continuation of existing situation, face prohibitive barriers. Therefore, continuation of existing situation is the most plausible future scenario and is the baseline scenario.

This baseline scenario has been established according to the criteria outlined in the JISC Guidance:

1) On a project specific basis. This project is the first of its kind and therefore other options could not be used;
2) In a transparent manner with regard to the choice of approaches, assumptions, methodologies, parameters, data sources and key factors. All parameters and data are either monitored by the project participants or are taken from sources that provide a verifiable reference for each parameter. Project participants use approaches suggested by the JISC Guidance and methodological tools provided by the CDM Executive Board;
3) Taking into account relevant national and/or sectoral policies and circumstances, such as sectoral reform initiatives, local fuel availability, power sector expansion plans, and the economic situation in the project sector. It is demonstrated by the above analysis that the baseline chosen clearly represents the most probable future scenario given the circumstances of modern day Donetsk coal sector;
4) In such a way that emission reduction units (ERUs) cannot be earned for decreases in activity levels outside the project activity or due to force majeure. According to the proposed approach emission reductions will be earned only when project activity will generate coal from the waste heaps, so no emission reductions can be earned due to any changes outside of project activity.
5) Taking account of uncertainties and using conservative assumptions. A number of steps have been taken in order to account for uncertainties and safeguard conservativeness:
    a. Same approaches as used for the calculation of emission levels in the National Inventory Reports (NIRs) of Ukraine are used to calculate baseline and project emissions when possible. NIRs use the country specific approaches and country specific emission factors that are in line with default IPCC values;
    b. Lower range of parameters is used for calculation of baseline emissions and higher range of parameters is used for calculation of project activity emissions;
    c. Default values were used to the extent possible in order to reduce uncertainty and provide conservative data for emission calculations.

Baseline Emissions

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[10] *Report on the fire risk of Donetsk Region's waste heaps*, Scientific Research Institute "Respirator", Donetsk, 2009. This is a proprietary study that will be made available to the accredited independent entity.

[11] *Coal Sector of Ukraine: Problems and Sustainable Development Perspectives*, Yuri Makogon, National Institute For Strategic Research, 2008 (http://www.niss.gov.ua/Monitor/desember08/5.htm)

In order to calculate baseline emissions following assumptions were made:

1) The project will produce energy coal that will displace the same amount of the same type of coal in the baseline scenario;
2) The coal that is displaced in the baseline scenario and the coal that is generated in the project activity are used for the same type of purpose and is stationery combusted;
3) The coal that is displaced in the baseline scenario is produced by the underground mines of the region and as such causes fugitive emissions of methane;
4) Waste-heaps of the region are vulnerable to spontaneous self-heating and burning and at some point in time will burn;
5) Probability of the waste heap burning at any point in time is determined on the basis of the survey of all the waste heaps in the area that provides a ratio of waste heaps that are or have been burning at any point in time to all existing waste heaps;
6) Coal burning in the waste heaps will oxidize to CO2 completely if allowed to burn uncontrolled.

Baseline emissions come from three major sources:

7) Carbon dioxide emissions that occur during combustion of energy coal. These are calculated as stationery combustion emissions from coal in the equivalent of the amount of coal that is extracted from the waste heaps in the project scenario.
8) Fugitive methane emissions due to the mining activities. As coal in the baseline scenario is only coming from mines it causes fugitive emissions of methane. These are calculated as standard country specific emission factor applied to the amount of coal that is extracted from the waste heaps in the project scenario.
9) Carbon dioxide emissions from burning waste heaps. These are calculated as stationery combustion emissions from coal in the equivalent of the amount of coal that is extracted from the waste heaps in the project scenario, adjusted by the probability of a waste heap burning at any point in time. As the baseline suggests that the current situation is preserved regarding the waste heaps burning, it is assumed that for any given waste heap, actual burning will occur in some point in time. This probability of burning is established by the study [12] that assessed the status of all existing waste heaps in Donetsk Region historically. Based on the gathered data it is concluded that 78% of all waste heaps in the Donetsk Region have been, or are now, on fire.

The table below provides values for constant parameters used to determine the baseline emissions

[12] *Report on the fire risk of Donetsk Region's waste heaps*, Scientific Research Institute "Respirator", Donetsk, 2009. This is a proprietary study that will be made available to the accredited independent entity.

Table 5 List of constants used in the calculations of baseline emissions

Data / Parameter	Data unit	Description	Data Source	Value
GWP_{CH4}		Global Warming Potential of Methane	IPCC Second Assessment Report[13]	21
ρ_{CH4}	t/m^3	Methane density	Standard (at room temperature 20˚C and 1 ATM)	0.00067
NCV_{Coal}	TJ/kt	Net Calorific Value of coal	National Inventory Report of Ukraine 1990-2007, p. 266	21.95
$OXID_{Coal}$		Carbon Oxidation factor of coal	National Inventory Report of Ukraine 1990-2007, p.273	0.98
k^C_{Coal}	tC/TJ	Carbon content of coal	National Inventory Report of Ukraine 1990-2007, p.272	26.8

Emissions in the baseline scenario are calculated as follows:

$$BE_y = BE_{Coal,y} + BE_{CH_4,y} + BE_{WHB,y},$$ (Equation 1)

where:

BE_y, - Baseline Emissions in the year *y* (tCO_2e),

$BE_{Coal,y}$ - Baseline Emissions due to combustion of coal for energy needs in the baseline scenario in the year *y* (tCO_2e),

$BE_{CH_4,y}$ - Baseline Emissions due to fugitive emissions of methane in the mining activities in the year *y* (tCO_2e),

$BE_{WHB,y}$ - Baseline Emissions due to burning of the waste heaps in the year *y* (tCO_2).

These, in turn, are calculated as:

$$BE_{Coal,y} = FC_{BE,Coal,y} \cdot NCV_{Coal} \cdot OXID_{Coal} \cdot k^C_{Coal} \cdot 44/12,$$ (Equation 2)

where:

$FC_{BE,Coal,y}$ - amount of coal that has been mined in the baseline scenario and combusted for energy use, equivalent to the amount of coal extracted from the waste heaps in the project activity in the year *y*, t.

$$BE_{CH_4,y} = FC_{BE,Coal,y} \cdot EF_{CH_4,CM} \cdot \rho_{CH_4} \cdot GWP_{CH_4},$$ (Equation 3)

where:

$EF_{CH_4,CM}$ - Emission factor for fugitive methane emissions from coal mining (m^3/t). This is equal to 25.67 m^3/t according to the relevant study[14].

[13] "*IPCC Second Assessment: Climate Change 1995. A Report of the Intergovernmental Panel on Climate Change*".Bolin, B. et al. (1995). IPCC website. http://www.ipcc.ch/pdf/climate-changes-1995/ipcc-2nd-assessment/2nd-assessment-en.pdf.

$$BE_{WHB} = FC_{BE,Coal,y} \cdot p_{WHB} \cdot NCV_{Coal} \cdot OXID_{Coal} \cdot k^{C}_{Coal} \cdot 44/12,$$ (Equation 4)

where:

p_{WHB} - Probability of waste heap burning. This number is taken from the study[15] of waste heaps in Donetsk region and is defined as the ratio of waste heaps that are or have been on fire historically to all existing waste heaps of Donetsk region. This ratio is equal to 0.78 according to this study.

Key information and data used to establish the baseline are provided below in tabular form:

Data/Parameter	$FC_{BE,Coal,y}$
Data unit	t
Description	Amount of coal that has been mined in the baseline scenario and combusted for energy use, equivalent to the amount of coal extracted from the waste heaps in the project activity in the year *y*.
Time of determination/monitoring	Yearly monitoring.
Source of data (to be) used	Project owner records
Value of data applied (for ex ante calculations/determinations)	As provided by the project owner
Justification of the choice of data or description of measurement methods and procedures (to be) applied	Measured for the commercial purposes on site.
QA/QC procedures (to be) applied	According to the project owner policy.
Any comment	No

Data/Parameter	$EF_{CH_4,CM}$
Data unit	m^3/t
Description	Emission factor for fugitive methane emissions from coal mining.
Time of determination/monitoring	Fixed ex ante.
Source of data (to be) used	*National Inventory Report of Ukraine 1990-2007*, p.75 http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/zip/ukr_2009_nir_25may.zip
Value of data applied (for ex ante calculations/determinations)	25,67
Justification of the choice of data or description of measurement methods and	Default emission factor established according to the national report.

[14] *National Inventory Report of Ukraine 1990-2007*, p. 75 http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/zip/ukr_2009_nir_25may.zip

[15] *Report on the fire risk of Donetsk Region's waste heaps*, Scientific Research Institute "Respirator", Donetsk, 2009. This is a proprietary study that will be made available to the accredited independent entity.

procedures (to be) applied	
QA/QC procedures (to be) applied	According to the annual National Inventory Report.
Any comment	No

Data/Parameter	p_{WHB}
Data unit	ratio
Description	Probability of waste heap burning.
Time of determination/monitoring	Fixed ex ante.
Source of data (to be) used	Proprietary study
Value of data applied (for ex ante calculations/determinations)	0,78
Justification of the choice of data or description of measurement methods and procedures (to be) applied	This number is taken from the study of waste heaps in Donetsk region and is defined as the ratio of waste heaps that are or have been on fire historically to all existing waste heaps of Donetsk region. This ratio is equal to 0,78 according to this study.
QA/QC procedures (to be) applied	Standard procedures are used.
Any comment	No

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:

According to Paragraph 2 of Annex 1 to the JISC Guidance, approach C has been selected for demonstration of this project's additionality:

(c) Application of the most recent version of the ìTool for the demonstration and assessment of additionalityî approved by the CDM Executive Board (allowing for a grace period of two months when the PDD is submitted for publication on the UNFCCC JI website), or any other method for proving additionality approved by the CDM Executive Board.;[16]

The most recent "Tool for the demonstration and assessment of additionality" (version 05.2)[17] is applied to prove that the anthropogenic emissions are reduced below those that would have occurred in the absence of the JI project.

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

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

Alternative 1. Coal extraction from waste heaps without JI incentives

This scenario is similar to the project activity, only in this case, the project is not benefiting from the possible development as a joint implementation project. In this scenario waste heaps are processed in

[16] *Guidance For Criteria On Baseline Setting And Monitoring*, Joint Implementation Supervisory Committee, Annex 1, Paragraph 2.

[17] http://cdm.unfccc.int/methodologies/PAmethodologies/AdditionalityTools/Additionality_tool.pdf

order to extract coal and used it the energy sector. Less coal is produced by underground mines of the region.

Alternative 2. Continuation of existing situation

In the current situation waste heaps are not utilised. The spontaneous self-heating and subsequent burning of waste heaps is very common and measures to extinguish fire are taken sporadically. Burning waste heaps are sources of uncontrolled green-house gas emissions. Coal is not extracted from the waste heaps. Coal is produced by underground mines of the region and used for energy production or other purposes. Coal mining activities cause emissions of fugitive methane and also the formation of new waste-heaps.

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

Please refer to section B.1. of this document where it is shown that identified alternatives are in compliance with mandatory legislation and regulations taking into account the enforcement of such in Ukraine.

Step 2: Investment analysis

The investment analysis in line with the "Tool for the demonstration and assessment of additionality" version 05.2 (further in the text CDM Additionality Tool ver.05.2) should determine whether the proposed project activity is not:

a) The most economically or financially attractive; or
b) Economically of financially feasible without revenue from the sales of CERs (ERUs for JI).

In analysis provided below option (b) will be considered.

Sub-step 2a: Determine appropriate analysis method

Option III – benchmark analysis will be considered here for a number of reasons:

1. As soon as the JI project generates financial benefits other than JI related income, the simple cost analysis (Option I) cannot be applied;
2. The above identified alternatives to the JI project activities are realistic and apart from continuation of the existing situation (which requires no investment) consist of implementation of this project without JI incentives, therefore, Option II – investment comparison analysis is not applicable.

Sub-step 2b: Option III. Apply benchmark analysis

For the benchmark analysis the indicator of Net Present Value (NPV) was used. The goal of analysis will be to show that the project activity not undertaken as a joint implementation project will not be financially attractive and will lead to negative value of NPV. This benchmark has been selected for a number of reasons:

3. Internal Rate of Return (IRR) cannot be applied to some of the cashflows under consideration, because alternating negative and positive cashflows do not allow IRR mathematically calculated;
4. The project owner does not have formalized internal benchmark that is systematically applied during project evaluation;
5. No governmental approved benchmark is available for projects of this kind in Ukraine;

6. Positive/negative NPV is a generally accepted project evaluation benchmark. Its use is encouraged by many project finance professionals, while IRR is considered to be controversial and is not recommended as the single benchmark for project evaluation[18].

The project cashflows and indicators are calculated for two separate investment decisions – constructions of unit "Snizhnyans'ka-1" and unit "Snizhnyans'ka-2" respectively. "Snizhnyans'ka-1" (hereinafter referred to as S1) unit was put into operation in 2004; therefore the date of making investment decision for this unit is in 2004. "Snizhnyans'ka-2" unit (referred to as S2) was already envisaged back in 2005, as the working design for it was prepared at that time, however the project participants decided to delay construction of the second unit until the uncertainty of the performance of the first unit and success of joint implementation component was proven. It is now planned to put the second unit into operation in 2010. The analysis will treat these two investments separately.

Following assumptions were used for the calculation of cashflows and indicators:

1) Prices, tariffs and costs for the S1 are fixed as of 1st of December 2004 and for S2 as of 1st of June 2008 as these are the dates of the investments decisions taken for respective units;
2) Project lifetime is 2004-2010 for S1 and 2010-2017 for S2 based on the physical expected depletion of the waste heaps that will be processed. This lifetime includes construction and decommission.
3) Discount rate for NPV calculation is taken as a bond rate for state bonds issued by the Ministry of Finance of Ukraine. The closest available issues are taken as a reference. No risk premium is applied as no credible source can be provided to justify the selection of risk premium. This is conservative for the approach chosen.

Sub-step 2c: Calculation and comparison of financial indicator:

The Table 3 below demonstrates financial indicator calculated for the project activity.

Table 6 Financial indicators

#	Project activity	NPV, Euro
1	Construction of "Snizhnyans'ka-1" unit	- 1 264 169
2	Construction of "Snizhnyans'ka-2" unit	- 890 740
3	Construction of S1 and S2 unit together as of 2004	- 2 383 278

As it can be seen from the table all possible project activities result in negative NPV under current conservative discount rate. This means that any investor wishing to invest into such project will lose value of his investment instead of increasing it.

Sub-step 2d: Sensitivity analysis:

The sensitivity analysis is supposed to demonstrate the robustness of preliminary conclusions made in the previous section. As suggested in the Guidance on the Assessment of Investment Analysis contained in the CDM Additionality Tool ver.05.2, variations of the key factors in the sensitivity analysis cover a range of +10% and –10%. All influencing factors are included in the analysis and both increase and decrease in value is analyzed to demonstrate stronger robustness.

Results of the analysis are provided in the table 4 below.

[18] *Principles of Corporate Finance* 7th edition, Richard A. Brealey, Stewart C. Myers, McGraw-Hill Higher Education, 2003 – p. 105

Table 7 Sensitivity analysis

Indicators	Investment cost				
	-10%	-5%	0	5%	10%
NPV S1, EUR	-1 123 973	-1 194 071	-1 264 169	-1 334 267	-1 404 365
NPV S2, EUR	-627 402	-759 071	-890 740	-1 022 408	-1 154 077
	Coal prices				
	-10%	-5%	0	5%	10%
NPV S1, EUR	-1 707 599	-1 485 884	-1 264 169	-1 042 454	-820 739
NPV S2, EUR	-2 220 069	-1 555 404	-890 740	-226 075	438 589
	Fuel prices				
	-10%	-5%	0	5%	10%
NPV S1, EUR	-1 207 239	-1 235 704	-1 264 169	-1 292 634	-1 321 099
NPV S2, EUR	-579 640	-735 190	-890 740	-1 046 290	-1 201 840
	Electricity tariffs				
	-10%	-5%	0	5%	10%
NPV S1, EUR	-1 227 651	-1 245 910	-1 264 169	-1 282 428	-1 300 687
NPV S2, EUR	-779 115	-834 927	-890 740	-946 552	-1 002 364
	Fixed costs				
	-10%	-5%	0	5%	10%
NPV S1, EUR	-621 643	-934 452	-1 264 169	-1 610 795	-1 974 329
NPV S2, EUR	-152 601	-521 670	-890 740	-1 259 809	-1 628 878

As we can see from the table, the project does not reach positive NPV under any of the varying assumptions. The only exception is the coal price for S2 unit going up from its original value taken for evaluation. But the overall NPV for the entire project remains negative.

Thus, the sensitivity analysis results presented above demonstrate the robustness of conclusions made in sub-step 2c. It can be concluded that project activity is unlikely to be financially/economically attractive.

Step 4. Common practice analysis

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

No activities similar to the proposed project activity are observed in Ukraine. Waste heaps are considered as increased safety risk waste objects. In only a limited number of cases some minor fire extinguishing measures are taken but generally no actions are taken to secure the coal mining waste heaps. Waste heaps rich in coal are often target for uncontrolled amateur coal extraction by local population. These activities lead to increased fire risk and expose local population to increased air pollution. Extracting coal from wastes is practiced by some coke beneficiation plants but they extract coal from organized slurry ponds and those activities are scarce.

Sub-step 4b: Discuss any similar Options that are occurring:

There are no similar activities that can be observed in Ukraine. Extraction of coal from the slurry ponds does not face risk of uncertainty regarding the coal content and is technologically a different process.

The facts mentioned above allow concluding that the proposed JI project is not common practice.

Conclusion: This JI project provides a reduction in emissions that is additional to any that would otherwise occur.

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

The project activities are physically limited to the waste heaps in the legal use of limited society "Anthracite". At the same time, some sources of GHG emissions are indirect – fugitive methane emissions as the result of coal mining in Ukraine, carbon dioxide emissions due to the consumption of power from the Ukrainian electricity grid, as a result of electricity generation using fossil fuels.

The table below shows an overview of all emission sources in the baseline and project scenarios. Project boundary has been delineated in accordance with provisions of Articles 11, 12, 13 of the JISC Guidance.

Table 8 Sources of emissions in the baseline and project scenarios

	Source	Gas	Included/Excluded	Justification / Explanation
Baseline	Waste heap burning	CO_2	Included	Main emission source
	Emissions from coal mining activities	CH_4	Included	Fugitive emissions. Main emission source
	Coal consumption	CO_2	Included	Main emission source. This coal is displaced in the project activity by the coal extracted from the waste heaps
Project scenario	Coal consumption	CO_2	Included	Main emission source. This coal is extracted from the waste heaps.
	Electricity use for the process of coal extraction from the waste heap	CO_2	Included	Main emission source
	Fossil fuel (diesel) consumption for the process of coal extraction from the waste heap	CO_2	Included	Main emission source

Baseline scenario

The baseline scenario is the continuation of the existing situation. Coal is produced by the underground mines causing fugitive methane emissions and used for energy generation. Waste heaps are often self-heating and burning causing carbon dioxide emissions into the atmosphere. Emission sources in the baseline are:

- Fugitive methane emissions during the underground coal mining,
- Carbon dioxide emissions due to the coal consumption for the production of energy,
- Carbon dioxide emissions from the burning of coal in the waste heaps.

Project scenario

In the project scenario waste heaps under processing are taken down and all combustible matter is extracted. Therefore, the possibility of emissions due to spontaneous self-heating and burning of these waste heaps is eliminated. Project activity anticipates combustion of auxiliary diesel fuel to supply coal extraction plant with rock from the waste heaps. Electricity is used to run the project equipment. Additional coal provided by the project reduces the need for coal to be mined from underground. Emission sources in the project scenario:

- Carbon dioxide emissions from the use of fuel to run part of the project equipment (motor cars),
- Carbon dioxide emissions associated with the electricity consumption by the project equipment,
- Carbon dioxide emissions due to the coal consumption for the production of energy.

The following figures show the project boundaries and sources of emissions in the baseline scenario and in the project scenario.

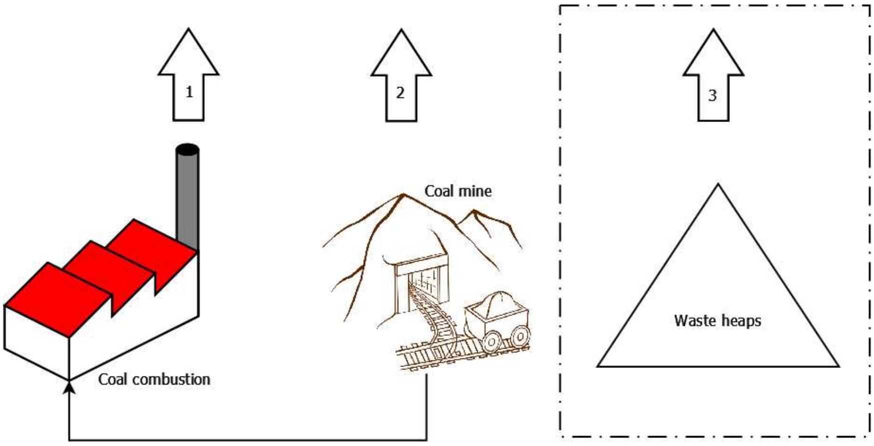

Figure 3. Project boundaries in the baseline scenario

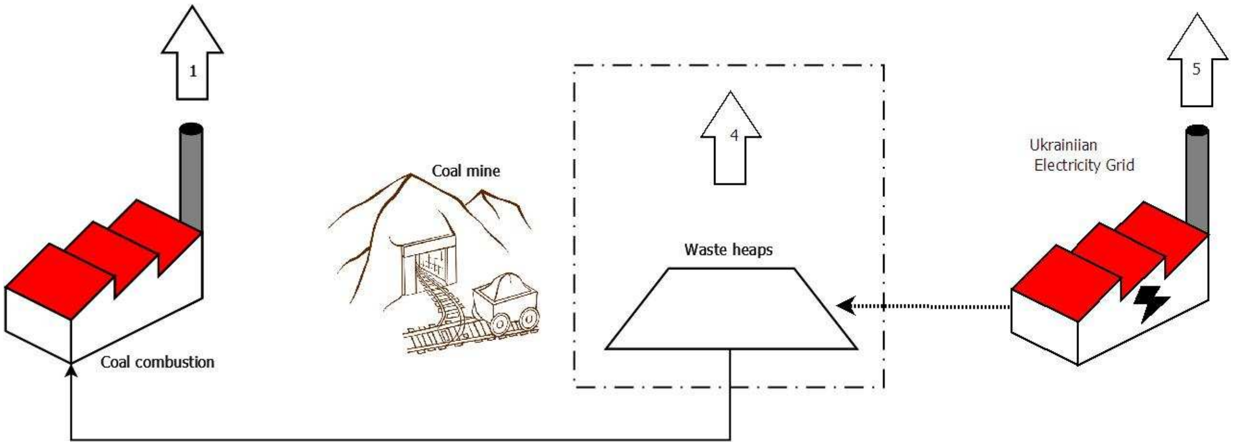

Figure 4. Project boundaries in the project scenario

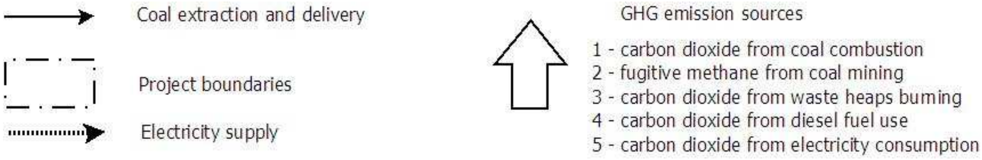

Figure 5 Legend for project boundary schematics

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

Date of completion of the baseline study: 22nd of October 2009

Name of person/entity determining the baseline:

Global Carbon B.V.

Denis Prusakov

For the contact details please refer to Annex 1.

SECTION C. Duration of the project / crediting period

C.1. Starting date of the project:

Starting date of the project is 1st of January 2005.

C.2. Expected operational lifetime of the project:

The lifetime of the project is estimated to last until the end of 2017. Thus the operational lifetime of the project will be 13 years or 156 months.

C.3. Length of the crediting period:

Start of the crediting period: 01/01/2008.
Length of crediting period: 5 years or 60 months.

Emission reductions generated after the crediting period may be used in accordance with an appropriate mechanism under the UNFCCC.

Emission reductions generated after the starting date of the project but before the start of the crediting period can be claimed and used in accordance with the procedures of the Host Party.

SECTION D. Monitoring plan

D.1. Description of monitoring plan chosen:

In order to provide a detailed description of the monitoring plan chosen a step-wise approach is used:

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

Option *a* provided by the Guidelines For The Users Of The Joint Implementation Project Design Document Form, Version 04[19] is used: JI specific approach is used in this project and therefore will be used for establishment of monitoring plan.

Step 2. Application of the approach chosen

Baseline emissions

The baseline scenario is the continuation of the existing situation. Coal is produced by the underground mines causing fugitive methane emissions and used for energy generation. Waste heaps are often self-heating and burning causing carbon dioxide emissions into the atmosphere. Emission sources in the baseline are:

- Fugitive methane emissions during the underground coal mining,
- Carbon dioxide emissions due to the coal consumption for the production of energy,
- Carbon dioxide emissions from the burning of coal in the waste heaps.

Project emissions

In the project scenario waste heaps being processed are removed and all combustible matter is extracted from them. Therefore, the possibility of emissions due to spontaneous self-heating and burning of these waste heaps is eliminated. Project activity anticipates combustion of auxiliary diesel fuel to supply coal extraction plant with rock from the waste heaps. Electricity is used to run the project equipment. Additional coal provided by the project reduces the need for coal to be mined from underground. Emission sources in the project scenario:

- Carbon dioxide emissions from the use of fuel to run part of the project equipment (motor cars),
- Carbon dioxide emissions associated with the electricity consumption by the project equipment,

[19] http://ji.unfccc.int/Ref/Documents/Guidelines.pdf

- Carbon dioxide emissions due to the coal consumption for the production of energy.

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

Table 9 List of constants used in the calculations of emissions

Data / Parameter	***Data unit***	***Description***	***Data Source***	***Value***
GWP_{CH4}		Global Warming Potential of Methane	IPCC Second Assessment Report[20]	21
ρ_{CH4}	t/m^3	Methane density	Standard (at room temperature 20˚C and 1 ATM)	0.00067
NCV_{Coal}	TJ/kt	Net Calorific Value of coal	National Inventory Report of Ukraine 1990-2007, p. 266	21.95
NCV_{Diesel}	TJ/kt	Net Calorific Value of diesel fuel	National Inventory Report of Ukraine 1990-2007, p. 266	42.44
$OXID_{Coal}$	ratio	Carbon Oxidation factor of coal	National Inventory Report of Ukraine 1990-2007, p. 273	0.98
$OXID_{Diesel}$	ratio	Carbon Oxidation factor of diesel fuel	Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories: Workbook, Energy, p. 1-8	0.99
k^C_{Diesel}	tC/TJ	Carbon content of diesel fuel	National Inventory Report of Ukraine 1990-2007, p. 272	20.2
k^C_{Coal}	tC/TJ	Carbon content of coal	National Inventory Report of Ukraine 1990-2007, p. 272	26.8

[20] "*IPCC Second Assessment: Climate Change 1995. A Report of the Intergovernmental Panel on Climate Change*".Bolin, B. et al. (1995). IPCC website. http://www.ipcc.ch/pdf/climate-changes-1995/ipcc-2nd-assessment/2nd-assessment-en.pdf.

$EF_{CO2,EL,y}$	tCO2/MWh	CO2 emission factor for electricity consumed by the project activity in year y equal to emission factor of Ukrainian grid for reducing projects.	See Annex 2. Emission factor is fixed ex ante.	0.896
$EF_{CH_4,CM}$	m3/t	Emission factor for fugitive methane emissions from coal mining	National Inventory Report of Ukraine 1990-2007, p.75	25.67
p_{WHB}	ratio	Probability of waste heap burning	Proprietary study21	0.78

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	PE_y - Project Emissions due to project activity in the year y	Monitoring of GHG emissions in year y	tCO_2e	c	yearly	100%	Electronic and paper	Calculated using the formulae in Section D.1.1.2
2	$PE_{Coal,y}$ - Project Emissions due to combustion	Monitoring of GHG emissions in year y	tCO_2e	c	yearly	100%	Electronic and paper	Calculated using the formulae in Section D.1.1.2

[21] *Report on the fire risk of Donetsk Region's waste heaps*, Scientific Research Institute "Respirator", Donetsk, 2009. This is a proprietary study that will be made available to the accredited independent entity.

	of coal for energy needs in the project activity in the year y							
3	$PE_{EL,y}$ - Project Emissions due to consumption of electricity from the grid by the project activity in the year y	Monitoring of GHG emissions in year y	tCO_2e	c	yearly	100%	Electronic and paper	Calculated using the formulae in Section D.1.1.2
4	$PE_{Diesel,y}$ Project Emissions due to consumption of diesel fuel by the project activity in the year y	Monitoring of GHG emissions in year y	tCO_2e	c	yearly	100%	Electronic and paper	Calculated using the formulae in Section D.1.1.2
5	$FC_{PJ,Coal,y}$ - Amount of coal that has been extracted from the waste heaps and combusted for energy use in the project	Company records, weights	t	m	monthly	100%	Electronic and paper	Equal to $FC_{BE,Coal,y}$

	activity in the year y							
6	$EC_{PJ,y}$ -	Company records, electricity meters	MWh	m	continuously with monthly totals	100%	Electronic and paper	
7	$FC_{PJ,Diesel,y}$ - Amount of diesel fuel that has been used for the project activity in the year y	Company records	t	m	monthly	100%	Electronic and paper	
8	NCV_{Coal} - Net Calorific Value of coal	See section D.1. Fixed ex ante	TJ/kt	e	Fixed ex ante	100%	Electronic	
9	$OXID_{Coal}$ - Carbon Oxidation factor of coal	See section D.1. Fixed ex ante	ratio	e	Fixed ex ante	100%	Electronic	
10	k_{Coal}^{C} - Carbon content of coal	See section D.1. Fixed ex ante	tC/TJ	e	Fixed ex ante	100%	Electronic	
11	$EF_{CO2,EL,y}$ - CO2 emission factor for electricity consumed by the project activity in year	See section D.1. Fixed ex ante	tC/TJ	e	Fixed ex ante	100%	Electronic	

	y equal to emission factor of Ukrainian grid for reducing projects.							
12	NCV_{Diesel} - Net Calorific Value of diesel fuel.	See section D.1. Fixed ex ante	TJ/kt	e	Fixed ex ante	100%	Electronic	
13	$OXID_{Diesel}$ - Carbon Oxidation factor of diesel fuel.	See section D.1. Fixed ex ante	ratio	e	Fixed ex ante	100%	Electronic	
14	k^{C}_{Diesel} - Carbon content of diesel fuel.	See section D.1. Fixed ex ante	tC/TJ	e	Fixed ex ante	100%	Electronic	

The table above includes data and parameters that are monitored throughout the crediting period.

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

Emissions from the project activity are calculated as follows:

$$PE_y = PE_{Coal,y} + PE_{EL,y} + PE_{Diesel,y},$$ (Equation 5)

where:

PE_y, - Project Emissions due to project activity in the year *y* (tCO_2e),

$PE_{Coal,y}$ - Project Emissions due to combustion of coal for energy needs in the project activity in the year *y* (tCO_2e),

$PE_{EL,y}$ - Project Emissions due to consumption of electricity from the grid by the project activity in the year *y* (tCO_2e),

$PE_{Diesel,y}$ - Project Emissions due to consumption of diesel fuel by the project activity in the year *y* (tCO_2e).

These, in turn, are calculated as:

$$PE_{Coal,y} = FC_{PJ,Coal,y} \cdot NCV_{Coal} \cdot OXID_{Coal} \cdot k^{C}_{Coal} \cdot 44/12, \quad \text{(Equation 6)}$$

where:

$FC_{PJ,Coal,y}$ - Amount of coal that has been extracted from the waste heaps and combusted for energy use in the project activity in the year *y*, t.

$$PE_{EL,y} = EC_{PJ,y} \cdot EF_{CO2,EL,y}, \quad \text{(Equation 7)}$$

where:

$EC_{PJ,y}$ - Additional electricity consumed in year *y* as a result of the implementation of the project activity (MWh),

$EF_{CO2,EL,y}$ - CO2 emission factor for electricity consumed by the project activity in year *y* equal to emission factor of Ukrainian grid for reducing projects (tCO_2/MWh).

$$PE_{Diesel,y} = FC_{PJ,Diesel,y} \cdot NCV_{Diesel} \cdot OXID_{Diesel} \cdot k^{C}_{Diesel} \cdot 44/12, \quad \text{(Equation 8)}$$

where:

$FC_{PJ,Diesel,y}$ - Amount of diesel fuel that has been used for the project activity in the year *y*, t.

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

1	BE_y, - Baseline Emissions in the year *y*	Monitoring of GHG emissions in year y	tCO_2e	c	yearly	100%	Electronic and paper	Calculated using the formulae in Section D.1.1.4
2	$BE_{Coal,y}$ - Baseline Emissions due to combustion of coal for energy needs in the baseline scenario in the year *y*	Monitoring of GHG emissions in year y	tCO_2e	c	yearly	100%	Electronic and paper	Calculated using the formulae in Section D.1.1.4
3	$BE_{CH_4,y}$ - Baseline Emissions due to fugitive emissions of methane in the mining activities in the year *y*	Monitoring of GHG emissions in year y	tCO_2e	c	yearly	100%	Electronic and paper	Calculated using the formulae in Section D.1.1.4
4	$BE_{WHB,y}$ - Baseline Emissions due to burning of the waste heaps in the year *y*	Monitoring of GHG emissions in year y	tCO_2e	c	yearly	100%	Electronic and paper	Calculated using the formulae in Section D.1.1.4

5	$FC_{BE,Coal,y}$ - Amount of coal that has been mined in the baseline scenario and combusted for energy use, equivalent to the amount of coal extracted from the waste heaps in the project activity in the year y	Company records, weights	t	m	monthly	100%	Electronic and paper	Equal to $FC_{PJ,Coal,y}$
6	NCV_{Coal} - Net Calorific Value of coal	See section D.1. Fixed ex ante	TJ/kt	e	Fixed ex ante	100%	Electronic	
7	$OXID_{Coal}$ - Carbon Oxidation factor of coal	See section D.1. Fixed ex ante	ratio	e	Fixed ex ante	100%	Electronic	
8	k^{C}_{Coal} - Carbon content of coal	See section D.1. Fixed ex ante	tC/TJ	e	Fixed ex ante	100%	Electronic	
9	NCV_{Diesel} - Net Calorific Value of diesel fuel.	See section D.1. Fixed ex ante	TJ/kt	e	Fixed ex ante	100%	Electronic	

10	$OXID_{Diesel}$ - Carbon Oxidation factor of diesel fuel.	See section D.1. Fixed ex ante	ratio	e	Fixed ex ante	100%	Electronic	
11	k^{C}_{Diesel} - Carbon content of diesel fuel.	See section D.1. Fixed ex ante	tC/TJ	e	Fixed ex ante	100%	Electronic	
12	GWP_{CH4} - Global Warming Potential of Methane	See section D.1. Fixed ex ante		e	Fixed ex ante	100%	Electronic	
13	$EF_{CH_4,CM}$ - Emission factor for fugitive methane emissions from coal mining	See section D.1. Fixed ex ante	m3/t	e	Fixed ex ante	100%	Electronic	
14	ρ_{CH4} - Methane density	See section D.1. Fixed ex ante	t/m3	e	Fixed ex ante	100%	Electronic	
15	p_{WHB} - Probability of waste heap burning	See section D.1. Fixed ex ante	ratio	e	Fixed ex ante	100%	Electronic	

The table above includes data and parameters that are monitored throughout the crediting period.

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

Emissions in the baseline scenario are calculated as follows:

$$BE_y = BE_{Coal,y} + BE_{CH_4,y} + BE_{WHB,y}, \qquad \text{(Equation 9)}$$

where:

BE_y, - Baseline Emissions in the year *y* (tCO_2e),

$BE_{Coal,y}$ - Baseline Emissions due to combustion of coal for energy needs in the baseline scenario in the year *y* (tCO_2e),

$BE_{CH_4,y}$ - Baseline Emissions due to fugitive emissions of methane in the mining activities in the year *y* (tCO_2e),

$BE_{WHB,y}$ - Baseline Emissions due to burning of the waste heaps in the year *y* (tCO_2e).

These, in turn, are calculated as:

$$BE_{Coal,y} = FC_{BE,Coal,y} \cdot NCV_{Coal} \cdot OXID_{Coal} \cdot k^C_{Coal} \cdot 44/12, \qquad \text{(Equation 10)}$$

where:

$FC_{BE,Coal,y}$ - Amount of coal that has been mined in the baseline scenario and combusted for energy use, equivalent to the amount of coal extracted from the waste heaps in the project activity in the year *y*, t.

$$BE_{CH_4,y} = FC_{BE,Coal,y} \cdot EF_{CH_4,CM} \cdot \rho_{CH_4} \cdot GWP_{CH_4}, \qquad \text{(Equation 11)}$$

where:

$EF_{CH_4,CM}$ - Emission factor for fugitive methane emissions from coal mining (m^3/t). This is equal to 25,67 m^3/t according to the relevant study[22].

$$BE_{WHB} = FC_{BE,Coal,y} \cdot p_{WHB} \cdot NCV_{Coal} \cdot OXID_{Coal} \cdot k^C_{Coal} \cdot 44/12, \qquad \text{(Equation 12)}$$

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[22] *National Inventory Report of Ukraine 1990-2007*, p.74
http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/zip/ukr_2009_nir_25may.zip

where:

p_{WHB} - Probability of waste heap burning. This number is taken from the study[23] of waste heaps in Donetsk region and is defined as the ratio of waste heaps that are or have been on fire historically to all existing waste heaps of Donetsk region. This ratio is equal to 0,78 according to this study.

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

This section is left blank on purpose

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

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

This section is left blank on purpose

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

This section is left blank on purpose

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

Not applicable.

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[23] *Report on the fire risk of Donetsk Region's waste heaps*, Scientific Research Institute "Respirator", Donetsk, 2009. This is a proprietary study that will be made available to the accredited independent entity.

D.1.3.1. If applicable, please describe the data and information that will be collected in order to monitor leakage effects of the project:								
ID number *(Please use numbers to ease cross-referencing to D.2.)*	Data variable	Source of data	Data unit	Measured (m), calculated (c), estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment

This section is left blank on purpose.

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

This section is left blank on purpose.

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 annual emission reductions are calculated as follows:

$$ER_y = BE_y - PE_y \qquad \text{(Equation 13)}$$

where:

ER_y - Emissions reductions of the JI project in year y (tCO_2e);

BE_y - Baseline Emission in year y (tCO_2e);

PE_y - Project Emission in year y (tCO_2e);

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:

Collection and archiving of the information on the environmental impacts of the project will be done based on the approved EIA in accordance of the host Party legislation (see Section F.1)

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.
D.1.1.1. – ID 1-4	Low	These data are a calculation of project emissions
D.1.1.1. – ID 5	Low	These data are used in commercial activities of the company. The weights will be calibrated according to the procedures of the Host Party.
D.1.1.1. – ID 6	Low	The electricity meters will be calibrated according to the host Party's legislation.
D.1.1.1. – ID 7	Low	This data are used in the commercial activity of the company. Accounting documentation will be used.
D.1.1.1. – ID 8-14	Low	These data are fixed values and standard constants taken from reputable sources
D.1.1.3. – ID 1-4	Low	These data are a calculation of baseline emissions
D.1.1.3. – ID 5	Low	These data are used in commercial activities of the company. The weights will be calibrated according to the procedures of the Host Party.
D.1.1.3. – ID 6-15	Low	These data are fixed values and standard constants taken from reputable sources.

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

The project owner – limited society "Anthracite" will implement provisions of this monitoring plan into its organizational and quality management structure. For monitoring, collection, registration, visualization, archiving, reporting of the monitored data and periodical checking of the measurement devices the management team headed by the Director Mr. Andrii Gogolev is responsible. A detailed structure of the team and team members will be established in the Monitoring Manual prior to initial and first verification. The principle structure presents on the following flow-chart:

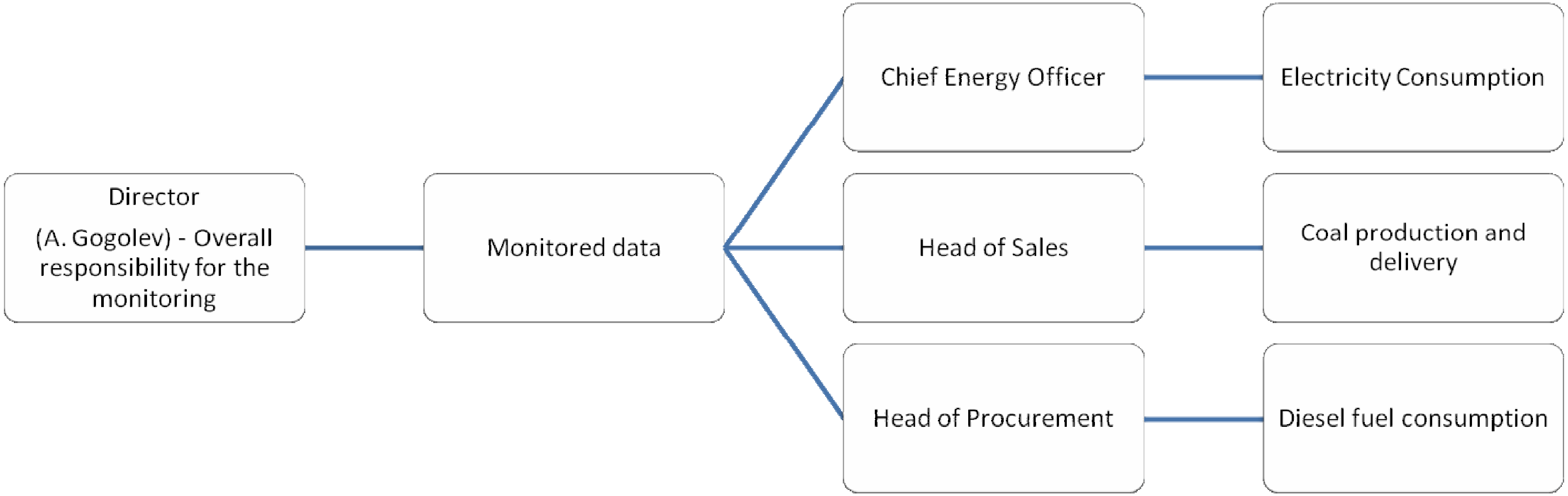

Figure 6 Monitoring flowchart

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

Global Carbon B.V.

Denis Prusakov, For the contact details please refer to Annex 1.

SECTION E. Estimation of greenhouse gas emission reductions

E.1. Estimated project emissions:

Table 10 Estimated project emissions during the crediting period

		2008	2009	2010	2011	2012	Total
Project emissions during the crediting period	[tCO2/yr]	107151	89128	44239	142650	131368	**514 537**

Table 11 Estimated project emissions after the crediting period

		2013-2017	Total
Project emissions after the crediting period	[tCO2]	656842	**656 842**

Table 12 Estimated project emissions before the crediting period

		2005-2007	Total
Project emissions before the crediting period	[tCO2]	434306	**434 306**

E.2. Estimated leakage:

Table 13 Estimated leakage during the crediting period

		2008	2009	2010	2011	2012	Total
Leakage during the crediting period	[tCO2/yr]	0	0	0	0	0	**0**

Table 14 Estimated leakage after the crediting period

		2013-2017	Total
Leakage after the crediting period	[tCO2]	0	**0**

Table 15 Estimated leakage before the crediting period

		2005-2007	Total
Leakage before the crediting period	[tCO2]	0	**0**

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

Table 16 Estimated total project emissions during the crediting period

		2008	2009	2010	2011	2012	Total
Project emissions during the crediting	[tCO2]	107151	89128	44239	142650	131368	**514 537**

period							

Table 17 Estimated total project emissions after the crediting period

		2013-2017	Total
Project emissions after the crediting period	[tCO2]	656842	**656 842**

Table 18 Estimated total project emissions before the crediting period

		2005-2007	Total
Project emissions before the crediting period	[tCO2]	434306	**434 306**

E.4. Estimated baseline emissions:

Table 19 Estimated baseline emissions during the crediting period

		2008	2009	2010	2011	2012	Total
Baseline emissions during the crediting period	[tCO2/yr]	200749	169784	82475	268045	247426	**968 479**

Table 20 Estimated baseline emissions after the crediting period

		2013-2017	Total
Baseline emissions after the crediting period	[tCO2]	1237130	**1 237 130**

Table 21 Estimated baseline emissions before the crediting period

		2005-2007	Total
Baseline emissions before the crediting period	[tCO2]	822440	**822 440**

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

Table 22 Estimated emission reductions during the crediting period

		2008	2009	2010	2011	2012	Total
Emission reductions during the crediting period	[tCO2/yr]	93598	80655	38236	125395	116058	**453 942**

Table 23 Estimated emission reductions after the crediting period

		2013-2017	Total
Emission reductions after the crediting period	[tCO2]	580288	**580 288**

Table 24 Estimated emission reductions before the crediting period

		2005-2007	Total

Baseline emissions before the crediting period	[tCO2]	388134	**388 134**

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

Table 25 Estimated balance of emissions under the proposed project over the crediting period

YEAR	Estimated Project Emissions (tonnes CO_2 Equivalent)	Estimated Leakage (tonnes CO2 Equivalent)	Estimated Baseline Emissions (tonnes CO_2 Equivalent)	Estimated Emissions Reductions (tonnes CO_2 Equivalent)
2008	107151	0	200749	93598
2009	89128	0	169784	80655
2010	44239	0	82475	38236
2011	142650	0	268045	125395
2012	131368	0	247426	116058
Total (tonnes CO_2 Equivalent)	**514 537**	**0**	**968 479**	**453 942**

Table 26 Estimated balance of emissions under the proposed project after the crediting period

YEAR	Estimated Project Emissions (tonnes CO_2 Equivalent)	Estimated Leakage (tonnes CO2 Equivalent)	Estimated Baseline Emissions (tonnes CO_2 Equivalent)	Estimated Emissions Reductions (tonnes CO_2 Equivalent)
2013	131368	0	247426	116058
2014	131368	0	247426	116058
2015	131368	0	247426	116058
2016	131368	0	247426	116058
2017	131368	0	247426	116058
Total (tonnes CO_2 Equivalent)	**656 842**	**0**	**1 237 130**	**580 288**

Table 27 Estimated balance of emissions under the proposed project before the crediting period

YEAR	Estimated Project Emissions (tonnes CO_2 Equivalent)	Estimated Leakage (tonnes CO2 Equivalent)	Estimated Baseline Emissions (tonnes CO_2 Equivalent)	Estimated Emissions Reductions (tonnes CO_2 Equivalent)
2005	142451	0	270898	128447
2006	160914	0	305340	144427
2007	130941	0	246201	115260
Total (tonnes CO_2 Equivalent)	**434 306**	**0**	**822 440**	**388 134**

SECTION F. Environmental impacts

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

The Host Party for this project is Ukraine. Environmental Impact Assessment (EIA) is the part of the Ukrainian project planning and permitting procedures. Implementation regulations for EIA are included in the Ukrainian State Construction Standard DBN A.2.2.-1-2003[24] (Title:"Structure and Contents of the Environmental Impact Assessment Report (EIR) for Designing and Construction of Production Facilities, Buildings and Structures").

Annex F of this standard contains a list of "types of projects or activities which constitute higher environmental risk" for which full EIA is mandatory, and the Ministry of Environment being the competent authority. Project activity, which is the utilization of coal mining waste and production of coal, is included in this list.

The full scope EIA in accordance with the Ukrainian legislation has been conducted for the proposed project in 2004-2005 by the local developer PE "Agency of environmental management and audit". Key findings of this EIA are summarized below:

- Impact on air is the main environmental impact of the project activity. Due to the project activity additional amount of coal dust and coal concentrate dust will be emitted into the atmosphere. However, the study of emission levels and disbursement patterns of the contaminators show that maximum concentration limits will not be exceeded throughout the project lifetime. Also, uncontrolled dust and hazardous substances emissions from the waste heap will be avoided;
- Impact on water is minor. The project activity will use water in a closed cycle without discharge of waste water. To feed the water cycle the drainage water from the nearby mine will be used. This will reduce the discharge of this water (treated with chlorine) into the environment;
- Impacts on flora and fauna are mixed. Due to the project activity the existing landscape will be changed but the overall resulting impact is positive. Grass and trees will be planted on the re-cultivated areas. No rare or endangered species will be impacted. Project activity is not located in the vicinity of national parks or protected areas;
- Noise impact is limited. Main source of noise will be located at the minimum required distance from residential areas, mobile noise sources (automobile transport) will be in compliance with local standards;
- Impacts on land use are positive. Significant portions of land will be freed from the waste heaps and will be available for development;
- Transboundary impacts are not observed. There are no impacts that manifest within the area of any other country and that are caused by a proposed project activity which wholly physically originates within the area of Ukraine.

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:

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[24] *State Construction Standard DBN A.2.2.-1-2003 :"Structure and Contents of the Environmental Impact Assessment Report (EIR) for Designing and Construction of Production Facilities, Buildings and Structures"* State Committee Of Ukraine On Construction And Architecture, 2004

An environmental impact assessment in accordance with the Ukrainian legislation has been conducted for the proposed project in 2004-2005 by the local developer PE "Agency of environmental management and audit":

- "Snizhnyans'ka-1" unit – EIA developed in 2004[25]. The findings of the report are summarized in the section F.1. above. The report has been reviewed by the expert ecologist's commission of the State Authority of Environment and Natural Resources in the Donetsk Region. This commission has issued an official Finding # C 04.08.186 of the compliance of the project documentation with the laws and regulations on environmental protection. The conclusion of this report states that: "The State Authority after studying the project of technogenically fractured land re-cultivation in the town of Snizhne considers the impact of project activity on environment as allowable and positively evaluates the project."[26]
- "Snizhnyans'ka-2" unit – EIA developed in 2005[27]. The findings of this report are close to the ones provided in the report for "Snizhnyans'ka-1" unit and integral evaluation of the environmental impact is acceptable. The report has been reviewed by the expert ecologist's commission of the State Authority of Environment and Natural Resources in the Donetsk Region. This commission has issued an official Finding # C 05.02.035 of the compliance of the project documentation with the laws and regulations on environmental protection. The conclusion of this report states that: "The State Authority after studying the project of breaking down the waste heaps #1 of the mine #32 "Podyomnaya", #2 of the mine "Severnaya-1", #3 of the mine "Severnaya-2" and re-cultivation of land in the town of Snizhne considers the impact of project activity on environment as allowable and positively evaluates the project."[28]

Completion of Environmental Impact Assessment reports and positive Findings of the State Authority of Environment and Natural Resources in the Donetsk Region conclude the procedure of the environmental impact assessment according to the Ukrainian laws and regulations.

[25] *Project of technogenically fractured land recultivation in the town of Snizhne. Explanatory Note. Environmental Impact Assessment. Book 1*. PE "Agency of environmental management and audit". Donetsk, 2004

[26] *Finding # C 04.08.186 of the compliance of the project documentation with the laws and regulations on environmental protection. Project of technogenically fractured land recultivation in the town of Snizhne.* Ministry of Environment and Natural Resources of Ukraine. State Authority of Environment and Natural Resources in the Donetsk Region

[27] *Project of breaking down the waste heaps #1 of the mine #32 "Podyomnaya", #2 of the mine "Severnaya-1", #3 of the mine "Severnaya-2" and recultivation of land in the town of Snizhne. Explanatory Note. Environmental Impact Assessment. Book 1*. PE "Agency of environmental management and audit". Donetsk, 2005

[28] *Finding # C 05.02.035 of the compliance of the project documentation with the laws and regulations on environmental protection. Project of breaking down the waste heaps #1 of the mine #32 "Podyomnaya", #2 of the mine "Severnaya-1", #3 of the mine "Severnaya-2" and recultivation of land in the town of Snizhne.* Ministry of Environment and Natural Resources of Ukraine. State Authority of Environment and Natural Resources in the Donetsk Region

SECTION G. Stakeholders' comments

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

No stakeholder consultation process for the JI projects is required by the Host Party. Stakeholder comments will be collected during the time of this PDD publication in the internet during the determination procedure.

Annex 1

CONTACT INFORMATION ON PROJECT PARTICIPANTS

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Represented by:	
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Annex 2

BASELINE INFORMATION

Table containing the key elements of the baseline

#	Parameter	Data unit	Source of data
1	$FC_{BE,Coal,y}$ - Amount of coal that has been mined in the baseline scenario and combusted for energy use, equivalent to the amount of coal extracted from the waste heaps in the project activity in the year y	t	Data of project owner
2	$EF_{CH_4,CM}$ Emission factor for fugitive methane emissions from coal mining.	m^3/t	*National Inventory Report of Ukraine 1990-2007*, p.75 http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/zip/ukr_2009_nir_25may.zip
3	p_{WHB} Probability of waste heap burning.	Dimentionless	*Report on the fire risk of Donetsk Region's waste heaps*, Scientific Research Institute "Respirator", Donetsk, 2009. This is a proprietary study that will be made available to the accredited independent entity.
4	GWP_{CH4} Global Warming Potential of Methane	Dimentionless	IPCC Second Assessment Report[29]
5	ρ_{CH4} Methane density	t/m^3	Standard (at room temperature 20˚C and 1 ATM)
6	NCV_{Coal} Net Calorific Value of coal	TJ/kt	National Inventory Report of Ukraine 1990-2007, p. 266
7	$OXID_{Coal}$ Carbon Oxidation factor of coal	Dimentionless	National Inventory Report of Ukraine 1990-2007, p.273
8	k^{C}_{Coal} Carbon content of coal	tC/TJ	National Inventory Report of Ukraine 1990-2007, p.272

[29] "*IPCC Second Assessment: Climate Change 1995. A Report of the Intergovernmental Panel on Climate Change*".Bolin, B. et al. (1995). IPCC website. http://www.ipcc.ch/pdf/climate-changes-1995/ipcc-2nd-assessment/2nd-assessment-en.pdf.

Standardized emission factors for the Ukrainian electricity grid

Introduction
Many Joint Implementation (JI) projects have an impact on the CO_2 emissions of the regional or national electricity grid. Given the fact that in most Economies in Transition (IET) an integrated electricity grid exists, a standardized baseline can be used to estimate the amount of CO_2 emission reductions on the national grid in case of:

a) Additional electricity production and supply to the grid as a result of a JI project (= producing projects);
b) Reduction of electricity consumption due to the JI project resulting in less electricity generation in the grid (= reducing projects);
c) Efficient on-site electricity generation with on-site consumption. Such a JI project can either be a), b), or a combination of both (e.g. on-site cogeneration with partial on-site consumption and partial delivery to the grid).

So far most JI projects in EIT, including Ukraine, have used the standardized Emission Factors (EFs) of the ERUPT programme. In the ERUPT programme for each EIT a baseline for producing projects and reducing projects was developed. The ERUPT approach is generic and does not take into account specific local circumstances. Therefore in recent years new standardized baselines were developed for countries like Romania, Bulgaria, and Estonia. In Ukraine a similar need exist to develop a new standardized electricity baseline to take the specific circumstances of Ukraine into account. The following baseline study establishes a new electricity grid baseline for Ukraine for both producing JI projects and reducing JI projects.

This new baseline has been based on the following guidance and approaches:
- The "Guidance on criteria for baseline setting and monitoring" for JI projects, issued by the Joint Implementation Supervisory Committee[30];
- The "Operational Guidelines for the Project Design Document", further referred to as ERUPT approach or baseline [31];
- The approved CDM methodology ACM0002 "Consolidated baseline methodology for grid-connected electricity generation from renewable sources" [32];
- Specific circumstances for Ukraine as described below.

ERUPT
The ERUPT baseline was based on the following main principles:
- Based mainly on indirect data sources for electricity grids (i.e. IEA/OECD reports);
- Inclusion of grid losses for reducing JI projects;
- An assumption that all fossil fuel power plants are operating on the margin and in the period of 2000-2030 all fossil fuel power plants will gradually switch to natural gas.

The weak point of this approach is the fact that the date sources are not specific. For example, the Net Calorific Value (NCV) of coals was not determined on installation level but was taken from IPCC default values. Furthermore the IEA data included electricity data until 2002 only. ERUPT assumes that Ukraine

[30] Guidance on criteria for baseline setting and monitoring, version 01, Joint Implementation Supervisory Committee, ji.unfccc.int

[31] Operational Guidelines for Project Design Documents of Joint Implementation Projects. Ministry of Economic Affairs of the Netherlands, May 2004
[32] Consolidated baseline methodology for grid-connected electricity generation from renewable sources, version 06, 19 May 2006, cdm.unfccc.int

would switch all its fossil-fuel plant from coal to natural gas. In Ukraine such an assumption is unrealistic as the tendency is currently in the opposite direction.

ACM0002
The ACM0002 methodology was developed in the context of CDM projects. The methodology takes a combination of the Operating Margin (OM) and the Build Margin (BM) to estimate the emissions in absence of the CDM project activity. To calculate the OM four different methodologies can be used. The BM in the methodology assumes that recent built power plants are indicative for future additions to the grid in the baseline scenario and as a result of the CDM project activity construction of new power plants is avoided. This approach is valid in electricity grids in which the installed generating capacity is increasing, which is mostly the case in developing countries. However, the Ukrainian grid has a significant overcapacity and many power plants are either operating below capacity or have been moth-balled.

Nuclear is providing the base load in Ukraine
In Ukraine nuclear power plants are providing the base load of the electricity in Ukraine. To reduce the dependence on imported fuel the nuclear power plants are running at maximum capacity where possible. In the past five years nuclear power plants provide almost 50% of the total electricity:

Year	2001	2002	2003	2004	2005
Share of AES	44%	45%	45%	48%	48%

Table 28: Share of nuclear power plant in the annual electricity generation

All other power stations are operating on the margin. This includes hydro power plants which is show in the table below.

	Minimum; 03:00	Maximum; 19:00
Consumption, MW	21,287	27,126
Generation, MW	22,464	28,354
Thermal power plants	*10,049*	*13,506*
Hydro power plants	*527*	*3,971*
Nuclear power plants	*11,888*	*10,877*
Balance imports/export, MW	-1,177	-1,228

Table 29: Electricity demand in Ukraine on 31 March 2005[33]

Development of the Ukrainian electricity sector
The National Energy Strategy[34] sets the approach for the overall energy complex of Ukraine and the electricity sector in particular. The main priority of Ukraine is to reduce the dependence of imported fossil fuels. The strategy sets the following priorities[35]:

- increased use of local coal as a fuel;
- construction of the new nuclear power plants;
- energy efficiency and energy saving.

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[33] Ukrenergo, http://www.ukrenergo.energy.gov.ua/ukrenergo/control/uk/publish/article?art_id=39047&cat_id=35061

[34] http://mpe.kmu.gov.ua/fuel/control/uk/doccatalog/list?currDir=50505

[35] Energy Strategy of Ukraine for the Period until 2030, section 16.1, page 127.

Due to the sharp increase of imported natural gas prices a gradual switch from natural gas to coal at the power plants is planned in the nearest future. Ukraine possesses a large overcapacity of the fossil-powered plants of which many are mothballed. These moth-balled plants might be connected to the grid in case of growing demand.

In the table below the installed capacity and load factor is given in Ukraine. As one can see the average load factor of thermal power plant is very low.

	Installed capacity (GW)	Average load factor, %
Thermal power plants	33.6	28.0
Hydro power plants	4.8	81.4
Nuclear power plants	13.8	26.0
Total	**52.2**	**39.0**

Table 30: Installed capacity in Ukraine in 2004[36]

According to IEA's estimations, about 25% of thermal units might not be able to operate (though there is no official statistics). This means that still at least 45% of the installed thermal power capacity could be utilized, but is currently not used. In accordance with the IEA report the 'current capacity will be sufficient to meet the demand in the next decade'[37].

In the table below the peak load of the years 2001- 2005 are given which is approximately 50% of the installed capacity.

	2001	2002	2003	2004	2005
Peak load (GW)	28.3	29.3	26.4	27.9	28.7

Table 31: Peak load in Ukraine in 2001 - 2005[38]

New nuclear power plants will take significant time to be constructed will not get on-line before the end of the second commitment period in 2012. There is no nuclear reactor construction site at such an advanced stage remaining in Ukraine, it is unlikely that Ukraine will have enough resources to commission any new nuclear units in the foreseeable future (before 2012)[39].

Latest nuclear additions (since 1991):
- Zaporizhzhya NPP unit 6, capacity 1 GW, commissioned in 1995;
- Rivne NPP unit 4, capacity 1 GW, commissioned in 2004;
- Khmelnitsky NPP unit 2, capacity 1 GW, commissioned in 2004.

Nuclear power plants under planning or at early stage of construction:
- South Ukraine NPP one additional unit, capacity 1 GW;
- Khmelnitsky NPP two additional units, capacity 1 GW each.

Approach chosen
In the selected approach of the new Ukrainian baseline the BM is not a valid parameter. Strictly applying BM in accordance with ACM0002 would result in a BM of zero as the latest additions to the Ukrainian

[36] Source: Ukraine Energy Policy Review. OECD/IEA, Paris 2006. p. 272, table 8.1

[37] Source: Ukraine Energy Policy Review. OECD/IEA, Paris 2006. p. 269

[38] Ministry of Energy, letter dated 11 January 2007

[39] http://www.xaec.org.ua/index-ua.html

grid were nuclear power plants. Therefore applying BM taking past additions to the Ukrainian grid would result in an unrealistic and distorted picture of the emission factor of the Ukrainian grid. Therefore the Operating Margin only will be used to develop the baseline in Ukraine.

The following assumptions from ACM0002 will be applied:
1) The grid must constitute of all the power plants connected to the grid. This assumption has been met as all power plants have been considered;
2) There should be no significant electricity imports. This assumption has been met in Ukraine as Ukraine is a net exporting country as shown in the table below;
3) Electricity exports are not accounted separately and are not excluded from the calculations.

	2001	2002	2003
Electricity produced, GWh	175,109	179,195	187,595
Exports, GWh	5,196	8,576	12,175
Imports, GWh	2,137	5,461	7,235

Table 32: Imports and exports balance in Ukraine[40]

ACM0002 offers several choices for calculating the OM. Dispatch data analysis cannot be applied, since the grid data is not available[41]. Simple adjusted OM approach is not applicable for the same reason. The average OM calculation 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 48% of the overall electricity generation during the past 5 years.

Therefore, the simple OM approach is used to calculate the grid emission factor. In Ukraine the low-cost must-run power plants are nuclear power stations. Their total contribution to the electricity production is below 50% of the total electricity production. The remaining power plants, all being the fossil-fuel plants and hydro power plants, are used to calculate the Simple OM.

%	2001	2002	2003	2004	2005
Nuclear power plants	44.23	45.08	45.32	47.99	47.92
Thermal power plants	38.81	38.32	37.24	32.50	33.22
Combined heat and power	9.92	11.02	12.28	13.04	12.21
Hydro power plants	7.04	5.58	5.15	6.47	6.65

Table 33: Share of power plants in the annual electricity generation of Ukraine[42]

[40] Source: State Committee of Statistics of Ukraine. Fuel and energy resources of Ukraine 2001-2003. Kyiv, 2004

[41] Ministry of Energy, letter dated 11 January 2007

[42] “Overview of data on electrical power plants in Ukraine 2001 - 2005“, Ministry of Fuel and Energy of Ukraine, 31 October 2006 and 16 November 2006.

The simple OM is calculated using the following formula:

$$EF_{OM,y} = \frac{\sum_{i,j} F_{i,j,y} \cdot COEF_{i,j}}{\sum GEN_{j,y}} \qquad \textit{(Equation 1)}$$

Where:

$F_{i,j,y}$ is the amount of fuel *i* (in a mass or volume unit) consumed by relevant power sources *j* in year(s) *y* (2001-2005);

j refers to the power sources delivering electricity to the grid, not including low-operating cost and must-run power plants, and including imports to the grid;

$COEF_{i,j,y}$ is the CO2 emission coefficient of fuel *I* (tCO2 / mass or volume unit of the fuel), taking into account the carbon content of the fuels used by relevant power sources *j* and the percent oxidation of the fuel in year(s) *y*;

$GEN_{j,y}$ is the electricity (MWh) delivered to the grid by source *j*.

The CO2 emission coefficient $COEF_i$ is obtained as:

$$COEF_i = NCV_i \cdot EF_{CO2,i} \cdot OXID_i \qquad \textit{(Equation 2)}$$

Where:

NCV_i is the net calorific value (energy content) per mass or volume unit of a fuel *i*;

$OXID_i$ is the oxidation factor of the fuel;

$EF_{CO2,i}$ is the CO2 emission factor per unit of energy of the fuel *i*.

Individual data for power generation and fuel properties was obtained from the individual power plants[43]. The majority of the electricity (up to 95%) is generated centrally and therefore the data is comprehensive[44].

The Net Calorific Value (NCV) of fossil fuel can change considerably, in particular when using coal. Therefore the local NCV values of individual power plants for natural gas and coal were used. For heavy fuel oil, the IPCC[45] default NCV was used. Local CO_2 emission factors for all types of fuels were taken for the purposes of the calculations and Ukrainian oxidation factors were used. In the case of small-scale power plants some data regarding the fuel NCV is missing in the reports. For the purpose of simplicity, the NCV of similar fuel from a power plant from the same region of Ukraine was used.

Reducing JI projects

The Simple OM is applicable for additional electricity production delivered to the grid as a result of the project (producing JI projects). However, reducing JI projects also reduce grid losses. For example a JI

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[43] "Overview of data on electrical power plants in Ukraine 2001 - 2005", Ministry of Fuel and Energy of Ukraine, 31 October 2006 and 16 November 2006.

[44] The data for small units (usually categorized in the Ukrainian statistics as 'CHPs and others') is scattered and was not always available. As it was rather unrealistic to collect the comprehensive data from each small-scale power plant, an average CO2 emission factor was calculated for the small-scale plants that provided the data. For the purpose of simplicity it was considered that all the electricity generated by the small power plants has the same average emission factor obtained.

[45] IPCC 1996. Revised guidelines for national greenhouse gas inventories.

project reduces on-site electricity *consumption* with 100,000 MWh and the losses in the grid are 10%. This means that the actual reduction in electricity *production* is 111,111 MWh. Therefore a reduction of these grid losses should be taken into account for reducing JI projects to calculate the actual emission reductions.

The losses in the Ukrainian grid are given in the table below and are based on the data obtained directly from the Ukrainian power plants through the Ministry of Energy.

Year	Technical losses %	Non-technical losses %	Total %
2001	14,2	7	21,2
2002	14,6	6,5	21,1
2003	14,2	5,4	19,6
2004	13,4	3,2	16,6
2005	13,1	1,6	14,7

Table 34: Grid losses in Ukraine[46]

As one can see grid losses are divided into technical losses and non-technical losses. For the purpose of estimating the EF only technical losses[47] are taken into account. As can been seen in the table the technical grid losses are decreasing. The average decrease of grid losses in this period was 0.275% per annum. Extrapolating these decreasing losses to 2012 results in technical grid losses of 12% by 2012. However, in order to be conservative the grid losses *over the full period 2006-2012* have been taken as 10%.

Further considerations

The "Guidance on criteria for baseline setting and monitoring" for JI projects requires baselines to be conservative. The following measures have been taken to adhere to this guidance and to be conservative:

- The grid emission factor is actually expected to grow due to the current tendency to switch from gas to coal;
- Hydro power plants have been included in the OM. This is conservative;
- With the growing electricity demand, out-dated mothballed fossil fired power plants are likely to come on-line as existing nuclear power plants are working on full load and new nuclear power plants are unlikely to come on-line before 2012. The emission factor of those moth-balled power plants is higher as all of them are coal of heavy fuel oil fired[48];
- The technical grid losses in Ukraine are high, though decreasing. With the current pace the grid losses in Ukraine will be around 12% in 2012. To be conservative the losses have been taken 10%;
- The emissions of methane and nitrous oxide have not taken into consideration, which is in line with ACM0002. This is conservative.

Conclusion

An average CO_2 emission factor was calculated based on the years 2003-2005. The proposed baseline factors is based on the average constituting a fixed emission factor of the Ukrainian grid for the period of 2006-2012. Both baseline factors are calculated using the formulae below:

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[46] "Overview of data on electrical power plants in Ukraine 2001 - 2005", Ministry of Fuel and Energy of Ukraine, 31 October 2006 and 16 November 2006.

[47] Ukrainian electricity statistics gives two types of losses – the so-called 'technical' and 'non-technical'. 'Non-technical' losses describe the non-payments and other losses of unknown origin.

[48] "Overview of data on electrical power plants in Ukraine 2001 - 2005", Ministry of Fuel and Energy of Ukraine, 31 October 2006 and 16 November 2006.

$$EF_{grid,produced,y} = EF_{OM,y}$$ *(Equation 3)*

and

$$EF_{grid,reduced,y} = \frac{EF_{grid,produced,y}}{1 - loss_{grid}}$$ *(Equation 4)*

Where:

$EF_{grid,produced,y}$ is the emission factor for JI projects supplying additional electricity to the grid (tCO2/MWh);
$EF_{grid,reduced,y}$ is the emission factor for JI projects reducing electricity consumptionfrom the grid (tCO2/MWh)factor of the fuel;
$EF_{OM,y}$ is the simple OM of the Ukrainian grid (tCO2/MWh);
$loss_{grid}$ is the technical losses in the grid (%).

The following result was obtained:

Type of project	**Parameter**	**EF (tCO2/MWh)**
JI project producing electricity	$EF_{grid,produced,y}$	0.807
JI projects reducing electricity	$EF_{grid,reduced,y}$	0.896

Table 35: Emission Factors for the Ukrainian grid 2006 - 2012

Monitoring

This baseline requires the monitoring of the following parameters:

- Electricity produced by the project and delivered to the grid in year y (in MWh);
- Electricity consumption reduced by the project in year (in MWh);
- Electricity produced by the project and consumed on-site in year y (in MWh);

The baseline emissions are calculated as follows:

$$BE_y = EF_{grid,produced,y} x EL_{produced,y} + EF_{grid,reduced,y} x \left(EL_{reduced,y} + EL_{consumed,y}\right)$$ *(Equation 5)*

Where:

BE_y are the baseline emissions in year y (tCO2);
$EF_{grid,produced,y}$ is the emission factor of producing projects (tCO2/MWh);
$EL_{produced,y}$ is electricity produced and delivered to the grid by the project in year y (MWh);
$EF_{grid,reduced,y}$ is the emission factor of reducing projects (tCO2/MWh);
$EL_{produced,y}$ is electricity consumption reduced by the project in year y(MWh);
$EL_{consumed,y}$ is electricity produced by the project and consumed on-site in year y (MWh).

This baseline can be used as ex-ante (fixed for the period 2006 – 2012) or ex-post. In case an ex-post baseline is chosen the data of the Ukrainian grid have to be obtained of the year in which the emission reductions are being claimed. Monitoring will have to be done in accordance with the monitoring plan of ACM0002 with the following exceptions:

- the Monitoring Plan should also include monitoring of the grid losses in year y;
- power plants at which JI projects take place should be excluded. Such a JI project should have been approved by Ukraine and have been determined by an Accredited Independent Entity.

Acknowledgements
The development of this new baseline has been made possible by funding of the EBRD and the Netherlands' Ministry of Economic Affairs. The authors would further like to thank the Ukrainian Ministry of Energy for supplying the data and the Ministry of Environmental Protection for their support.
This baseline study can be used freely in case of proper reference.

Global Carbon B.V.
Version 5, 2 February 2007

Industrie Service

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Ukraine - Assessment of new calculation of CEF

Introduction

Many Joint Implementation (JI) projects have an impact on the CO_2 emissions of the regional or national electricity grid. Given the fact that in most Economies in Transition an integrated electricity grid exists, a standardized baseline should be used to estimate the amount of CO_2 emission reductions on the national grid.

The Ukraine is one of the major JI host countries where many grid related projects have been developed or will be implemented. In order to enhance the project development and reliability in emission reductions from the Ukraine a standardized and common agreed grid factor expressing the carbondioxid density per kWh is crucial.

Objective

Global Carbon B.V. is one of the pioneers developing JI projects in Ukraine who has developed a baseline approach for determining the Ukrainian grid factor. The approach is implied from the approved CDM methodology ACM0002.

The team of Carbon Management Service (CMS) of TÜV SÜD Industrie Service GmbH with its accredited certification body "Climate and Energy" has been ordered to verify the developed approach and the calculated grid factor.

Once an approach is agreed it should be used for calculating the grid by using current available data served from the Ukraine Ministry for Fuel and Energy. Such annual grid factor shall be used as a binding grid factor for JI projects developed in the Ukraine.

Date: 17.08.2007

Our reference:
IS-USC-MUC/

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Scope

The baseline approach to which this confirmation is referring is attached. The confirmation includes the inherent approach if the algorithms are developed reasonable and from a technical point of view correct. Furthermore the verified the

The test results refer exclusively to the units under test.

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Our reference/Date: IS-USC-MUC/ / 17.08.2007

TÜV SÜD Industrie Service

origin of the data. The team consists of:

- Werner Betzenbichler (Head of the certification Body "Climate and Energy"),
- Thomas Kleiser (Head of division JI/CDM, GHG-Auditor and Project Manager)
- Markus Knödlseder (GHG-Auditor and Project Manager)

Mr. Kleiser and Betzenbichler assessed the baseline approach and agreed with Global Carbon on the conclusive approach. Mr. Kleiser and Mr. Knödlseder assessed the calculation model whereas Mr. Knödlseder interviewed also Mr. Nikolay Andreevich Borisov, Deputy Director for Strategic Development in Ministry of Fuel and Energy (+380 (44) 2349312 // bo-risov@mintop.energy.gov.ua) who explained the process of data gathering in the Ukraine. He also confirmed that GlobalCarbon B.V. uses the served data.

Conclusion

The conclusive assessment does not include potential uncertainties that might be occurred in the data gathering process of the ministry. Considering that we confirm that applied data served by Ministry of Fuel and Energy are reliable and correctly used.

Based on submitted calculation method, developed baseline study (see attachment), applied data and written confirmation from Ministry of Fuel and Energy (see attached documents) the team of Carbon Management Service of TÜV SÜD Industrie Service GmbH with its accredited certification body "Climate and Energy" confirms further that developed approach is eligible to determine the Ukrainian electricity grid factor as a standard value for JI project in the Ukraine.

The team recommends updating the calculation annually depending on point of time when national consolidated data are available.

Munich,17/08/2007

Markus Knödlseder
GHG-Auditor and Project Manager

Munich, 17/08/2007

Werner Betzenbichler
Head of the certification Body "Climate and Energy" and Carbon Management Service

Annex 3

MONITORING PLAN

For the monitoring plan please refer to section D of this PDD.

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