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

CONTENTS

Annexes

SECTION A. General description of the project

A.1. Title of the project:

Utilization of coke gas with electricity generation by two 6 MWe CHP at "ZaporozhCox Plant".

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

Version of the document: 5.0.

Date of the document: 27 October 2010.

A.2. Description of the project:

The project proposes to make use of excess coke oven gas (COG) to generate electricity by two new steam turbine generators, replacing power currently being sourced from the national grid. This will be introduced in parallel with improved automated process control systems that will increase the efficiency of the use of the power, further still reducing that required from the national grid.

Ukraine is one of the most energy intensive countries in the world. In Ukraine the primary energy consumption has been fairly stable from 2004 until 2007, with about 79% of the total energy consumption being produced from fossil fuels such as coal, oil, and natural gas. Ukraine's overall self-sufficiency in fossil fuels is less than 50 %, made up of 10-15% from oil 20 - 25% from gas, and 80 - 85% from coal.

Coke production is an energy intensive process, one tonne of dry blast furnace coke requires about 3.7 GJ (0.89 Gcal) of energy. However, the coke oven gas (COG) produced in the coke battery as a by-product is suitable for energy production. The common practise in the Former Soviet Union (FSU) countries is using COG to produce heat/steam.

From the year 2002, steam was produced at the ZaporozhCox Plant (ZCP) using two boilers, each with a capacity of 75 t/h, Before 2002, the required steam was imported from a neighbouring steel plant, ZaporozhStal, in return for some of the excess COG that could not be consumed by ZCP internally. The excess COG was used by ZaporozhStal as a supplementary fuel (the main fuel being natural gas).

The two ZCP boilers generate steam with a pressure of 35 kgf/sm^2 and temperature of approximately 440°C. These parameters are excess for the technological needs of the project. To reduce the pressure and temperature, three PRDS (pressure-reducing and desuperheating stations) units are used. PRDS work by cooling and depressurization of superheated steam by introducing water. The output is steam with a pressure of 5.0-5.5 kgf/sm^2 and temperature of 300°C. This is a common practice in FSU countries.

In 2004, the management of ZCP decided to further improve the existing scheme, by implementing units which would generate electricity from the excess temperature and pressure reduced by the PRDS's. This electricity will be used for ZCP's energy consuming equipment and therefore will substitute energy purchased from the Ukrainian distribution network. The design documents were completed by 2004 and after a short consideration in January 2005 the company approved the project.

It should be noted that there are no reasons, financial, legislative, etc. that obliges ZCP to undertake this project, and there is no legislation against the proposed project activity.

As it shown in Section B, the most probable scenario which would have been taken place without the project is a continuation of existing practice. In this scenario electricity will continue to be imported from the grid. The COG available for the energy production would be flared and burnt in the existing boiler house without electricity generation. PRDS would still be used for correction of the steam parameters, with some of the COG being delivered for external consumers (Zaporozhstal) as a fuel, for heat generation.

The proposed technology will cover approximately 70% of ZCP electricity needs, therefore all electricity generated will be consumed onsite.

An initial review of possible financial sources was considered at OJSC "Zaporozhcoke" Plant Technical Council Meeting on 14 January 2005 and included a reference to Joint Implementation.

A.3. Project participants:

Table A.3.1 - 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)	"ZaporozhCox Plant"	No
Netherlands	Global Carbon B.V.	No

ZaporozhCox Plant is the project host. Global Carbon B.V. is developer of this JI project.

Global Carbon BV is a potential buyer of the ERUs generated under the proposed project. Global Carbon BV is a project participant.

A.4. Technical description of the project:

A.4.1. Location of the project:

Premises of the ZaporozhCox Plant

A.4.1.1. Host Party(ies):

Ukraine

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

Zaporizhya region

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

City of Zaporizhya

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

Figure A.4.1. Map of Ukraine and location of the city of Zaporizhya.

The address and detailed contact information are given in Annex 1.

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

The installation of two turbines, one backpressure and one condensing, each generating 6 MWh of electricity with simultaneous steam generation, with pressure of 5 – 5.5 kgf/sm^2, and temperature of 300°C.

The installation of the backpressure turbine was competed in February 2008 as it stated in the relevant commissioning act. The completion of the condensing turbine, is expected at the March 2010.

The turbines will be installed at site of ZaporozhCox in the new turbine workshop. All necessary peripheries, including automation system, are included in the project activity. The project also includes the modernization of the power-supply system.

All technical staff working with new turbine have the necessary permission and have successfully completed relevant training.

The project doesn't require extensive maintenance efforts in order to work as presumed during the project period.

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 anthropogenic emissions of greenhouse gases will be reduced by replacing electricity generated by Ukrainian power plants with less carbon intensive power, generated from the two turbines, described above, using excess temperature and pressure from the steam produced and associated energy efficiency measures.

In the absence of this project, the plant will continue to use power from the Ukrainian power plants which is generated from fossil fuels.

In general, electricity generated under the project activity is less carbon intensive than electricity from the grid. Therefore, emissions reduction can be considered.

The implementation schedule is shown in the diagram below:

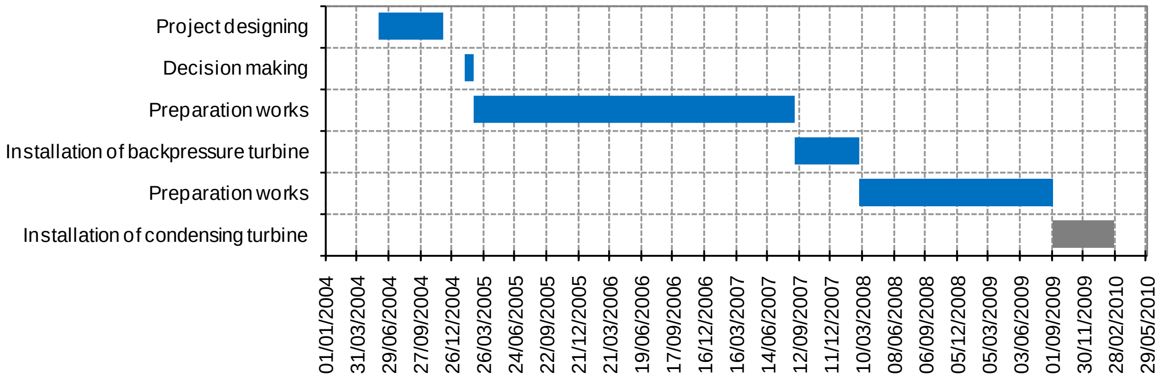

Figure A.4.2. Implementation schedule diagram.

For more information please see Section B.

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

Table A.4.1 - Estimated amount of emission reductions over the crediting period

	Years
Length of the crediting period	59 months
Year	**Estimate of annual emission reductions in tonnes of CO2 equiv.**
Year 2008	36,016
Year 2009	42,567
Year 2010	49,038
Year 2011	64,815
Year 2012	64,815
Total estimated emission reductions over the period within which emission reduction units are to be earned (tonnes of CO_2 equiv.)	257,251
Annual average of estimated emission reductions over the crediting period/period (tonnes of CO2 equiv.)	52,322

Table A.4.2 - Estimated amount of emission reductions after the crediting period

	Years
Period after 2012, for which emission reductions are estimated	
Year	**Estimate of annual emission reductions in tonnes of CO2 equiv.**
Year 2013	64,815
Year 2014	64,815
Year 2015	64,815
Year 2016	64,815
Year 2017	64,815
Year 2018	64,815
Year 2019	64,815
Year 2020	64,815
Total estimated emission reductions over the period indicated (tonnes of CO_2 equiv.)	518,520

A.5. Project approval by the Parties involved:

The Project Idea Note was submitted for review to the National Environmental Investment Agency of Ukraine. A Letter of Endorsement (LoE) # 912/23/7 for the proposed project was issued 12 August 2009. Letter of Approval from the Netherlands #2010JI01 is dated 25 February 2010. National approval (LoA #567/23/7) was issued 17 May 2010.
Therefore proposed project obtained necessary approval.

SECTION B. Baseline

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

In accordance with the paragraph 24 of the "Guidance on criteria for baseline setting and monitoring", Version 02[1], the project developer proposes the identification of a baseline scenario by listing and describing plausible future scenarios on the basis of conservative assumptions and selecting the most plausible one.

For the emission reduction calculation and monitoring, project developer proposes using a JI specific approach in accordance with the JI Guidance on Criteria for Baseline Setting and Monitoring, Version 02[1]. No approved CDM methodologies are used. All information concerning the methodological approach for the emissions reduction calculation chosen is given bellow in section B.1. All information concerning methodological approach for monitoring of emissions reduction is given in section D.

The baseline scenario has been identified by selecting the most plausible scenario from all realistic and credible alternatives. All identified alternatives are listed and described below.

1. **Alternative** *"Implementation of the Coke Oven Gas CHP without JI incentive".*

In this scenario a CHP (Combined Heat and Power) will be constructed on the site of the ZCP. The main revenue will come reducing the electricity imported from the grid.

No additional revenue from generating and selling ERUs will be earned. This alternative is identical to the proposed JI project activity, however without the JI incentive.

As it is shown in the investment analyze below, this alternative is not realistic, because it is not feasible without JI revenue. Therefore, this alternative cannot be considered as a baseline.

2. **Alternative** *"Implementation of the Coke Oven Gas CHP with increase in COG production compared to the baseline scenario with aim to generate more electricity and ERUs".*

In this scenario a CHP (Combined Heat and Power) will be constructed on the site of the ZCP. The main revenue will come reducing the electricity imported from the grid but also from ERUs selling. In this scenario it is assumed that more COG will be produced in the project scenariocompared to this baseline alternative. This will allow to generate more electricity which will results in increase of ERUs amount.

This scenario cannot be chosen as plausible one, because of the following:

COG is a waste gas that is produced as a result of the production of coke in a coke plant. Most COG is fed back into the coke plant as a fuel for the coking process. The remaining COG is flared or can be available for utilization outside the coke plant. No fossil fuels are used in the coke plant (other than the coal as raw material) so no extra COG can be produced unless the production of cokes is increased. Therefore technically production extra COG can only be done by increasing coke production. As the project is expected to work at full capacity it is not possible to increase the utilization of the coke oven gas. As a result it is not plausible to assume the more COG will be produced compared to the baseline scenario as it cannot be utilized.

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

Even in the unlikely event that the project is not working at full capacity it is not plausible that production of coke is increased. The production of coke is the core business of the company and driven by market circumstances. The cost price of one tonne of coke is approximately 100 Euro and each tonne of coke will allow to generate 0.09 ERU). Assuming a price of 10 Euro/ERU this would mean a decrease of costs price of one tonne of coke of to 99,1 Euro/tonne cokes (or 0.9%) only.

Also note that even if the plant would start to produce more coke compared to the baseline scenario, it will lead to less coke production at other plants[2].

3. Alternative *"Continuation of the existing situation".*

In this scenario the required electricity will be imported from the grid. COG available for the energy production will be flared and burnt in the existing boiler house without electricity generation. The PRDS will be used to correct the steam parameters. A part of the COG will be delivered to external consumers as a fuel, for heat generation. No additional revenue from the sale of ERUs will be earned. Technical conditions of all existing equipment allow to work at least until to 2020.

This scenario can continue at least until the end of 2012 as there is no need to replace the existing boiler house[3]. This alternative is the most realistic and can be considering as a baseline scenario.

4. Alternative *"COG is used for heat energy production".*

In this scenario the required electricity will be imported from the grid. A new boiler house with higher capacity will be constructed. COG currently flared in the old boiler house, will be directed to the new boiler(s). Steam will be used on site (as it is now) and sold to the external consumers. In addition to the new boiler house, steam and condensate pipelines to external consumers should be constructed.

This alternative cannot be considered as a plausible scenario . The construction of additional boilers with higher capacity (more than 85 t/h), and the construction of the steam and condensate pipelines to external consumers would be complicated and expensive. The following arguments need to be also taken into account:

- to bring heat to residential areas would require high-pressure pipes over the distance exceeding 800 m. This is very unprofitable as considerable heat losses will occur. Also high-pressure steam is not used in the district heat supply systems;
- closer to the plant are industrial enterprises which do not require heat as they have their own heat generation and supply facilities;
- transportation of high pressure steam, especially on long distances, is bound to meet heightened safety and networks thermal insulation requirements, which in its turn is connected with the high implementation costs and, as a result, impacts the overall project profitability.

[2] In other registered JI projects this possible effect is also not seen as the most plausible. For example in cement projects it is assumed that a cement plant would not to produce more cement after applying energy efficiency measures, a CMM utilization project would note start to produce more coal and a steel plant would not start to produce more steel. Exceptions could be some industrial gases projects, like HFC projects, were the impact of ERU/CER revenue on the cost price can be significant making it profitable to increase production for the purpose of ERU/CER generation only.

[3] The boilers were installed in 2002 and therefore have not reached its technical lifetime which is usually exceeds 25 years. Hence there is no necessity to replace the boiler house.

Therefore, this alternative cannot be considered as a baseline.

Consistency with mandatory applicable laws and regulations

All the alternatives defined above are compliant with national laws and regulations.

Therefore, the only possible scenario for the baseline is Alternative 3 *"Continuation of the existing situation".*

Theoretical description of the approach chosen for baseline setting.

The main principles of the JI specific approach can be described by the following positions:

1. Setting of the baseline should be based on real data (project scenario), obtained during the years before and after the project realization.
2. Estimated values of the key parameters under the project activity should be based on the project owner's forecasts.
3. The proposed project should concerns electricity generation only, as a part of combined heat and power production cycle.
4. The proposed project should have no influence on the COG production level. Therefore, amount of COG for the project scenario and for the baseline scenario can be assumed to be the same for each year.
5. All steam produced under the project have to be based on COG combustion only. No other fossil fuel can be used for steam generation.
6. In general, proposed project should have no influence on technological heat/steam demand level. Both turbines under the project can be considered substitutions of the PRDS units that were used for correction of the steam parameters. However, some differences can be considered in heat generation level due to principle of operation of the condensing turbine, as appropriate.
7. All significant leakages should be taking into consideration.
8. The project implementation can result in an increase in electricity consumption due to the installation of the new equipment or modernization the existing one. However, this electricity can be considered as carbon neutral, because it is generated from the waste heat.
9. The reduction of GHG emissions should be due to additional electricity generated with the same level of heat production with respect to the baseline scenario. Therefore, the amount of emission reduction can be calculated based on the monitoring data of the electricity generated by the project.

In formulas, the proposed approach can be described the following way:

$$BE_y = EG_{net,\mathrm{Pr},y} \times EF_{grid,y} \quad \text{where} \qquad \text{(B.1.1)}$$

BE_y - baseline emissions in the year *y* due to grid electricity consumption, $tCO_2eq.$;

$EG_{net,\mathrm{Pr},y}$ - net amount of electricity in the year *y*, generated by turbines under the project activity (without electricity consumed by the project equipment), MWh.

$EF_{grid,y}$ - emission factor for the electricity from the grid in the year *y*. $EF_{grid,y}$ = 0.896 tCO_2/MWh (see Annex 2, value $EF_{grid,reduced,y}$).

$$EG_{net,\mathrm{Pr},y} = EG_{CHP,\mathrm{Pr},y} - EC_{equip,\mathrm{Pr},y} \quad \text{where} \qquad \text{(B.1.2)}$$

$EG_{CHP,\mathrm{Pr},y}$ - amount of electricity in the year *y*, generated by turbines under the project activity, MWh.

$EC_{equip,\Pr,y}$ - amount of electricity consumed by equipment in the year *y*, installed under the project activity, MWh.

Project emissions are equal to zero, because no new emissions source are created in comparison with the baseline:

$$PE_y = 0 \text{ where} \quad (B.1.3)$$

PE_y - Project Emissions, t CO_2eq

As for leakages, the only additional consumption of fuel is at site of the external consumers, to cover the lack of COG supplied before the project was implemented.

$$LE_{CHP,y} = Lack_{fuel,i,y} \times EF_{fuel,j,y}, \text{ where} \quad (B.1.4)$$

$LE_{CHP,y}$ - possible leakages due to the reduction of COG supplied to the external consumers due to the project, and the additional combustion of an equivalent amount of fuel at site of the external consumers, to cover the lack of COG, t CO_2eq./MW

$Lack_{fuel,i,y}$ - energy equivalent of COG, which would not be supplied to external consumers due to the project activity, as appropriate, GJ.

$EF_{fuel,j,y}$ - emission factor for fuel that would have been combust to cover the lack of COG at site of external consumers, t CO_2eq./GJ.

Taken into account information given above, reduction of GHG emission can be calculated by formula:

$$ER_y = BE_y - PE_y - LE_{CHP,y} \text{ where} \quad (B.1.5)$$

ER_y - Annual emission reductions, t CO_2eq

BE_y - baseline emissions due to grid electricity consumption, t CO_2eq.

PE_y - Project Emissions, t CO_2eq

$LE_{CHP,y}$ - possible leakages due to the reduction of COG supplied to the external consumers due to the project, and the additional combustion of an equivalent amount of fuel at site of the external consumers, to cover the lack of COG, t CO_2eq

Application of the approach chosen

All calculations concerning estimated emission reduction are given in Excel spreadsheets. All the assumptions used in this model are based on official forecasts of the project owner as well as on the real historical data for the previous period. The key information and data in tabular form are given below.

With regards to the substitution of electricity, the approach taken is simple and transparent, however, some clarification may be needed to explain the leakages associated with the turbine operation.

Within the condensing turbine, the steam expands below the atmospheric pressure and then "condenses" whilst heating the cooling water in a condenser. The condensing turbine can generate more power from the same amount of steam than the backpressure turbine, but a smaller of steam exits the outlet.

The steam production is dependent on the capture technology. Therefore, to provide the same amount of steam as to a scenario without the project, more steam must be produced to compensate for the specifics of condensing turbine, described above.

To produce steam at ZCP, two boilers running on COG, each with a capacity of 75 t/h, are used. A part of the COG that cannot be consumed for internal needs was exported to Zaporozhstal as a supplementary fuel (the main fuel is natural gas) for blast furnaces and for steam production.

As it is likely that COG consumption would be increased in the boiler to produce additional steam for the turbines, it can be assumed that this additional steam generated, in the absence of the project, would be delivered to ZaporozhStal, reducing the need for additional natural gas. This can be considered as an additional area of leakage that can be calculated using the following approach.

Due to the principles of work of condensing turbine, there is a difference between the amount of steam input and amount of steam output from the condensing turbine. This can be described using the following formula:

$$\Delta SG_{extra,y} = SG_{input} - SG_{output} \text{ where} \quad (B.1.6)$$

$\Delta SG_{extra,y}$ - difference between heat equivalents of steam input and output of the condensing turbine for the year *y*, GJ.;

SG_{input} - heat equivalent of steam before the condensing turbine, GJ;

SG_{output} - heat equivalent of steam after the condensing turbine, GJ;

This value shows an amount of additional heat energy generated under the project activity in comparison with baseline scenario. Therefore, equivalent amount of COG to produce such amount of heat would be:

$$FC_{COG,extra,y} = \frac{\Delta SG_{extra,y}}{NCV_{COG}} \times 1000 \text{ where} \quad (B.1.7)$$

$FC_{COG,extra,y}$ - extra amount of COG that have to be combusted in the year *y* to generate the extra amount of steam for condensing turbine, th m^3.

NCV_{COG} - net calorific value of COG. NCV_{COG} = 3996 kcal/m^3 in accordance with the ZCP' data.

The equivalent amount of natural gas, which would be needed to generate necessary amount of steam can be calculated by formula:

$$FC_{NG,extra,y} = \frac{\Delta SG_{extra,y}}{NCV_{NG}} \times 1000 \text{ where} \quad \text{(B.1.8)}$$

$FC_{NG,extra,y}$ - equivalent amount of natural gas in the year *y*, which is needed to generate necessary amount of steam , th m^3;

NCV_{NG} - net calorific value of natural gas[4]. NCV_{NG} = 7910 kcal/m^3.

Leakages due to extra natural gas combustion in the year *y* at site of external consumers can be calculated using following formula:

$$LE_{CHP,y} = \frac{\Delta SG_{extra,y} \times EF_{NG}}{1000} \text{ where} \quad \text{(B.1.9)}$$

EF_{NG} - emission factor for natural gas. In accordance with IPCC 2006 (Volume 2 "Energy", Introduction)[5], this value is equal to 56.1 kg CO_2 eq/GJ.

As it was described above, the concept of the project is an installation of the two turbines to substitute PRDS (pressure-reducing and desuperheating stations) that were used for correction of parameters of steam.

In order to exclude N_2O project emissions as being negligibly small, due to additional electricity consumption from further calculations, simple analyse has to be carried out. No emission factor has been calculated for COG, however, conservative emission factors for different emissions for natural gas are available. Therefore, one can compare concentration of N_2 in both gases and if they are similar, use relevant emission factor for natural gas for N_2O emissions. Preliminary composition of COG[6] is the following:

Table B.2.1 - Preliminary composition of COG

Component	**H_2**	**CH_4**	**CO**	**CO_2**	**N_2**	**Alkenes**	**O_2**
Concentration , % vol.	55-60	20-30	5-7	2-3	4	2-3	0.4-0.8

[4] Reference book "Theoretical bases of thermotechnics", Volume 2 (V.A. Grigor'ev and V.M. Zorin, Moskow 1988). The source will be provided to AIE on the first demand.

[5] http://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/2_Volume2/V2_1_Ch1_Introduction.pdf

[6] http://dic.academic.ru/dic.nsf/bse/96728/%D0%9A%D0%BE%D0%BA%D1%81%D0%BE%D0%B2%D1%8B%D0%B9

Preliminary composition of natural gas[7] is the following:

Table B.2.2 - Preliminary composition of natural gas

Component	CH_4	C_2H_6	C_3H_8	C_4H_{10}	CO_2	O_2	N_2	H_2S	Rare gases
Concentration , % vol.	70-90	0-20			0-8	0-0.2	0-5	0-5	trace

As it seen from these tables, concentrations of N_2 for both gases are almost the same. Therefore, using the N_2O emission factor for natural gas is a reasonable assumption. In accordance with IPCC 2006, this value is equal to 0.02 g/m^3 n. gas or $EF_{NG,N_2O} = 0.02\ \text{g/m}^3$

Additional COG consumption due to the principle of work of condensing turbine is already considered as a leakage and equal to $FC_{NG,extra,y}$ value.

Maximum ex-ante value of this parameter is equal to 14,073 th. m3 (please see the Excel calculation model).

Using the above stated emission factor, one can find the value of possible N_2O leakage:

$$LE_{N2O,y} = \frac{FC_{NG,extra,y} \times EF_{NG,N_2O}}{1000} = \frac{14{,}073{,}000 \times 0.02}{10^6} = 0.28\ t\ N_2O \tag{B.1.10}$$

Using the conversion factor equal to 310, needed to convert N_2O into CO_2 equivalent one can get the following figure of possible leakage:

$$0.28 \times 310 = 87.2\ \text{t } CO_2 \text{ eq.} \tag{B.1.11}$$

This value is not significant, (less than 1% from project emissions and less than 2,000 t CO_2) and can be considered as a negligible.

Conservative assumptions used can be described the following way:

1. As it was mentioned above, it is likely that COG consumption would be increased in the boiler to produce additional steam for the turbines. In fact, big part of this additional gas will be provided due to the minimizing of flaring. Under the proposed approach, it is assumed that this additional amount of gas would not be supplied to Zaporozhstal and therefore leakages due to the natural gas combustion will appear.
2. Conservative emission factor for electricity from the grid is used to calculate baseline emissions due to electricity consumption.

[7] http://www.naturalgas.org/overview/background.asp

Key parameters

No national policies and circumstances can significantly influence the baseline. Therefore, only some technical parameters have to be described.

As a key parameters that can significantly influent on ER amount the following parameters can be considered:

- Electricity generation by the backpressure turbine
- Electricity generation by the condensing turbine
- Electricity consumed by the project equipment
- Difference between steam input and steam output amounts in condensing turbine
- Emission factor for natural gas
- Emission factor for electricity from the grid

Data/Parameter	**Electricity generation by the backpressure turbine**						
Data unit	MWh						
Description	Annual amount of electricity generated by backpressure turbine.						
Time of determination/monitoring	Monitored during crediting period						
Source of data to be used	Official statistic data of project owner						
Value of data applied (for ex ante calculations/determinations)	**Year**	**2008**	**2009**	**2010**	**2011**	**2012**	**> 2013**
	Value	40,659	48,075	43,800	52,560	52,560	52,560
Justification of the choice of data or description of measurement methods and procedures (to be) applied	The data applied for ex ante determination are based on the forecasts of the project owner. The value for 2008 year is factual and reflects the real amount of generated electricity. It is assumed that the load will increase gradually due to setup works and adjustments. This parameter has to be continuously monitored during the year. The electricity meters are used for the measurements.						
QA/QC procedures (to be) applied	The electricity meters will be calibrated according to the host Party's legislation.						
Any comment							

Data/Parameter	**Electricity generation by the condensing turbine**						
Data unit	**MWh**						
Description	Amount of electricity generated by condensing turbine during a year.						
Time of determination/monitoring	Monitored during crediting period						
Source of data to be used	Official statistic data of project owner						
Value of data applied (for ex ante calculations/determinations)	**Year**	**2008**	**2009**	**2010**	**2011**	**2012**	**> 2013**
	Value	-	-	35,040	52,560	52,560	52,560
Justification of the choice of data or description of measurement methods and procedures (to be) applied	The data applied for ex ante determination are based on the forecasts of the project owner. It is assumed that the load will increase gradually due to setup works and adjustments. This parameter has to be continuously monitored during the year. The electricity meters will be installed together with the turbine.						
QA/QC procedures (to be) applied	The electricity meters will be calibrated according to the host Party's legislation.						
Any comment							

Data/Parameter	Electricity consumed by the project equipment
Data unit	MWh
Description	Annual amount of electricity $EC_{equip,\Pr,y}$ consumed by new installed equipment under the project activity.
Time of determination/monitoring	Monitored during crediting period
Source of data to be used	Official statistic data of project owner
Value of data applied (for ex ante calculations/determinations)	<table><tr><th>Year</th><th>2008</th><th>2009</th><th>2010</th><th>2011</th><th>2012</th><th>> 2013</th></tr><tr><td>Value, MWh</td><td>463</td><td>556</td><td>2,600</td><td>3,600</td><td>3,600</td><td>3,600</td></tr></table>
Justification of the choice of data or description of measurement methods and procedures (to be) applied	The data applied for ex ante determination are based on the forecasts of the project owner. This parameter have to be continuously monitored during the year. The separate device for metering electricity consumption at the turbine shop are already installed. This data is necessary to calculate net amount of electricity generated $EG_{net,\Pr,y}$, which is used for baseline emissions calculation.
QA/QC procedures (to be) applied	The meter will be calibrated according to the host Party's legislation.
Any comment	

Data/Parameter	Difference between heat equivalents of steam input and steam output amounts in condensing turbine
Data unit	GJ
Description	Difference between heat equivalents of steam input and steam output amounts in condensing turbine $\Delta SG_{extra,y}$
Time of determination/monitoring	Monitored during crediting period
Source of data to be used	Official statistic data of project owner
Value of data applied (for ex ante calculations/determinations)	<table><tr><th>Year</th><th>2008</th><th>2009</th><th>2010</th><th>2011</th><th>2012</th><th>> 2013</th></tr><tr><td>Value</td><td>0</td><td>0</td><td>82,049</td><td>111,315</td><td>111,315</td><td>111,315</td></tr></table>
Justification of the choice of data or description of measurement methods and procedures (to be) applied	The data applied for ex ante determination are based on the forecasts of the project owner. This parameter depends on two parameters which have to be continuously monitored during the year: - Heat equivalent of steam at the input of condensing turbine (SG_{input}), GJ - Heat equivalent of steam at the output of condensing turbine (SG_{output}), GJ The separate device for determining this difference will be installed together with the condensing turbine.
QA/QC procedures (to be) applied	The meters will be calibrated according to the host Party's legislation.
Any comment	

Data/Parameter	Emission factor for natural gas
Data unit	kg CO_2 eq/GJ
Description	Factor of emissions occur while natural gas combusting $EF_{NG,y}$
Time of determination/monitoring	Fixed ex-ante during determination
Source of data to be used	IPCC 2006, Volume 2 “Energy”, Introduction[8]
Value of data applied (for ex ante calculations/determinations)	56.1
Justification of the choice of data or description of measurement methods and procedures (to be) applied	This data is recommended by IPCC and is a default for project connected with natural gas combustion.
QA/QC procedures (to be) applied	-
Any comment	

Data/Parameter	Emission factor for electricity from the grid
Data unit	tCO_2/MWh
Description	Emission factor for the grid electricity for JI projects reducing electricity consumption from the grid. $EF_{grid,y}$
Time of determination/monitoring	Fixed ex-ante during determination
Source of data to be used	“Standardized emission factors for the Ukrainian electricity grid” research (please find in Annex 2), made by Global Carbon and positively determined by TÜV SÜD[9]
Value of data applied (for ex ante calculations/determinations)	0.896
Justification of the choice of data or description of measurement methods and procedures (to be) applied	This research is the most credible source for Ukrainian grid emission factor at this moment. All calculations based on official data from the relevant scope Ministries.
QA/QC procedures (to be) applied	-
Any comment	Detailed description of the standardized emission factor for the Ukrainian electricity grid is given bellow.

[8] http://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/2_Volume2/V2_1_Ch1_Introduction.pdf

[9] The determination conclusion will be provided to AIE on demand.

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:

Two ZCP boilers generate steam with a pressure of 35 kgf/sm2 and temperature of approximately 440°C. These parameters are excess for the technological needs of the project. To reduce the pressure and temperature, three PRDS (pressure-reducing and desuperheating stations) units are used. PRDS work by cooling and depressurization of superheated steam by introducing water. The output is steam with a pressure of 5,0-5,5 kgf/sm2 and temperature of 300°C.

Therefore, some amount of energy that contained in the superheated steam would be lost without useful utilization, in the absence of this project.

The concept of the project is an installation of the two turbines to substitute PRDS (pressure-reducing and desuperheating stations) that were used for correction of parameters of steam. Therefore, electricity generated under the project activity can be considered like less carbon intensive than electricity from the grid, because the turbines use waste source.

The information above showing that emissions in the baseline scenario would likely exceed the emissions in the project scenario.

To demonstrate additionality the "Tool for the demonstration and assessment of additionality", Version 05.2[10] is used. In accordance with the Tool, the following sequence shall be used:

STEP 1. IDENTIFICATION OF ALTERNATIVES

Identification of alternatives was undertaken in section B.1. Four alternatives where identified, listed below, please refer to section B.1. for a more detailed description.

- Implementation of the Coke Oven Gas CHP without JI incentive
- Implementation of the Coke Oven Gas CHP with increase in COG production compared to the baseline scenario with aim to generate more electricity and ERUs
- Continuation of the existing situation
- COG used for heat energy production

The third alternative, Continuation of the existing situation, was selected as the baseline. The benchmark investment analyze of the project will be used as a step 2.

[10] http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-01-v5.2.pdf

STEP 2. INVESTMENT ANALYSIS

Sub-step 2a: Determine appropriate analysis method

Option III (Benchmark analyze) is used as an analysis method

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

The Net Present Value (NPV) directly measures the increase in value to the firm, therefore it is generally used in business as the main indicator over IRR as IRR is unreliable in the following situations non-conventional cash flow and mutually exclusive projects. It is safe to use IRR only when the cash inflow or outflow only changes once. If the cash flow changes over time, from negative to positive and then back again to negative there is a high chance that the investment contains multiple IRR. If that is the case, then it would be difficult to determine which IRR to use. As this project has two distinct cash injections the project developer has elected to use NPV only.

Therefore, NPV of the project has been selected as the key indicator of profitability. A positive NPV indicates that the project is profitable.

The following assumptions were taken into account when calculating financial parameters of the project:

- All prices and figures are relevant to investment decision making period (2004), including the forecasting values.

- Capital investment injections were 23.251m and 49.784m UAH for the years 2005 and 2007 respectively;

- The project horizon is limited to 20 years – a common period for the depreciation of the energy equipment and maximum assessment period in accordance with the *Guidance on the Assessment of Investment Analysis* (Annex for "Tool for the demonstration and assessment of additionality", Version 05.2).

- Prices for electricity from the grid are taken as the actual figures for 2004, and held constant for the full life cycle at 144.2 UAH/MWh;

- The turbine was brought into service in 2008, therefore the net price for electricity generated by the new turbines is equal to actual historical data. It is assumed that the price remains fixed until 2009 at 165.7 UAH/MWh. However, a significant reduction is expected in 2010, due to condensing turbine installation[11]. Therefore the net price for electricity generated from 2010 will be equal to 140.0 UAH/MWh. Both prices do not include deprecation. Taking into account that these figures are actual for 2008 year, costs of electricity production has been deflated from 2008 values to 2004 using the deflation index of 1,252*1,128*1,091*1,135=1,749 (Using inflation data 2008-2005 from official statistic[12]).

- Costs of major overhauls for both turbines does not included in the analyze for simplification, which is conservative;

[11] The condensing turbine is a much more technological advanced than backpressure turbine, therefore less "attention" in the form of maintenance and operational monitoring is needed. This figure is based on ZCP' forecast.

[12] http://www.ukrstat.gov.ua/operativ/operativ2008/ct/cn_rik/icsR/iscR_u/isc_tp_rik_u.htm

- The discount rate of 7.8% is based on average loan rate in UAH, equal to 17.5 %, reported by the National Bank of Ukraine on the 5th of November 2004[13]. This and 9% expected 2004 inflation combine to a real discount rate of 7.8%.

- The liquidation value (scrap value) is based on the following parameters: weight of both turbines is 90.37 t; market price in 2005 for scrap assumed[14] equal to 250$ per t; exchange rate for €/$ is assumed[15] equal to 1.35 for 2005 year.

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

All financial calculations were made in the Excel spreadsheet. Achieved results described bellow in table forms.

Table B.2.3, below, shows the main economic parameters for the project scenarios.

Table B.2.3. Economic parameters

Parameter	Unit	Project
NPV	k UAH	-19,056.68

Hence, the project could not have been profitable if undertaken within the framework of common commercial practices not taking JI revenues into account.

Sub-step 2d: Sensitivity analyze

The sensitivity analyze of the project is based on fluctuations of the investment cost, the electricity generation costs and the electricity prices from the grid, by plus or minus 10%.

The results of sensitivity analyze are shown in the table B.2.4.

Table B.2.4. Outcomes of Sensitivity Analyze

Variable	Rate	NPV, k UAH
Investment	+10%	-25,665.95
	-10%	-12,447.41
Electricity price	+10%	-8,269.99
	-10%	-29,843.37
Electricity generation price	+10%	-25,144.40
	-10%	-12,968.96

From table B.2.4 one can see that NPV of this project remains negative despite the variation in the key assumptions.

[13] http://www.bank.gov.ua/Fin_ryn/Pot_tend/2004/2004.zip

[14] http://ugmk.info/art/obzor-mirovogo-rynka-stali-27-dekabrja--10-janvarja/3.html

[15] http://finance.yahoo.com/currency-converter

STEP 4. COMMON PRACTICE ANALYZE

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

Common practice in Ukrainian coke production, dictates that about 50% of the coke gas is used for the coke battery coking process, and the remainder is free waste gas, which is available as a secondary energy source.

Finished coke is mainly used in blast furnaces during iron production, hence coke plants are either constructed separately, near the material source, or as part of a full cycle metallurgical plant.

The full cycle metallurgical plants usually include:

- Sinter plant;
- Pig iron plant;
- Steel plant;
- Auxiliary plants and workshops (such as coke plant, CHP, etc).

The coke is used as a main energy source for the iron production in the blast furnaces. The average coke consumption is 400-500 kg per tonne of pig iron. Most of full cycle metallurgical plants in Ukraine have integrated coke plants.

A scheme using a "coke department – blast furnace – oxygen steel-making converter" is widespread throughout the world. Therefore, it is a common practice to use the COG as a fuel for internal technological needs. Using the COG for heat/steam production as well as simple flaring of excess is also a popular practice.

With regards to electricity sources, the most common practice is to use take electricity from a National distribution grid.

There are some previous examples of similar projects in Ukraine can be observed. For example, Yasinovskiy Coke Plant[16], and Horlivka Coke Plant[17]

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

Although similar activities are observed, all of them are not financial attractive and have being considered under the JI mechanism, with the JI incentive as being deemed necessary for project realization.

Based on the information above we conclude that for a standalone Coke Plant using the excess COG as a source of electricity production is not common practice.

Conclusion: The above stated confirms to recognize that the GHG emission reductions generated by the proposed JI project activity are additional to those that could have occurred otherwise.

[16] http://ji.unfccc.int/UserManagement/FileStorage/MRUAQE80DJZ16WCINXK4T9SHYBGFP5

[17] http://ji.unfccc.int/UserManagement/FileStorage/MEF827W6HTDNYX0941BOKVCIL3SPUR

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

The project activities are limited physically by the premises of the ZCP. At the same time, the source of GHG emission is indirect, the Ukrainian electricity grid, as a result of a reduction in electricity generation using fossil fuels.

The table below shows an overview of all emission sources in the baseline and project scenarios process:

Table B.3.1 – Sources of emissions in the baseline and project scenarios

	Source	Gas	Included/ Excluded	Justification / Explanation
Baseline scenario	Net electricity generation, grid or captive source	**CO_2**	**Included**	**Main emission source**
		CH_4	Excluded	Excluded for simplification.
		N_2O	Excluded	Excluded for simplification.
	Fossil fuel consumption in boiler for thermal energy	CO_2	Excluded	As continuation of existing situation has been established as the baseline, fossil fuel consumption in existing boiler house is excluded.
		CH_4	Excluded	Excluded for simplification.
		N_2O	Excluded	Excluded for simplification.
	Fossil fuel consumption in cogeneration plant	CO_2	Excluded	There is no cogeneration plant in the baseline scenario, so this source of emissions is excluded.
		CH_4	Excluded	Excluded for simplification.
		N_2O	Excluded	Excluded for simplification.
Project scenario	Supplemental electricity consumption.	CO_2	Excluded	Proposed CHP has some own electricity consumption under normal operational conditions. This electricity is already included into the baseline emissions via the value "Net electricity generation", therefore double counting is not possible.
		CH_4	Excluded	Excluded for simplification. COG combustion is taken place in efficient covered boilers. Therefore, all inflammable gases including methane are fully burning down.
		N_2O	Excluded	Excluded for simplification as not significant
Leakages	Additional natural gas combustion at site of external consumer of COG due to the lack of COG under the project activity	**CO_2**	**Included**	**The principles of work of condensing turbine connected with additional consumption of steam and correspondingly additional volume of COG combusted in the boiler house. This volume would not be sold to external consumer as usual. Therefore, to cover this lack of COG, additional volume of natural gas required at site of external consumer.**
		CH_4	Excluded	Minor source. Boilers used for COG combustion has an efficient burning systems. Therefore, possible concentration of combustible gases at the output would be too small to be considered as significant.
		N_2O	Excluded	Minor source (please see Section B.1.).

The baseline scenario is a continuation of the existing situation. Thus, the source of emissions is the Ukrainian electricity grid, namely the emissions from the fossil fuels combustion for the electricity generation.

There is no combustion of auxiliary fuel to supply waste gas. Electricity is not used to clean the COG before being used for generating electricity under proposed project activity. The project emissions are limited by the supplemental carbon neutral electricity consumption. Additional electricity will be consumed by new equipment installed within the limits of the proposed CHP during operation (e.g. pumps, fans, control system, etc.). This electricity is a carbon neutral, because the CHP is fuelled by COG, which, in the baseline scenarios, is flared and burnt in the existing boiler house and at site of external consumers. However, auxiliary electricity consumption would not occur in the absence of the proposed project, so it needs to be considered as a projects emissions source.

The following figure shows the project boundaries and sources of emissions in the baseline and project scenarios.

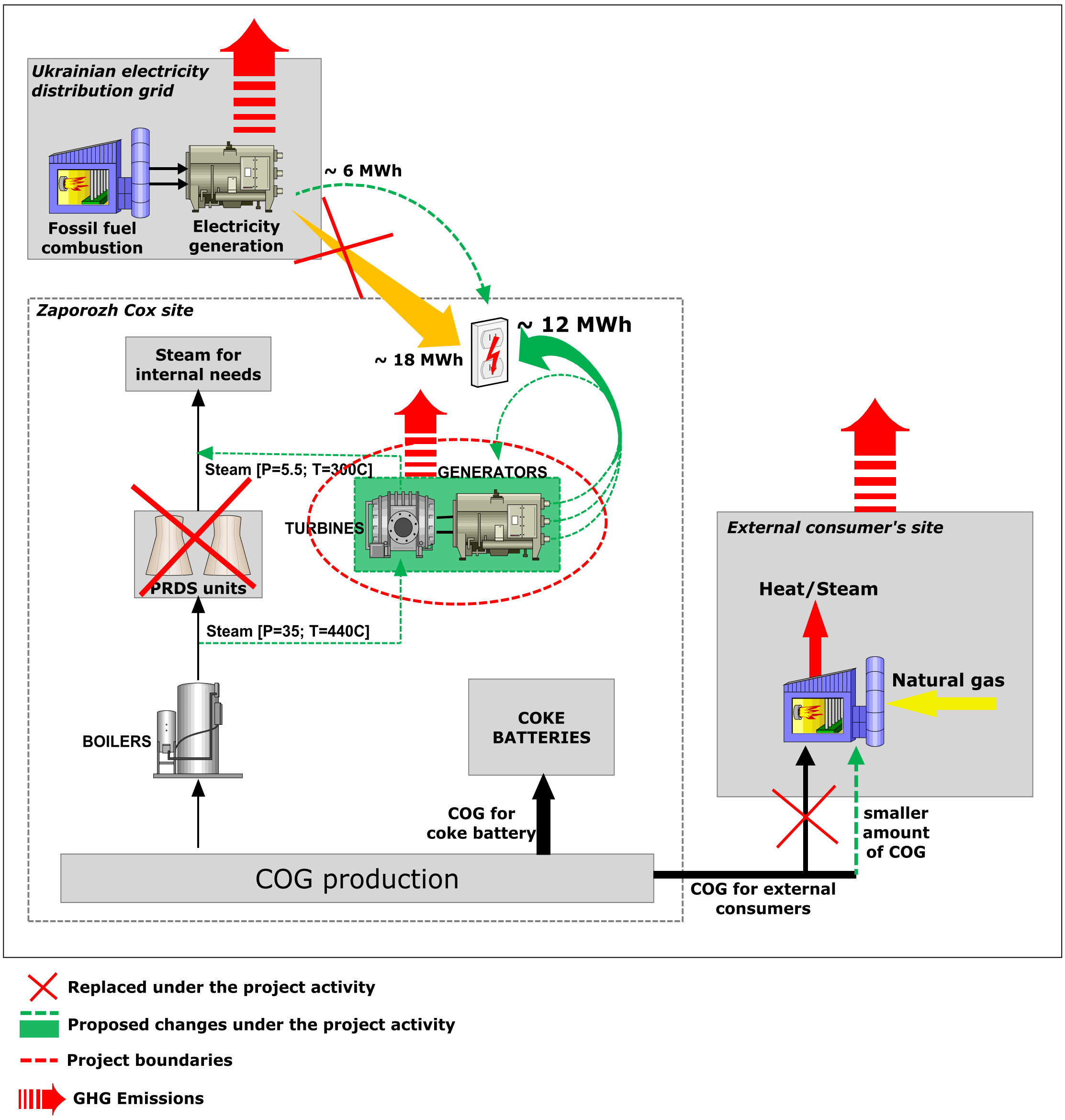

Figure B.3.1 - Project boundaries

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: 03/03/2010

Name of person/entity determining the baseline:
Denis Rzhanov
Global Carbon B.V.

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 14 January 2005.

C.2. Expected operational lifetime of the project:

The lifetime of the equipment will be at least 20 years. Thus operational lifetime of the project will be 20 years or 240 months.

C.3. Length of the crediting period:

Start of crediting period: 01.02.2008.

Length of crediting period: 4 years 11 months or 59 months.

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

SECTION D. Monitoring plan

D.1. Description of monitoring plan chosen:

In accordance with JI Guidance on Criteria for Baseline Setting and Monitoring[18], Version 02 project participants propose JI specific approach for monitoring.

The baseline emissions would occur in the absence of the project from the electricity imported from the grid for all ZCP's needs.

The baseline emissions will be calculated based on the following inputs:

- All electricity generated by the project from the COG is carbon neutral[19];
- Electricity generated by the project from the COG and consumed by ZCP's auxiliaries apply an Emission Factor (EF) of 0.896 tCO_2/MWh as a project reducing electricity consumption from the grid (see Annex 2). The emission factor for the Ukrainian electricity grid, developed by Global Carbon B.V., determined by TUV SUD and final determined by the JISC, will be used for the baseline emissions calculation. ;

All data in the calculation of the baseline emissions have sufficient level of uncertainties due to regularly calibrating of meters.

Project emissions can include emissions due to combustion of auxiliary fuel to supplement waste gas and electricity emissions due to consumption of electricity for cleaning gas before being used for generation of heat/energy/electricity. In case of the proposed project there is no auxiliary fuel to supplement COG due to the CHP design.

The following conservative approach is used to monitor project scenario emissions.

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18 http://ji.unfccc.int/Ref/Documents/Baseline_setting_and_monitoring.pdf

19 During the verification it has to be checked if any fossil fuel different to COG were combusted to produce steam during the monitoring period. In case other fossil fuels were combusted the relevant project emissions should be calculated and included in the project emissions.

The proposed CHP does not require any additional COG cleaning before fuelling the boiler, so there is no consumption of electricity for cleaning of COG. Additional electricity will be consumed by new equipment installed within the limits of the proposed CHP during operation (e.g. pumps, fans, control system, etc.). This electricity is carbon neutral, because CHP will be fuelled by COG, which is flared and burnt in the existing boiler houses at the moment. However, auxiliary electricity consumption would not occur in the absence of the proposed project, so it needs to be substituted from the amount of electricity generated by new CHP. Taking into account the information given above, the monitoring plan should include the following positions:

- Amount of electricity, generated by new turbines under the project activity
- Amount of electricity consumed by project equipment
- Amount of COG, which would not be supplied to external consumers due to the project activity. This value can be either monitored or calculated, subject to project conditions.
- Amount of other fossil fuel have been combusted during the monitoring period, if any. This parameter was not included into the tables D.1.2.1 and D.1.3.1 as well as there is no reflection of this parameter in any formulas of the MP, because everything depends on fossil fuel type. For every monitoring period AIE have to find out if any fossil fuel have been combusted in mixture with COG. In this case relevant emissions have to be calculated using IPCC default factors and relevant NCV.

If the main metering device fail, and there are no reserve metering device available, the monitoring report will use indirect data and evidence, but only if their applicability (data and evidence) is justifiable proved. Likely, a conservative approach will be used. **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

Not applicable

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

Not applicable

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

Not applicable

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

Not applicable

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
1. $EG_{CHP,\mathrm{Pr},y}$	Electricity generated by the new turbines	Plant records	MWh	m	continuously	100%	Electronic and paper	
2. $EC_{equip,\mathrm{Pr},y}$	Electricity consumed by the project equipment	Plant records	MWh	m	continuously	100%	Electronic and paper	

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):

Baseline Emissions will be estimated by the following formulas:

$$BE_y = EG_{net,\mathrm{Pr},y} \times EF_{grid,y} \text{ where} \quad \text{(D.1.1)}$$

BE_y - baseline emissions in the year *y* due to grid electricity consumption, tCO_2eq.;

$EG_{net,\mathrm{Pr},y}$ - net amount of electricity in the year *y*, generated by turbines under the project activity (without electricity consumed by the project equipment), MWh.

$EF_{grid,y}$ - emission factor for the electricity from the grid in the year *y*. $EF_{grid,y}$ = 0.896 tCO_2/MWh (see Annex 2, value $EF_{grid,reduced,y}$).

$$EG_{net,\Pr,y} = EG_{CHP,\Pr,y} - EC_{equip,\Pr,y} \text{ where} \qquad (D.1.2)$$

$EG_{CHP,\Pr,y}$ - amount of electricity in the year *y*, generated by turbines under the project activity, MWh. This data should be monitored;

$EC_{equip,\Pr,y}$ - amount of electricity consumed by equipment in the year *y*, installed under the project activity, MWh. This data should be monitored;

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

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

ID number *(Please use numbers to ease cross-referencing to D.2.)*	Data variable	Source of data	Data unit	Measured (m), calculated (c), estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment
3. SG_{input}	Heat equivalent of steam at the input of condensing turbine	Plant records	GJ	m	continuously	100%	Electronic and paper	Special device will measure temperature, pressure and flow of steam. These data will be automated transformed into heat equivalent.
4. SG_{output}	Heat equivalent of steam at the output of condensing turbine	Plant records	GJ	m	continuously	100%	Electronic and paper	Special device will measure temperature, pressure and flow of steam. These data will be automated transformed into heat equivalent.

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

Due to the principles of work of condensing turbine, there is a difference between steam input and steam output amounts. This difference describes the lack of fuel due to the leakages and can be calculated the following way:

$$Lack_{fuel,i,y} = SG_{input} - SG_{output} \text{ where} \quad (D.1.3)$$

$Lack_{fuel,i,y}$ - difference between heat equivalents of steam input and steam output amounts, in the year *y*, GJ.;

SG_{input} - heat equivalent of steam before the condensing turbine, GJ;

SG_{output} - heat equivalent of steam after the condensing turbine, GJ;

Leakages due to extra natural gas combustion at site of external consumers can be calculated using following formula (in accordance with formula B.1.4):

$$LE_{CHP,y} = \frac{Lack_{fuel,i,y} \times EF_{NG}}{1000} \text{ , where} \quad (D.1.4)$$

EF_{NG} - emission factor for natural gas. In accordance with IPCC 2006[20], this value is equal to 56.1 kg CO_2 eq/GJ.

1000 – conversion factor needed to normalize measurement units in formula.

[20] http://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/2_Volume2/V2_1_Ch1_Introduction.pdf

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:

$$ER_y = BE_y - LE_{CHP,y} \text{ where} \quad (D.1.5)$$

ER_y - emission reductions in the year *y*, t CO_2 eq;

BE_y - baseline emissions in the year *y* due to grid electricity consumption, t CO_2eq.;

$LE_{CHP,y}$ - leakages due to the project realization in the year *y*, t CO_2eq.

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:

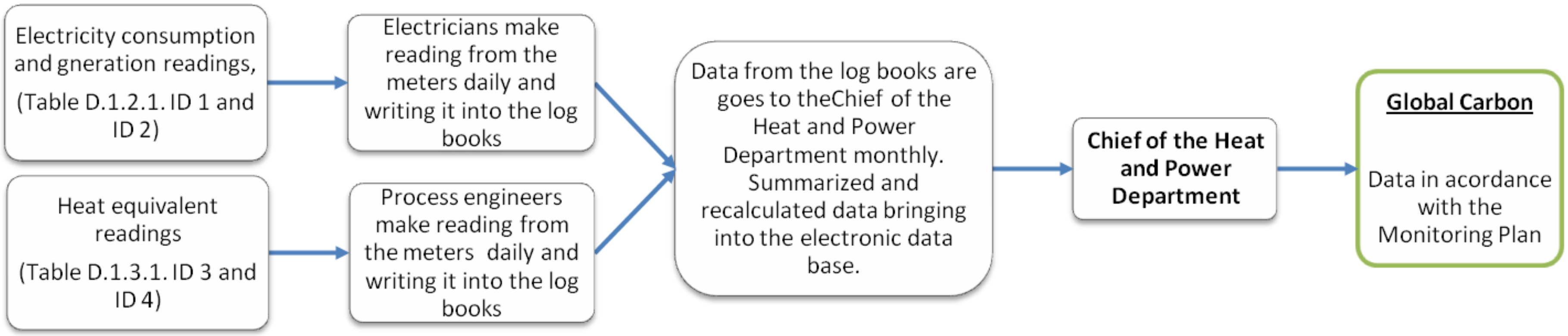
Collection and archiving of the information on the environmental impacts of the project was done based on the approved EIA (see Section F.1).

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.
Table D.1.2.1. ID 1	Low	The electricity meters will be calibrated according to the host Party's legislation. Accuracy class index for the current device (Alpha A1140) is 1
Table D.1.2.1. ID 2	Low	The electricity meters will be calibrated according to the host Party's legislation. Accuracy class index for the current device (Energiya-9) is 0.2
Table D.1.3.1. ID 3	Low	The device (s) for heat equivalent meter will be calibrated according to the host Party's legislation. The meter is going to be installed together with the condensing turbine. Certain accuracy class index for the meter will determined later.
Table D.1.3.1. ID 4	Low	The device (s) for heat equivalent meter will be calibrated according to the host Party's legislation. The meter is going to be installed together with the condensing turbine. Certain accuracy class index for the meter will determined later.

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 data and periodical checking of the measurement devices, the measurement team from Chief Energy's Department 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 is presented on the following flow-chart:



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

Name of person/entity establishing the monitoring plan:

Denis Rzhanov

Global Carbon B.V.

For the contact details please refer to Annex 1.

SECTION E. Estimation of greenhouse gas emission reductions

E.1. Estimated project emissions:

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

Table 1: Estimated project emissions during the crediting period

		2013-2020	Total
Project emissions after the crediting period	[tCO2/yr]	0	**0**

Table 2: Estimated project emissions after the crediting period

E.2. Estimated leakage:

		2008	2009	2010	2011	2012	Total
Leakage during the crediting period	[tCO2/yr]	0	-	19,273	26,147	26,147	71,567

Table 3: Estimated leakage during the crediting period

		2013-2020	Total
Leakage after the crediting period	[tCO2/yr]	209,176	**209,176**

Table 4: Estimated leakage after the crediting period

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

		2008	2009	2010	2011	2012	Total
Project emissions during the crediting period	[tCO2/yr]	0	0	19,273	26,147	26,147	71,567

Table 5: Estimated total project emissions during the crediting period

		2013-2020	Total
Project emissions after the crediting period	[tCO2/yr]	209,176	**209,176**

Table 6: Estimated total project emissions after the crediting period

E.4. Estimated baseline emissions:

		2008	2009	2010	2011	2012	Total
Baseline emissions during the crediting period	[tCO2/yr]	36,016	42,567	68,311	90,962	90,962	**328,818**

Table 7: Estimated baseline emissions during the crediting period

		2013-2020	Total
Baseline emissions after the crediting period	[tCO2/yr]	727,696	**727,696**

Table 8: Estimated baseline emissions after the crediting period

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

		2008	2009	2010	2011	2012	Total
Emission reduction during the crediting period	[tCO2/yr]	36,016	42,567	49,038	64,815	64,815	**257,251**

Table 9: Estimated emission reduction during the crediting period

		2013-2020	Total
Emission reduction after the crediting period	[tCO2/yr]	518,520	**518,520**

Table 10: Estimated emission reduction after the crediting period

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

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	0	0	36,016	36,016
2009	0	0	42,567	42,567
2010	0	19,273	68,311	49,038
2011	0	26,147	90,962	64,815
2012	0	26,147	90,962	64,815
Total (tonnes CO_2 Equivalent)	**0**	**71,567**	**328,818**	**257,251**

Table 11: 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)
2013	0	26,147	90,962	64,815
2014	0	26,147	90,962	64,815
2015	0	26,147	90,962	64,815
2016	0	26,147	90,962	64,815
2017	0	26,147	90,962	64,815
2018	0	26,147	90,962	64,815
2019	0	26,147	90,962	64,815
2020	0	26,147	90,962	64,815
Total (tonnes CO_2 Equivalent)	**0**	**209,176**	**727,696**	**518,520**

Table 12: Estimated balance of emissions under the proposed project after the crediting period

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:

According to Ukrainian legislation, an Environmental Impact Assessment (EIA), as a part of the project design documents, has been completed for the proposed project and approved by local authority. Analyze of this document shows that introduction of the CHP will have a lot of positive environmental effects. Among others the following:

- Decreasing of the CO concentration in the flue gases of the coke battery;
- Afterburning of the H_2 and C_mH_m;
- Decreasing of the solid carbonaceous.

According to calculations made in EIA, emissions of air pollutants will be reduced after start up of the CHP. Construction of the proposed CHP will be carried out at the premises of ZCP and does not require any felling of the green plantation.

Extracts of important sections of EIA are available to the AIE on request.

As shown in the EIA, the proposed project will improve the environmental conditions in the region, so it has a positive transboundary effect.

Project activity is permitted by:

- Protocol of extraordinary meeting of Environment City Council under the Environmental Management Committee with representatives of industrial enterprises from 12.10.2007.
- OJSC "ZAPOROZHKOKS". Reconstruction of coke-oven batteries №1-bis. Project. I phase. Environmental impact assessment. Correction. Inv. #111348, 2006.
- OJSC "ZAPOROZHKOKS". Reconstruction of coke-oven batteries №1-bis. Project. I phase. Environmental impact assessment. Correction. Inv. #111349, 2006.
- Act of State Admission Committee on taking into operation of finally constructed facility dated 14.02.2008.
- Annex 1 to the Act of State Admission Committee on taking into operation of finally constructed facility.
- Permit for construction works performance #206 issued by OJSC "Zaporozhkoks" dated 14.04.2008.
- Consolidated complex conclusion "206|201a SOE "Central Service of Ukrainian investment expertise" concerning the project "Reconstruction of the complex of coke batteries #1-біс". OJSC "Zaporizhkoks" dated 29.11.2006.
- Decision #86 Zaporizhia City Council dated 28.02.2008.

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:

Environmental impacts are not considered significant by the project participants or the host Party

SECTION G. Stakeholders' comments

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

In accordance with Ukrainian legislation, ZCP has consulted the regional authority to obtain the necessary approvals for construction of the CHP. No stakeholder consultation is required by Host Party for the JI project. Stakeholder comments will be gathered during the month following publication of this PDD on the UNFCCC website in accordance with the determination process.

Annex 1

CONTACT INFORMATION ON PROJECT PARTICIPANTS

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Annex 2

BASELINE INFORMATION

Summary of the key elements in tabular form:

#	Parameter	Data unit	Source of data
1	Electricity generation by the backpressure turbine	MWh	Official statistic data of project owner
2	Electricity generation by the condensing turbine	MWh	Official statistic data of project owner
3	Electricity consumed by the project equipment $EC_{equip,\Pr,y}$	MWh	Official statistic data of project owner
4	Difference between heat equivalents of steam input and steam output amounts in condensing turbine $\Delta SG_{extra,y}$	GJ	Official statistic data of project owner
5	Emission factor for natural gas $EF_{NG,y}$	kg CO2 eq/GJ	IPCC 2006, Volume 2 “Energy”, Introduction
6	Emission factor for electricity from the grid $EF_{grid,y}$	tCO2/MWh	“Standardized emission factors for the Ukrainian electricity grid” research (please find in Annex 2), made by Global Carbon and positively determined by TÜV SÜD

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[21];

- The "Operational Guidelines for the Project Design Document", further referred to as ERUPT approach or baseline [22];

- The approved CDM methodology ACM0002 "Consolidated baseline methodology for grid-connected electricity generation from renewable sources" [23];

- 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.

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

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

[22] Operational Guidelines for Project Design Documents of Joint Implementation Projects. Ministry of Economic Affairs of the Netherlands, May 2004

[23] Consolidated baseline methodology for grid-connected electricity generation from renewable sources, version 06, 19 May 2006, cdm.unfccc.int

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 13: 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 14: Electricity demand in Ukraine on 31 March 2005[24]

Development of the Ukrainian electricity sector

The National Energy Strategy[25] 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[26]:

- increased use of local coal as a fuel;
- construction of the new nuclear power plants;

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

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

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

- 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.

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 15: Installed capacity[27] in Ukraine in 2004

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'[28].

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 16: Peak load in Ukraine in 2001 - 2005[29]

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)[30].

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.

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

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

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

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

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;
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 17: Imports and exports balance in Ukraine[31]

ACM0002 offers several choices for calculating the OM. Dispatch data analyze cannot be applied, since the grid data is not available[32]. 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.

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

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

%	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 18: Share of power plants in the annual electricity generation of Ukraine[33]

The simple OM is calculated using the following formula:

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

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:

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

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[34]. The majority of the electricity (up to 95%) is generated centrally and therefore the data is comprehensive[35].

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[33] "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.

[34] "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 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[36] 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 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 19: Grid losses in Ukraine[37]

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[38] 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:

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[35] 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.

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

[37] “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.

[38] 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.

- 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[39];

- 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:

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

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 20: Emission Factors for the Ukrainian grid 2006 - 2012

[39] "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.

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:

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

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

Annex 3

MONITORING PLAN

Key elements for the monitoring plan are the following:

Data/Parameter	**Electricity generated by the new turbines** $EG_{CHP,\Pr,y}$
Data unit	MWh
Description	Amount of electricity generated by both turbines during a year. The main parameter for ERUs calculation.
Source of data to be used	Official statistic data of project owner
Justification of the choice of data or description of measurement methods and procedures (to be) applied	The electricity meters are used for the measurements.

Data/Parameter	**Electricity consumed by the project equipment** $EC_{equip,\Pr,y}$
Data unit	MWh
Description	Annual amount of electricity consumed by new installed equipment under the project activity. This parameter needed to calculate net amount of electricity generated under the project activity.
Source of data to be used	Official statistic data of project owner
Justification of the choice of data or description of measurement methods and procedures (to be) applied	The separate device for metering electricity consumption at the turbine shop is already installed.

Data/Parameter	**Heat equivalent of steam at the input of condensing turbine** SG_{input}
Data unit	GJ
Description	Heat equivalent of steam amount at the input of condensing turbine. This parameter needed to calculate the leakages.
Source of data to be used	Official statistic data of project owner
Justification of the choice of data or description of measurement methods and procedures (to be) applied	The separate device for determining this value is going to be installed together with the condensing turbine.

Data/Parameter	**Heat equivalent of steam at the output of condensing turbine** SG_{output}
Data unit	GJ
Description	Heat equivalent of steam amount at the input of condensing turbine. This parameter needed to calculate the leakages.
Source of data to be used	Official statistic data of project owner
Justification of the choice of data or description of measurement methods and procedures (to be) applied	The separate device for determining this value is going to be installed together with the condensing turbine.