JOINT IMPLEMENTATION PROJECT DESIGN DOCUMENT FORM
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SECTION A. General description of the project

A.1. Title of the project:

"Improvement of the Energy efficiency at Energomashspetsstal (EMSS), Kramatorsk" – Ukraine.

Date 29 October 2007, version 2.2

A.2. Description of the project:

The envisaged JI project takes place as the production facilities of Energomashspetsstal (EMSS). The main scope of activity of EMSS is the production of special casting and forged steel forms for energy and transport machine building, power engineering, metallurgical, mining, cement and other industries in Ukraine and abroad (Russia, France, Belgium, Denmark).

The machine-building production sector is a highly energy intensive industry. Ukraine has inherited from the Soviet Union large machine-building production sector. The majority of the machine-building plants in Ukraine were constructed in the first part of 20^{th} century, but no major energy efficiency projects or refurbishment works were implemented in the machine-building sector of Ukraine during the past 15 years.

In the machine-building sector in Ukraine there is no policy in place which requires companies to reduce the CO_2 emissions.

The machine-building sector in Ukraine is facing significant competition from China and other countries. China has recently built several machine-building plants which will lower export opportunities for Ukrainian plants. Therefore Ukrainian machine-building companies need continuously to increase there competitiveness and market share in order to survive. The meagre investment climate creates additional burden for Ukrainian companies to attract capital and optimize their processes. Additionally the increasing price for natural gas in Ukraine decreases profitability of production of steel and steel details for machine-building in the sector.

EMSS produces and sells special casting and forged steel forms for energy and transport machine building, power engineering, metallurgical, mining, cement and other industries in Ukraine and abroad. With the planned modernization at the plant, EMSS wants to increase its production level and quality of steel forms to expand export.

The project activity consists of the improvement of the energy efficiency at the premise of EMSS by the implementation of seven subprojects:

Subproject 1. Reconstruction of thermal and heating furnaces – there are 35 thermal and heating furnaces in operation in different shops at the premises of EMSS. The main goal of this subproject is the reduction of the natural gas (NG) consumption on 19 of these furnaces by commissioning of new automated NG burners (this enables to maintain the required temperature inside of the furnace) and by implementation of new thermal insulation for the walls, front doors and roofs of the furnaces. The first sixteen furnaces (from the total 35) will be reconstructed to the end of 2007 and the other nineteen furnaces will be reconstructed from January 2008 to November 2009.

Subproject 2. Decrease of the time of thermal treatment of the forged details – Reduction of NG consumption by reduction of the time of treatment of the forged details. The time of treatment depends of the content and allocation of hydrogen inside of the details and after the installation of the system "arc ladle furnace", the initial content of hydrogen before the thermal treatment will be reduced from 2 to 1 ppm.

Subproject 3. Installation of a new vacuum system – Installation of a new vacuum system for the vacuumed steel production. The amount of vacuumed steel is in average 40% of the total steel produced. The existing vacuum system uses heat (1.16 MWh/t steel) and electricity (0.81 kWh/t steel). The new vacuum system will use only electricity (1.92 kWh/t steel).

Subproject 4. New steel slag making technology – Improvement of the steel coagulation (slag making) on the smelting process by using CaO like coagulant instead of $CaCO_3$. The result will be a lower heat demand of the process and avoidance of the CO_2 emissions from the process of disintegration of the $CaCO_3$ to CaO and CO_2.

Subproject 5. Installation of an arc ladle furnace – New arc ladle furnace will be installed for the steel production. This means that the part of the process of the steel preparation will be done in the ladle from which the steel will be cast into the forms. As a result there will be reduction of the electricity consumption (from 950 kWh/t electro steel to 852 kWh/t electro steel).

Subproject 6. New heating system – Replacing the old centralized heating system (using heat received from DHC Kramatorsk) by a new one – multiple small heating systems for the working places. The DHC Kramatorsk uses local coal as a fuel and there were big heat losses during heat delivery from DHC Kramatorsk to EMSS (10 km heat transmission line). The new heating system at EMSS will use natural gas and biomass like energy sources.

Subproject 7. Modernization of press equipment – Replacing the old pump system, serving the 15,000 ton press, with a new one, more effective pump system. The number of old pumps is 27 (with 500 kW installed capacity each), and the number of new pumps will be 22 (with 440 kW installed capacity each).

With the implementation of described energy efficiency measures, EMSS will be able to reduce direct and indirect CO_2 emissions at the production of steel and steel details. These emissions reductions can be sold as ERUs on the international emission reduction market.

A.3. Project participants:

Party involved	Legal entity project participant (as applicable)	Kindly indicate if the Party involved wishes to be considered as project participant (Yes/No)
Ukraine (Host party)	Open Joint Stock Company "Energomashspetsstal" (EMSS)	No
Netherlands	Global Carbon BV	No

Table A.3.1: Project participants

A.4. Technical description of the project:

A.4.1. Location of the project:

The physical location of the project is at the premise of Energomashspetsstal (EMSS) located in the town of Kramatorsk, Donetsk region, Ukraine.

Graph A.4.1: Location of Kramatorsk

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:

City of Kramatorsk

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

The town of Kramatorsk is located 150 kilometres North from Donetsk – the biggest industrial centre of Ukraine. Kramatorsk is an industrial centre with around 300,000 inhabitants, mainly occupied in the different industries in the region – coal mines, several heavy machine building entities like EMSS, metallurgical plants and the concomitant industries.

The geographical coordinates of the town of Kramatorsk are:
- 48 degrees, 44 minutes and 11.44 seconds North and
- 37 degrees, 34 minutes and 18.11 seconds East.

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

EMSS is a scrap-based electric arch furnace process steel producer, fully capable of producing products in carbon, low, medium and high alloy grades. The EMSS main products are special steels (round and square), forged and cast details for the nuclear power plants in Ukraine and Russia with extra big dimensions and volume.

Recovered metal materials from different sources, including dismantled plants and industries, motors and old appliances, are delivered to EMSS plant via truck and rail. The recovered metal is stored and processed in a Scrap Yard and then carried into the EAF Shop and charged into the Electric Arc Furnaces.

Subproject 1

Reconstruction of thermal and heating furnaces - The main goal of this subproject is the reduction of the relative natural gas (NG) consumption per tone steel produced by the thermal and heating furnaces. The reconstruction will take place at nineteen furnaces – the first of them will be commissioned on January 2008 and the last – on November 2009. The reconstruction includes:
- Implementation of a new impulse burners based system for heating the metal inside of the furnaces – the new impulse burners will be very fast and with high level of automation of the burning process – this enables to sustain the exact needed temperature inside of the furnace in function of the time of treatment and the technological exigencies;
- Implementation of a new thermal insulation for the walls and the roofs of the furnaces. The new insulation will be based on the materials with low specific weight – this reduce the heat accumulation on the walls and roofs and directly reduce the heat loses of the furnaces;
- Implementation of full hermetic front doors for the furnaces – this enables to reduce the heat loses of the furnaces;
- Utilization of the waste heat from the exhaust gases in field to heat the input burners air;
- Implementation of a new fully automated system for the control of the technological processes in the furnaces.

The different furnaces with their capacities and relative consumption of NG are represented at the table below:

Quantity of furnaces	Capacity of the furnace [t steel/month] [t steel/y]	Before reconstruction Relative NG consumption [nm3 NG/t steel]	After reconstruction Relative NG consumption [nm3 NG/t steel]
2	167 2,000	0.14	0.075
2	250 3,000	0.28	0.15
4	292 3,500	0.16	0.085
7	333 4,000	0.16	0.085
4	375 4,500	0.28	0.15

Table A.4.2.1: Furnaces, subject of reconstruction and their relative NG consumption.

The new burning systems will be supplied by Promgasservice, Ukraine. The new thermal insulation will be supplied by Keratech, Czech Republic.

Subproject 2

Decrease of the time of thermal treatment of the forged details – Reduction of NG consumption by reduction of the time of treatment of the forged details. The purpose of the thermal treatment is the partial extraction and equalisation of the allocation of the hydrogen inside of the forged details.

The time of treatment depends of the content and allocation of hydrogen inside of the details and after the installation of the system "arc ladle furnace", the initial content of hydrogen before the thermal treatment will be reduced from 2 to 1 ppm.

In the existing situation (before the commissioning of the system "arc ladle furnace") the relative consumption of NG for the thermal treatment of one tone forged details is 160 m3/t and after the implementation of the project this value will be 80 m3/t.

The actual and prospective quantities of the forged details on the EMSS are shown at the table below:

Year	Forged details [tons]
1990	49,607
2005	43,100
2006	55,434
2007	156,680
2008	169,750
2009	169,750
2010	170,000
2011	170,000
2012	170,000

Table A.4.2.2: Quantities of the forged details in different periods.

The supplier of the arc ladle furnace is NKMZ (Kramatorsk), Ukraine.

Subproject 3

Installation of a new vacuum system (Vacuum Degasser (VD)) – Installation of a new vacuum system for the vacuumed steel production. The amount of vacuumed steel is in average 40% of the total steel produced. The existing vacuum system uses heat (1.16 MWh/t steel) and electricity (0.81 kWh/t steel). The new vacuum system will use only electricity (1.92 kWh/t steel).

Year	Electro steel produced [tons]	Vacuumed steel produced [tons]
2008	247,100	98,840
2009	247,900	99,160

2010	248,300	99,320
2011	248,500	99,400
2012	248,700	99,480

Table A.4.2.3: Quantities of the vacuumed steel produced in different periods.

The existing vacuum systems for the extraction of the gases from the liquid steel are based on the steam injector pump installations. A conservative approach for the heat consumption on this process show an average value of 1.163 MWh/t vacuumed steel (1.0 Gcal/t). The old vacuum systems consume also some electricity – 0.81 kWh/t vacuumed steel.

The main elements on the new vacuum installations are dry mechanical pumps with high dust resistance. This principle of work permits to avoid the big heat demand of the old steam injection installations. The new dry pumps will consume only electricity – 1.92 kWh/t vacuumed steel.

The supplier of the new equipment is BOC Edwards, England. This technology is common in Western countries, but new for Ukraine.

Subproject 4

New steel slag making technology – Improvement of the steel coagulation (slag making) on the smelting process by using CaO like coagulant instead of $CaCO_3$. The result will be a lower heat demand of the process and avoidance of the CO_2 emissions from the process of disintegration of the $CaCO_3$ to CaO and CO_2.

The quantities of the produced electro steel are showing on table A.4.2.3.

In the existing technology for the separation from the liquid steel of the harmful elements like phosphor, sulphur is used limestone – $CaCO_3$. On the process of steel making on high temperature the limestone is disintegrated to CO_2 and CaO, and in the same time this reaction consumes heat.

According to the IPCC 2006 guidelines, table 2.1, chapter 2.4, book 2, the conversion factor for $CaCO_3$ disintegration is 0.79 $tCO_2/tCaCO_3$, (0.44 from the direct conversion plus 0.35 from the heat consumed by the reaction). The baseline consumption of limestone is 150 kg $CaCO_3$/tsteel.

In the new technology will be used directly CaO like slag making reagent and no $CaCO_3$ will be used. This enables to reduce the CO_2 emissions.

The supplier of CaO will be Reaktiv Company from Slavyansk, Ukraine.

Subproject 5

Installation of arc ladle furnace – New arc ladle furnace will be installed for the steel production. This means that the part of the process of the steel preparation will be done in the ladle from which the steel will be cast into the forms.

As a result there will be reduction of the electricity used (from 950 kWh/t electro steel to 852 kWh/t electro steel). This reduction of consumed electricity will lead to reduction of the off side emissions of the Ukrainian electricity system.

The quantities of the produced electro steel for different periods are shown in table A.4.2.3.

The supplier of the technology is NKMZ, Ukraine.

Subproject 6

New heating system – Replacing the old centralized heating system (using heat hot water, received from DHC Kramatorsk) by a new one – multiple small heating systems for the working places. The DHC Kramatorsk uses local coal as a fuel and there were big heat losses during heat delivery from DHC Kramatorsk to EMSS (10 km total heat transmission lines). The new heating system at EMSS will use natural gas and biomass like energy sources.

The consumption of heat with hot water in the existing situation is 115,137 MWh/y (the metering point is on the output of the DHC Kramatorsk). The DHC use local coal like fuel input. The emission factor for this local coal burning is relatively high – 353 $kgCO_2$/MWh.

In the project case the centralized heating system with their big thermal losses will be substituted by several small heating systems based on Natural gas small boilers. Some small quantity of biomass will be also used on heating boilers. This biomass is available like waste product from the wood shop of EMSS – the purpose of this wood shop is the preparation of wood models of the cast details.

The new technology is innovative in the existing situation, but common one for the Western countries.

Subproject 7

Modernization of press equipment – Replacing the old pump system, serving the 15,000 ton press, with a new, more effective pump system.

The number of old pumps, serving now the big 15,000 press is 27 (with 500 kW installed capacity each), and the number of new pumps will be 22 (with 440 kW installed capacity each).

The supplier of the technology is HBE Huntbund Engineering Co Ltd., USA.

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 CO_2 emissions are reduced by lowering the specific energy consumption at EMSS. As a result the combustion of fossil fuels is reduced leading to less CO_2 emission. The energy consumption is reduced through lower natural gas, coal and electricity consumption.

Although the proposed energy efficiency measures are beneficial for EMSS, there are barriers for the implementation of the proposed project:

Investment barrier
Domestic financial market opportunities for project financing in Ukraine are virtually absent. A common practice for the commercial bank financing can be a loan for up to maximum three years at 18-24% interest rate in the national currency. This is confirmed by the following article about project financing: "*The Ukraine continues to pose some investment risks due to political, economic and legislative instability. To date, these risks have made strictly private, long term financing prohibitively expensive or impossible to obtain, leaving quasi-public multilateral financial institutions (such as the European Bank for Reconstruction and Development, the International Finance Corporation, etc.) as*

the principal sources for Ukrainian project financing."[1] From this article it can also be concluded that international private capital is also absent except for multilateral financial institutions.

Lack of prevailing practise
No major modernisation projects in the Ukrainian steel sector were reported in past 15 years. The majority of the steel producers operate the existing equipment, in most cases inherited from the times of Soviet Union. Energy efficiency measures are encouraged by the national law; however, there is no legal requirement of introducing energy efficiency measures in the steel industry.

Taking into account the identified barriers and the impact of Joint Implementation, the proposed JI project is additional to what would otherwise occur. A more detailed description on 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:

Length of the crediting period	Years 5 (or extended beyond 2012 if applicable)
Year	**Estimate of annual emission reductions in tonnes of CO2 equiv.**
Year 2008	209,812
Year 2009	215,541
Year 2010	217,439
Year 2011	217,526
Year 2012	217,612
Total estimated emission reductions over the period within which emission reduction units are to be earned (tonnes of CO_2 equiv.)	1,077,930
Annual average of estimated emission reductions over the crediting period/period within which emission reduction units are to be earned (tonnes of CO2 equiv.)	215,586

Table A.4.3.1.1: Estimated emission reductions

A.5. Project approval by the Parties involved:

The Project Idea Note had been submitted for review to the Ministry of Environment of Ukraine. A Letter of Endorsement for the proposed project was issued in April 2007. After the project has completed the determination process, the PDD and the Determination Protocol will be presented to the Ministry of Environment of Ukraine to obtain a Letter of Approval.

[1] "Project Financing", Alexey V. DIDKOVSKIY, the Ukrainian Journal of Business Law, May 2003. http://www.shevdid.com/publication/ovd_031.pdf

SECTION B. Baseline

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

The “Guidance on criteria for baseline setting and monitoring”, issued by the Joint Implementation Supervisory Committee allows using approved methodologies of the CDM. At the moment of writing this PDD, there is no approved methodology with the CDM that would apply to the proposed JI project.

For baseline setting, all CDM methodologies require the identification of alternative scenarios, a compliance check with mandatory laws and regulations and barriers facing particular projects. The approach will be used for establishing the baseline.

Step 1: Identification of alternative scenarios

Step 1a. Define alternative scenarios to the proposed JI project activity

Alternative scenario will be defined for each proposed subproject. For the identification of each scenario it is assumed that the same output of product is produced.

1.1 Reconstruction of thermal and heating furnaces (subproject 1).

There are two alternatives to the reconstruction:

a) Continuation of the existing situation
In this scenario the furnaces will continue to produce steel with high specific consumption of NG, due to the big heat losses of walls, roofs and doors of the furnaces, and also due to the old burners with their low efficiency and incapability to have automated regime of work. The actual specific NG consumption per tone steel is twice bigger than the project one.

b) Implementation of the proposed intervention without the JI incentive
In this scenario the furnaces will produce steel with low specific consumption of NG, but no additional income from ERU will be generated.

1.2 Decrease of the time of treatment of the forged details (subproject 2).

a) Continuation of the existing situation
In this scenario EMSS will produce forget details with existing specific consumption of NG.

b) Implementation of the proposed intervention without the JI incentive
In this scenario EMSS will produce forged details with low specific consumption of NG, but no additional income from ERU will be generated.

1.3 New vacuum system (subproject 3)

There are two alternatives to the installation of the new vacuum system:

a) Continuation of the existing situation
In this scenario EMSS can continue working with the existing vacuum steel degasser. For this EMSS need to purchase steam from DHC Kramatorsk – 1.163 MWh/tone electro steel (up to 115,000

MWh/y). This quantity of heat purchased will increase the price of the produced vacuumed steel and decrease the competitiveness of the plant.

b) Implementation of the proposed intervention without the JI incentive
In this scenario EMSS will produce vacuumed steel using only electricity, but no additional income from ERU will be generated.

1.4 New steel making process (subproject 4)

There are two alternatives to the implementation of the new steel making process:

a) Continuation of the existing situation
In this scenario EMSS can continue working using $CaCO_3$ like slag making additive, but will not be in position to increase the quality of the produced electro steel. This will decrease the competitiveness of the plant.

b) Implementation of the proposed intervention without the JI incentive
In this scenario EMSS will produce steel with high quality, but no additional income from ERU will be generated.

1.5 New system arc ladle furnace (subproject 5)

There are two alternatives to the implementation of the new ladle furnace system:

a) Continuation of the existing situation
In this scenario EMSS can continue working using the old arc furnaces with specific electric consumption of 0.95 MWh/tone electro steel. EMSS will not be in position to increase the quality of the produced electro steel. This will decrease the competitiveness of the plant.

b) Implementation of the proposed intervention without the JI incentive
In this scenario EMSS will produce steel with high quality with specific electro consumption of 0.852 MWh/tone electro steel, but no additional income from ERU will be generated.

1.6 New heating system for the premise of EMSS (subproject 6)

There are two alternatives to the implementation of the new heating system:

a) Continuation of the existing situation
In this scenario EMSS will continue to purchase heat energy with hot water from DHC Kramatorsk – the total annual amount of the purchased heat for heating the shops and the administrative buildings is around 115,137 MWh/y (99,000 Gcal/y). the metering point is on the border of the DHC. This heat is produced from coal burning process on the DHC, after that the hot water is transported by using electrical pumps to the end consumers (length of the pipes – 10 km in one direction, 20 km in the two directions).

b) Implementation of the proposed intervention without the JI incentive
In this scenario EMSS will produce heat with multiple heating systems on the working places based on natural Gas burning processes with low emission factor and in additionality the produced energy will be on lower quantity and price, but no additional income from ERU will be generated.

1.7 New pump system for the 15,000 tonnes press (subproject 7)

There are two alternatives to the implementation of the new pump system:

a) Continuation of the existing situation
In this scenario EMSS will continue to exploit the big press with the old pumps (27 pumps, 500 kW installed capacity each of them). This manner of work requires also investments for refurbishing and keeping in good condition the existing pump facilities.

b) Implementation of the proposed intervention without the JI incentive
In this scenario EMSS will implement the new pump equipment (22 pumps, 440 kW installed capacity each of them), but no additional income from ERU will be generated.

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

All the alternatives defined in the Step 1 above are compliant with the national law and regulation. There is neither a mandatory requirement to reduce energy consumption nor any of the alternative scenarios are not in compliance with any applicable law or regulation.

Step 2: Barrier analysis

Sub-step 2a. Identification of barriers that would prevent the implementation of alternative scenarios

Investment barrier.
Domestic financial market opportunities for project financing in Ukraine are virtually absent. A common practice for the commercial bank financing can be a loan for up to maximum three years at 18-24% interest rate in the national currency. This is confirmed by the following article about project financing: *"The Ukraine continues to pose some investment risks due to political, economic and legislative instability. To date, these risks have made strictly private, long term financing prohibitively expensive or impossible to obtain, leaving quasi-public multilateral financial institutions (such as the European Bank for Reconstruction and Development, the International Finance Corporation, etc.) as the principal sources for Ukrainian project financing."*[2] From this article it can also be concluded that international private capital is also absent except for multilateral financial institutions.

Technological barrier.
For this project can be observed technological barriers, due of the lack of prevailing practise. No major modernisation projects in the Ukrainian steel sector were reported in past 15 years. The majority of the steel producers operate the existing equipment, in most cases inherited from the times of Soviet Union. The new technologies, employed on the seven subprojects, are new ones for Ukraine, but common on the West countries.

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

All alternative scenarios that represent a continuation of the existing situation, are not prevented by the identified barriers. The scenarios do not require any investment or change the technology.

The alternative scenarios that represent the proposed project without the JI incentive, do face all identified barriers. Please note that the proposed subprojects were considered as one investment by the management. Implementing not all subprojects was not feasible given the interdependencies between the different steps in the production process. Hence the project as a whole faces the investment barrier.

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[2] "Project Financing", Alexey V. DIDKOVSKIY, the Ukrainian Journal of Business Law, May 2003. http://www.shevdid.com/publication/ovd_031.pdf

As a result of the barrier analysis only the continuation of the existing situation remains as an alternative scenario and hence constitutes the baseline scenario.

The registration[3] of the project as a JI project will alleviate the investment barrier as it will reduce the payback time of the project significantly. Hence the project does not require external financing, but can be financed from the cash flow of EMSS. Please refer to section B.2 for more information. The registration as in JI project will also provide an incentive to the management to accept risk associated with implementing a new technology. With a higher return on the investment an extra buffer is created to cushion any delays or underperformance of the equipment Furthermore it will allow EMSS to attract external expertise and training opportunities.

Conclusion: Continuation of the existing situation is the baseline scenario for the proposed JI project.

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

The most recent "Tool for the demonstration and assessment of additionality (version 03)" 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

Please refer to step 1 of section B.1.

Step 2: Investment analysis

Sub-step 2a. Determination of the analysis method

The proposed JI project will generate additional profit from reduced consumption of coal, natural gas and electricity consumption during different stages of steel making.

Obtaining financial indicators for similar projects in Ukraine is not possible as this project is unique in its kind; therefore the investment comparison analysis (Option II) cannot be performed for the identified alternatives. Therefore the benchmark analysis (Option III) will be used to test the additionality of the proposed JI activity.

Sub-step 2b. Application of the benchmark analysis

Within the decision making context, two factors are relevant: the discount rate which is set b the Central Bank of Ukraine (the without risk factor) and the specific risk factor for similar type of investment projects in the steel sector. Adding both factors an external benchmark is set of 21 – 23%. The specific risk factor has been taken for projects aimed at modernization of existing production while increasing the production capacity.

Sub-step 2c. Calculation and comparison of the indicators

[3] In JI registration does not exists. In this context the approval of the JI project and/or making the determination final at the JISC is meant.

The economic indicators for the proposed project (alternative 3) without JI revenue has been calculated under the following assumptions:

- All calculations were made in constant January 1st, 2006 prices in Euro.
- Operation savings comprise natural gas, coal and electricity consumption reductions and were calculated in line with SP 1 – SP5 description above based on average annual vacuumed steel electric steel and forged details production;
- Coal savings in SP6 were calculated based on average for the last 5 years coal consumption data.
- Additional operation cost consists of labour cost due to increase of working places and difference in prices and volumes of limestone to be replaced by burnt lime (the latter's price is 10 times higher);
- The biomass cost is neglected as internal wood waste is being used;

The project has the following economic indicators:

IRR	17%
Discounted PBP	13 years

Table 1: Economic indicators of project

As clearly can been seen the project is not an attractive financial investment.

Sub-step 2d. Sensitivity analysis

A sensitivity analysis of the proposed project was made based on the market forecasts available at the moment of making the financial analysis of the proposed project. The key tested indicators included natural gas , coal and electricity prices and final products volumes.

The table below presents the result of sensitivity analysis.

Scenario	IRR (%)	Discounted PBP (full years)
Base case	16,7	13
Natural gas price 10% up	17,6	12
NG and electricity price 10% up	17,9	11
Natural gas price 20% up	18,5	11
NG and electricity price 20% up	18,7	11
Steel production down 10%	15,4	20
Steel production up 20%	19	10
Coal price up 10%	17,3	12
Steel production up 40 %	21,3	9

Table 2: Result of sensitivity analysis

As it can bee seen from the table the project results are not significantly affected by price fluctuations even in case of joint electricity and natural gas prices increase by 20% the IRR benchmark is not passed. The natural gas price will increase more only in case of political crisis as it is already reached 80% of European price and Russia as the main NG supplier keeps Ukraine in a group of former Soviet republics for which price is kept lower then for Europe.

The project is sensitive to the enterprise economic performance in terms volumes of steel and steel products produced. However, only production growth by 40% will make the project able to reach the IRR benchmark. But as more than 50% of production is exported the enterprise performance is vulnerable to world steel market developments and conjuncture.

As annual profit generated by project is not so big even in the last case the discounted pay back period is 9 years.

Thus, financial and sensitivity analysis shows the project is financially not attractive without Kyoto protocol flexible economic mechanism opportunities.

Step 3. Barrier analysis

Please refer to step 2 of section B.1

Step 4. Common practice analysis

Several metallurgical companies are *considering* reducing the energy consumption, in particular after the price hike in 2006. However, no investment projects are known that have been implemented. The project developer is aware of energy efficiency projects that are currently under consideration or under construction in Ukraine, but which are considered as a JI project being:

- Introduction of energy efficiency measures at ISTIL mini steel mill, Ukraine;
- Revamping and Modernization of the Alchevsk Steel Mill - Using Higher Efficiency Technology to replace Open Hearth Furnaces (OHF), Ingot Casting and Blooming Mills;
- Displacement of electricity generation with fossil fuels in the electricity grid by an electricity generation project with introduction of Steel Mill Waste Gas Firing Turbine power generation system.

In accordance with the methodological tool, these projects do not have to be considered in the common practice analysis.

The proposed JI project is not common practice.

Conclusion: The project is additional to what would have occurred otherwise.

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

There are following sources of GHG emissions related to the proposed seven subprojects:

- Emissions that are related to the direct fuel combustion on the premise of EMSS;
- Indirect GHG emissions on the premise of DHC Kramatorsk as result of heat consumption;
- Indirect GHG emission in the Ukrainian grid as a result of electricity consumption.

In the table below an overview of all emission sources are given. The following approach has been used in determining whether they have been included in the project boundary:

– All sources of emissions that are not influenced by the project have been excluded;
– All sources of emissions that are influenced by the project have been included.

No	Source	Gas	direct/indirect	included/excluded	Justification/Explanation
1	Fuel combustion on furnaces	CO_2	Direct	included	Fuel consumption will decrease after implementation of SP1 and SP2
2	Fuel combustion on DHC Kramatorsk	CO_2	Indirect	included	Fuel consumption on DHC Kramatorsk will decrease after implementation of SP3 and SP6
3	Electricity consumption by: - new vacuum system; - ladle furnace; - pumps.	CO_2	Indirect	included	Electricity consumption will: -Increase in result of SP3; -Decrease in result of SP5; -Decrease in result of SP 7.
4	Consumption of CO_3 on the steel making process	CO_2	Direct	included	Consumption of CO3 will disappear in result of SP 4.
5	All other emissions due to fuel and electricity consumption, which are not influenced directly by the proposed project	CO_2	Direct/Indirect	excluded	

Table B.3.1: Emissions at EMSS

Only CO_2 emissions are taken into account. CH_4 and N_2O emissions have not been included into the data calculations. As a result, resulting reduction in emissions of CH_4 and N_2O are not being claimed. According to the ACM0009 methodology used to determine the baseline of the proposed project, emissions of CH_4 and N_2O have to be excluded.

The boundary of the project includes all stages of the EMSS production cycle which are influenced by the described seven subprojects. All other stages are excluded from the project boundaries.

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

Date of completion of the baseline study: 29 October 2007

Name of person/entity determining the baseline:
Lennard de Klerk
Phone: +31 70 3142456
Fax: +31 70 8910791
E-mail: deklerk@global-carbon.com
Web: www.global-carbon.com

SECTION C. Duration of the project / crediting period

C.1 Starting date of the project:

The proposed JI project consists of seven interventions to the production cycle. Equipment for the proposed interventions will be installed and commissioned in the following order:

- SP1: From 01 January 2008 to 01 November 2009 – 19 furnaces will be commissioned;
- SP2: April 2007;
- SP3: May 2007;
- SP4: March 2007;
- SP5: April 2007;
- SP6: December 2007;
- SP7: December 2007.

Therefore the starting data of the project is 1 December 2007

C.2. Expected operational lifetime of the project:

For all proposed measures the lifetime of equipment will be at least 20 years.

C.3. Length of the crediting period:

For the period 1 January 2008 till 31 December 2012 credits will be transferred through Article 6 of the Kyoto Protocol (JI).

SECTION D. Monitoring Plan

D.1. Description of monitoring plan chosen

The Project involves seven different interventions:

- SP1 - Reconstruction of thermal and heating furnaces;
- SP2 – Decrease of the time of thermal treatment of the forged details;
- SP3 - Installation of a new vacuum system (Vacuum Degasser (VD));
- SP4 - New steel slag making technology;
- SP5 - Installation of arc ladle furnace;
- SP6 - New heating system;
- SP7 - Modernization of press equipment.

These interventions will involve savings of different energy sources, mainly of electricity and natural gas. The energy consumption at the EMSS depends on the steel production, which could be different from EMSS previsions. In particular there are productions that have to be considered:

- The production of electro steel in [tonnes/y];
- The production of vacuumed steel (part of the electro steel) in [tonnes/y];
- The production level of each of the nineteen reconstructed thermal and heating furnaces in [tonnes/y];
- The production level of forged details in [tonnes/y];

The specific energy consumption can be measured in terms of electricity and natural gas, divided by the production of steel and steel details.
The total energy and total GHG emissions can be evaluated directly from these consumptions, but a comparison with the baseline – and thus a global evaluation of GHG reductions – can not be done without taking into account the production levels.
Data can be collected by means of electric power meters and gas flow meters at each of the plants where improvements will take place; the monitoring plan will depend on direct measurements

The project emissions are mainly emissions of CO_2 from the burning process of natural gas and emissions lied to electricity generation elsewhere on the Ukrainian electricity system. There is an insignificant quantity of methane emissions (assessed as insignificant and excluded from supervision) and emissions from nitrous oxide released during the natural gas burning process. These quantities are insignificant, because:

- the technology employed for the burning process is state-of-art one and there is not unburned quantity of natural gas in the flue gases;
- the quantity of nitrous oxide in the flue gases released during the burning process will be lower than in the existing situation.

Additionally, to the natural gas quantity feed for burning, there is a quantity of emissions from methane, from natural gas leakages during its delivery through the gas pipeline. These indirect greenhouse emissions are assessed by the delivered natural gas parameters through the incorporate gas pipelines and their length, using standard assessments for the specific leakages and emissions factors. These indirect greenhouse emissions are not taken into account. Given the fact the project will lead to lower leakages, the monitored emission reductions are conservative.

Considering the project scope, the following data/parameters need to be monitored:

- Natural gas consumed by the reconstructed furnaces, in thousand Nm3;
- Natural gas consumed for the thermal treatment of the forged details, in thousand Nm3;
- Natural gas consumed by the ladle furnace, in thousand Nm3;
- Natural gas consumed by the new heating system, in thousand Nm3;
- The production level of each of the nineteen reconstructed thermal and heating furnaces, in tonnes;
- The production of forged details, who are subject of thermal treatment, in tonnes;
- The production of electro steel, in tonnes;
- The production of vacuumed steel, in tonnes;
- Electricity consumed by the new vacuum system (VD), in MWh;
- Electricity consumed by the ladle furnace, in MWh;
- Electricity consumed by the new pumps of the 15,000 tonnes press, in MWh.

There is a monitoring model, expressing the specific requirements, during the assessments in this PDD. Such model is prepared under MS-Excel and is presented below in the annexes. The model requirements are to enter the monitored parameters as an input data, so it will automatically calculates simultaneously the project and the baseline emissions, for each year after the project commissioning. The electronic worksheets should be filled with information by the project manager and also the inspecting personnel, through the whole operational lifetime of the project related to the crediting period.

The baseline emissions relate to the energy consumption that would have occurred when operating the existing infrastructure (baseline scenario) assuming that the same volume of products would be produces as monitored in the project scenario. The specific energy consumption for each subproject is fixed ex-post by taking the average specific energy consumption of the years 2002- 2006. With the formulae given below the baseline CO_2 emissions are calculated.

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 this data will be archived:

ID number (Please use numbers to ease cross-referencing to D.3)	**Data variable**	**Source of data**	**Data unit**	**Measured (m), calculated (c) or estimated (e)**	**Recording frequency**	**Proportion of data to be monitored**	**How will the data be archived? (electronic/ paper)**	**Comment**
1 - 19	Quantity of NG, used by the nineteen reconstructed furnaces	Measuring devices of the thermal shop	1,000 nm3/y	m	monthly	100%	Electronic and paper	Accuracy of the NG measuring devices – 1%.
20	Quantity of NG, used for thermal treatment of the forged details	Measuring devices of the thermal shop	1,000 nm3/y	m	monthly	100%	Electronic and paper	Accuracy of the NG measuring devices – 1%.
21	Natural gas consumed by the new	Measuring devices of the heating	1,000 nm3/y	m	monthly	100%	Electronic and paper	Accuracy of the NG measuring

	heating system	burners and boilers						devices – 1%.
22	Electricity consumed by the new vacuum system (VD)	Measuring devices of VD	MWh/y	m	monthly	100%	Electronic and paper	Accuracy of the electricity measuring devices – 1%.
23	Electricity consumed by the ladle furnace	Measuring devices of ladle furnace	MWh/y	m	monthly	100%	Electronic and paper	Accuracy of the electricity measuring devices – 1%.
24	Electricity consumed by the new pumps of the 15,000 tonnes press	Measuring devices of the press equipment	MWh/y	m	monthly	100%	Electronic and paper	Accuracy of the electricity measuring devices – 1%.
25	Low Calorific Value of the NG	Supplier of the NG	MWh/1000nm3	m	monthly	100%	Electronic and paper	The reports of the national supplier will be used.

26	Emission factor of the Ukrainian electrical grid	Ukrainian el. grid	tCO2/MWh	c	yearly	100%	Electronic and paper	The official data from the Ukrainian electrical operator will be used.

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

The annual project emissions are done by the equation:

$$PE_y = \sum_{i=1}^{i=7} PE_{spi}, ;$$

Where:

PE_y - are the annual project emissions for the year y;

PE_{spi} - are the annual project emissions from each subproject, from SP1 to SP7;

The annual project emissions [tCO2/y] from SP1 are:

$$PE_{sp1} = NG_{tf,y} * LCV_{NG} * EF_{NG} ;$$

Where:

$NG_{tf,y}$ - is the annual quantity of NG, used by the nineteen reconstructed furnaces (sum from ID1 to ID19), [1000 nm3/y];

LCV_{NG} - is the lower calorific value of the NG (ID25), [MWh/1000nm3];

EF_{NG} - is the emission factor of the NG burning process, 0.202 tCO2/MWh (IPCC default value).

The annual project emissions [tCO2/y] from SP2 are:

$$PE_{sp2} = NG_{FD} * LCV_{NG} * EF_{NG} \;;$$

Where:

NG_{FD} - is the annual quantity of NG, used for the thermal treatment of the forged details (ID20), [1000 nm3/y].

The annual project emissions [tCO2/y] from SP3 are:

$$PE_{sp3} = EL_{VD} * EF_{el,y} \;;$$

Where:

EL_{VD} - is the annual electrical consumption of the new VD (ID22), [MWh/y];

$EF_{el,y}$ - is the calculated emission factor of the Ukrainian electrical grid (ID26), [tCO2/MWh].

The annual project emissions [tCO2/y] from SP4 are:

PE_{sp4} -, equals zero.

The annual project emissions [tCO2/y] from SP5 are:

$$PE_{sp5} = EL_{LF} * EF_{el,y} \;;$$

Where:

EL_{LF} - is the annual electrical consumption of the new ladle furnace (ID23), [MWh/y].

The annual project emissions [tCO2/y] from SP6 are:

$$PE_{sp6} = NG_{HS} * LCV_{NG} * EF_{NG};$$

Where:

NG_{HS} - is the annual quantity of NG, used for the new heating systems (ID21), [1000 nm3/y].

The annual project emissions [tCO2/y] from SP7 are:

$$PE_{sp7} = EL_{PR} * EF_{el,y};$$

Where:

EL_{PR} - is the annual electrical consumption of the new pumps (ID24), [MWh/y].

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
26-45	The production level of each of the nineteen reconstructed thermal and	Measuring devices of the thermal shop	Tonnes/y	m	monthly	100%	Electronic and paper	

	heating furnaces							
46	The production of forged details, who are subject of thermal treatment	Measuring devices of the thermal shop	Tonnes/y	m	monthly	100%	Electronic and paper	
47	The production of electro steel	Measuring devices of the electro steel shop	Tonnes/y	m	monthly	100%	Electronic and paper	
48	The production of vacuumed steel	Measuring devices of the VD	Tonnes/y	m	monthly	100%	Electronic and paper	
49-68	The baseline ex-ante specific NG consumption of the nineteen reconstructed furnaces	Baseline five years information	1000nm3/tsteel	e	once	100%	Electronic and paper	
69	The baseline ex-ante specific NG consumption	Baseline five years information	1000nm3/tforged details	e	once	100%	Electronic and paper	

	for thermal treatment of the forged details							
70	The baseline ex ante heat load from DHC to EMSS	Baseline five years information	MWh/y	e	once	100%	Electronic and paper	
71	The baseline ex ante specific heat consumption of the old VD	Baseline five years information	MWh/t	e	once	100%	Electronic and paper	
72	Efficiency of the steam and water boilers at the DHC	DHC	-	c	yearly	100%	Electronic and paper	
73	Baseline ex ante specific electrical consumption of the old VD	Baseline five years information	MWh/t	e	once	100%	Electronic and paper	
74	Baseline ex ante specific consumption of CaCO3 per tone of electro	Baseline five years information	t/t	e	once	100%	Electronic and paper	

	steel							
75	Baseline ex ante specific consumption of electricity per tone of electro steel	Baseline five years information	MWh/t	e	once	100%	Electronic and paper	
76	Baseline ex ante annual heat load from DHC for heating the premise	Baseline five years information	MWh/y	e	once	100%	Electronic and paper	
77	Baseline ex ante electricity consumption of the pumps serving the 15,000 tonnes press	Baseline five years information	MWh/y	e	once	100%	Electronic and paper	

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

The annual baseline emissions are done by the equation:

$$BE_y = \sum_{i=1}^{i=7} BE_{spi};$$

Where:

BE_y - are the annual baseline emissions for the year y;

BE_{spi} - are the annual baseline emissions from each subproject, from SP1 to SP7.

The annual baseline emissions for SP1 [tCO2/y] are:

$$BE_{sp1} = SPNG_{tf} * PRST_{tf} * LCV_{NG} * EF_{NG};$$

Where:

$SPNG_{tf}$ - is the baseline ex-ante specific NG consumption of the nineteen reconstructed furnaces (from ID49 to ID68), [1000nm3/tsteel];

$PRST_{tf}$ - is the annual production steel level of each of the nineteen reconstructed thermal and heating furnaces (from ID26 to ID45), [t/y].

The annual baseline emissions for SP2 [tCO2/y] are:

$$BE_{sp2} = SPNG_{FD} * PRFD_y * LCV_{NG} * EF_{NG};$$

Where:

$SPNG_{FD}$ - is the baseline ex-ante specific NG consumption for thermal treatment of the forged details (ID69), [1000nm3/t];

$PRFD_{tf}$ - is the production of forged details, who are subject of thermal treatment (ID46), [t/y].

The annual baseline emissions for SP3 [tCO2/y] are:

$$BE_{sp3} = SPH_{VD} * PRVS_{VD} \div EB_{DHC} * EF_{Coal} + SPEL_{VD} * PRVS_{VD} * EF_{el,y};$$

Where:

SPH_{VD} - is a baseline ex ante specific heat consumption of the old VD (ID71), [MWh/t];

$PRVS_{VD}$ - is the annual production of vacuumed steel (ID48), [t/y];

EB_{DHC} - is the efficiency of the steam and water boilers at the DHC (ID72);

EF_{Coal} - is the emission factor for local (anthracite) coal burning – 0.353 tCO2/MWh, IPCC default value;

$SPEL_{VD}$ - is a baseline ex ante specific electrical consumption of the old VD (ID73), [MWh/t].

The annual baseline emissions for SP4 [tCO2/y] are:

$$BE_{sp4} = SPC_{ES} * PRES * EFC_{ES};$$

Where:

SPC_{ES} - is the baseline ex ante specific consumption of CaCO3 per tone of electro steel (ID74), [tCaCO3/t steel];

$PRES$ - is the production of electro steel (ID47), [t/y];

EFC_{ES} - is the emission factor of the CaCO3 conversion – 0.79 tCO2/tCaCO3, IPCC default value.

The annual baseline emissions for SP5 [tCO2/y] are:

$$BE_{sp5} = SPEL_{ES} * PRES * EF_{el,y};$$

Where:

$SPEL_{ES}$ - is the baseline ex ante specific consumption of electricity per tone of electro steel (ID75), [MWh/t steel]

The annual baseline emissions for SP6 [tCO2/y] are:

$$BE_{sp6} = HL_{DHC} * EB_{DHC} * EF_{Coal};$$

Where:

HL_{DHC} - is the baseline ex ante annual heat load from DHC for heating the premise (ID76), [MWh/y].

The annual baseline emissions for SP7 [tCO2/y] are:

$$BE_{sp7} = EL_{pp} * EF_{el,y};$$

Where:

EL_{pp} - is the baseline ex ante electricity consumption of the pumps serving the 15,000 tonnes press (ID77), [MWh/y].

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

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

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

Not applicable

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):

See D.1.4.

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

The only possible leakage effect not considered in the above analysis is linked to the substitution of the coal used on DHC Kramatorsk for heating the premise of EMSS with natural gas – SP6 (New heating system). The implementation of this SP6 will lead to the use of natural gas on multiple small heating systems instead of coal, burned on the boilers of DHC. But the fact that the total consumption of natural gas on the premise of EMSS will decrease in result of implementation of the JI project, this possible leakage is not considered in the monitoring plan.

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

ID number (Please use numbers to ease cross-referencing to table D.3)	Data variable	Source of data	Data unit	Measured (m), calculated (c) or estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment

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

Not applicable

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 reduction is done by the equation:

$ER_y = BE_y - PE_y$, [tCO_2/y];

Where:

BE_y - Annual baseline emissions, calculated in respect of D.1.1.4;

PE_y - Annual project emissions, calculated in respect of D.1.1.2.

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

Not applicable. There is no information related to the environmental impacts of this project which will especially be collected.

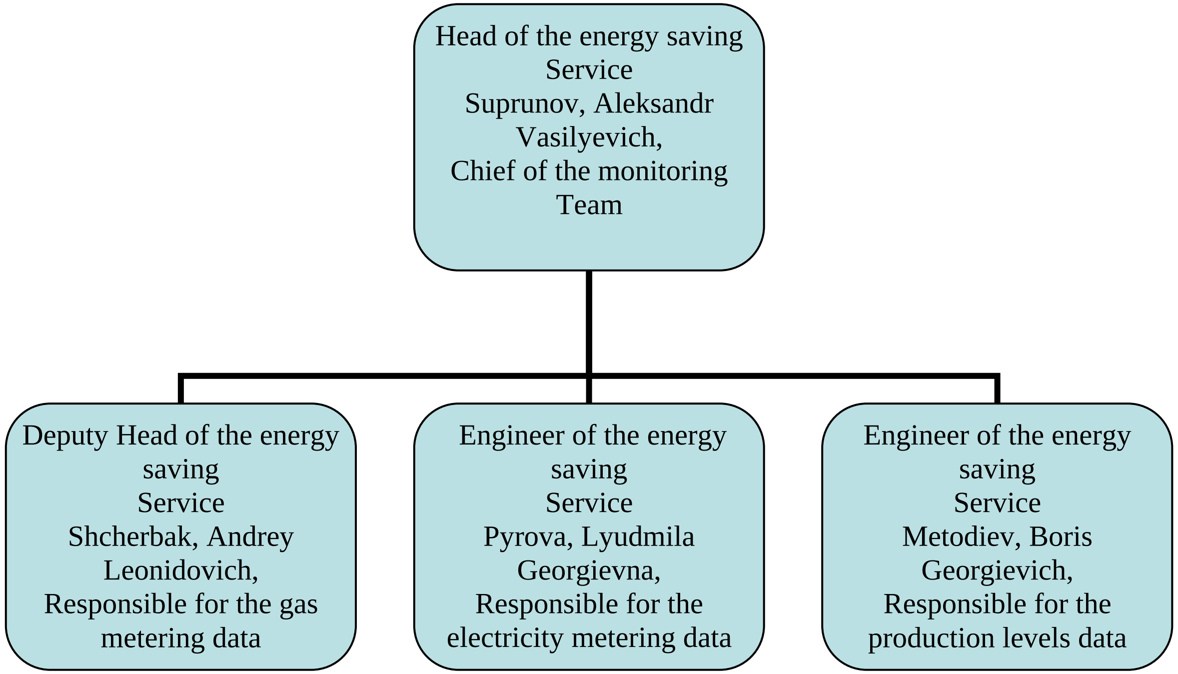
D.2. Quality control (QC) and quality assurance (QA) procedures undertaken for data monitored:

Data ***(Indicate table and ID number)***	**Uncertainty level of data (high/medium/low)**	**Explain QA/QC procedures planned for these data, or why such procedures are not necessary.**
1-19	Low	These data will be directly used for calculation of emissions reductions
20	Low	These data will be directly used for calculation of emissions reductions
21	Low	These data will be directly used for calculation of emissions reductions
22	Low	These data will be directly used for calculation of emissions reductions
23	Low	These data will be directly used for calculation of emissions reductions
24	Low	These data will be directly used for calculation of emissions reductions
25	Low	These data will be directly used for calculation of emissions reductions
26	Low	These data will be directly used for calculation of emissions reductions
27-46	Low	These data will be directly used for calculation of emissions reductions
47	Low	These data will be directly used for calculation of emissions reductions
48	Low	These data will be directly used for calculation of emissions reductions
49	Low	These data will be directly used for calculation of emissions reductions
50-69	Low	These data will be directly used for calculation of emissions reductions
70	Low	These data will be directly used for calculation of emissions reductions
71	Low	These data will be directly used for calculation of emissions reductions
72	Low	These data will be directly used for calculation of emissions reductions
73	Low	These data will be directly used for calculation of emissions reductions

74	Low	These data will be directly used for calculation of emissions reductions
75	Low	These data will be directly used for calculation of emissions reductions
76	Low	These data will be directly used for calculation of emissions reductions
77	Low	These data will be directly used for calculation of emissions reductions
78	Low	These data will be directly used for calculation of emissions reductions

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

For monitoring, collection, registration, visualization, archiving, reporting of the monitored dates and periodical checking of the measurement devices is responsible the measurement team from 4 people and its manager Mr Suprunov. The responsibilities are shown on the next flowchart:



Flowchart D.3.1: Responsibilities within the monitoring team.

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

Name of person/entity determining the baseline:
Lennard de Klerk
Phone: +31 70 3142456
Fax: +31 70 8910791
E-mail: deklerk@global-carbon.com
Web: www.global-carbon.com

SECTION E. Estimation of greenhouse gas emission reductions

E.1. Estimated project emissions:

The amount of the estimated project emissions is shown in the next table:

	SP1	SP2	SP3	SP4	SP5	SP6	SP7	Total
Project Emissions [tCO_2]	60,200	127,670	851	0	943,817	8,674	331,939	1,473,151

Table E.1.1: Project emissions.

E.2. Estimated leakage:

Not applicable. There was no leakage identified

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

	SP1	SP2	SP3	SP4	SP5	SP6	SP7	Total
Sum of E.1 and E.2 [tCO_2]	60,200	127,670	851	0	943,817	8,674	331,939	1,473,151

Table E.3.1: The sum of project emissions and leakage.

E.4. Estimated baseline emissions:

	SP1	SP2	SP3	SP4	SP5	SP6	SP7	Total
Baseline emissions [tCO_2]	112,771	255,339	281,582	146,999	1,052,378	239,079	462,931	2,551,081

Table E.4.1: Baseline emissions.

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

	SP1	SP2	SP3	SP4	SP5	SP6	SP7	Total
Emission reductions [tCO_2]	52,571	127,670	280,732	146,999	108,561	230,405	130,992	1,077,930

Table E5.1: Emission reductions.

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

YEAR	Estimated Project Emissions (tonnes CO2 Equivalent)	Estimated Leakage (tonnes CO2 Equivalent)	Estimated Baseline Emissions (tonnes CO2 Equivalent)	Estimated Emissions Reductions (tonnes CO2 Equivalent)
2008	287,798	0	497,610	209,812
2009	294,530	0	510,071	215,541
2010	296,789	0	514,228	217,439
2011	296,940	0	514,466	217,526
2012	297,094	0	514,706	217,612
Total (tonnes CO2 Equivalent)	1,473,151	0	2,551,081	1,077,930

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:

In accordance with Ukrainian legislation, EMSS has consulted the regional authority to obtain the necessary approvals for construction of the individual subprojects. Parts of these approvals are the analyses of the environmental impacts of the subprojects:

- SP1 Statement from the Ministry of the health of Ukraine for the approval of the subproject;
- SP2 Statement from the Ministry of the health of Ukraine for the approval of the subproject;
- SP3 Statement from the Ministry of the health of Ukraine for the approval of the subproject;
- SP4 Analyses of the EIA are not required;
- SP5 Statement from the Ministry of the health of Ukraine for the approval of the subproject;
- SP6 Analyses of the EIA are not required;
- SP7 Analyses of the EIA are not required.

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:

Not applicable.

SECTION G. Stakeholders' comments

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

In accordance with Ukrainian legislation, EMSS has consulted the regional authority to obtain the necessary approvals for construction of the individual subprojects. No stakeholder consultation is required under JI.

Annex 1

CONTACT INFORMATION ON PROJECT PARTICIPANTS

Organisation:	Global Carbon BV
Street/P.O.Box:	Benoordenhoutseweg 23
Building:	
City:	The Hague
State/Region:	
Postal code:	2596 BA
Country:	Netherlands
Phone:	+31 70 3142456
Fax:	+31 70 8910791
E-mail:	info@global-carbon.com
URL:	www.global-carbon.com
Represented by:	
Title:	
Salutation:	
Last Name:	de Klerk
Middle Name:	
First Name:	Lennard
Department:	
Phone (direct):	
Fax (direct):	+31 70 8910791
Mobile:	+31 70 3142456
Personal e-mail:	deklerk@global-carbon.com

Organization:	Energomashspetsstal
Street/P.O.Box:	
Building:	
City:	Kramatorsk
State/Region:	
Postal code:	84306
Country:	Ukraine
Phone:	+380 6264 855 71
Fax:	+380 6264 655 67
E-mail:	central@emss.dn.ua
URL:	www.emss.krm.net.ua
Represented by:	
Title:	
Salutation:	
Last Name:	Masyuk
Middle Name:	Grigoryevich
First Name:	Alexander
Department:	
Phone (direct):	
Fax (direct):	+380 6264 725 58
Mobile:	+380 6264 655 86
Personal e-mail:	masjuk@emss.dn.ua

Annex 2

BASELINE INFORMATION

For the electricity baseline of the Ukrainian grid, please see below the separate document.

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Choose certainty.
Add value.

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.

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

Date: 17.08.2007

Our reference:
IS-USC-MUC/

This document consists of
4 Pages
Page 1 of 4

The test results refer exclusively to the units under test.

Headquarters: Munich
Trade Register: Munich HRB 96 869

Supervisory Board:
Dr. Axel Stepken (Chairman)
Board of Management:
Dr. Manfred Bayerlein (Spokesman)
Dr. Udo Heisel

Telefon: +49 89 5791-0
Telefax:
www.tuev-sued.de

TÜV SÜD Industrie Service GmbH
Carbon Management Service
Westendstrasse 199
80686 Munich
Germany

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

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 // borisov@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

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[1];
- The "Operational Guidelines for the Project Design Document", further referred to as ERUPT approach or baseline [2];
- The approved CDM methodology ACM0002 "Consolidated baseline methodology for grid-connected electricity generation from renewable sources" [3];
- 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 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.

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[1] Guidance on criteria for baseline setting and monitoring, version 01, Joint Implementation Supervisory Committee, ji.unfccc.int
[2] Operational Guidelines for Project Design Documents of Joint Implementation Projects. Ministry of Economic Affairs of the Netherlands, May 2004
[3] Consolidated baseline methodology for grid-connected electricity generation from renewable sources, version 06, 19 May 2006, cdm.unfccc.int

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 3: 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 4: Electricity demand in Ukraine on 31 March 2005[4]

Development of the Ukrainian electricity sector
The National Energy Strategy[5] 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[6]:

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

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.

[4] Ukrenergo, http://www.ukrenergo.energy.gov.ua/ukrenergo/control/uk/publish/article?art_id=39047&cat_id=35061
[5] http://mpe.kmu.gov.ua/fuel/control/uk/doccatalog/list?currDir=50505
[6] Energy Strategy of Ukraine for the Period until 2030, section 16.1, page 127.

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 5: Installed capacity in Ukraine in 2004[7]

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'[8].

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 6: Peak load in Ukraine in 2001 - 2005[9]

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)[10].

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 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;

[7] Source: Ukraine Energy Policy Review. OECD/IEA, Paris 2006. p. 272, table 8.1
[8] Source: Ukraine Energy Policy Review. OECD/IEA, Paris 2006. p. 269
[9] Ministry of Energy, letter dated 11 January 2007
[10] http://www.xaec.org.ua/index-ua.html

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 7: Imports and exports balance in Ukraine[11]

ACM0002 offers several choices for calculating the OM. Dispatch data analysis cannot be applied, since the grid data is not available[12]. 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 8: Share of power plants in the annual electricity generation of Ukraine[13]

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

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

[13] “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[14]. The majority of the electricity (up to 95%) is generated centrally and therefore the data is comprehensive[15].

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[16] 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 project reduces on-site electricity *consumption* with 100,000 MWh and the losses in the grid are

[14] "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.

[15] 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.

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

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 9: Grid losses in Ukraine[17]

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[18] 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[19];
- 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:

$$EF_{grid,produced,y} = EF_{OM,y} \qquad \text{(Equation 3)}$$

[17] "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.
[18] 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.
[19] "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.

and

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

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 10: 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:

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

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.

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Annex 3

MONITORING PLAN

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