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:

"Implementation of energy efficient measures at "Donetsksteel" – metallurgical plant".

Sectoral scope 4: Manufacturing Industries
Sectoral scope: 9 (Metal Production)

Project design document (PDD) version 2.0

5 July 2010

A.2. Description of the project:

Enterprise description
CJSC "Donetsksteel" – metallurgical plant", further referred to as Donetsksteel is the owner of the emission source where the project is implemented. Donetsksteel is a producer of iron & steel and steel semi-finished products. The plant has several Blast Furnaces for the pig iron production. The technology to produce steel is based on Open Hearth Furnaces.

CJSC "Donetsksteel" - Metallurgical Plant" was established in August of 2002 and was based on blast-furnace and open-hearth shops of Donetsk Metallurgical Plant.

Today this is a modern metallurgical enterprise that specializes in manufacturing of:

- cast iron and steel-making iron;
- more than 100 varieties of carbonic, structural, low-alloyed, alloyed steel grades of commercial quality, fine and high quality;
- church bells of high-quality non-ferrous alloy;
- steel electric-welded straight-line-seam pipes and metal furniture network;
- construction materials, iron-bearing scrap, slag products and lime manufacturing products.

CJSC "Donetsksteel" - Metallurgical Plant" is recognized by English Lloyd's Register as steel and semi-finished steel manufacturer (slabs and open-hearth process ingots of carbonic and carbonic-manganiferous steel grades of single and increased strength) according to the Register's Rules. Ship constructional steel slabs of single strength of GL-A and GL-B grades are certified by rule of the German Lloyd; NVA grade steel (dead-melted) of open-hearth process – by Det Norske Veritas rules. CJSC "Donetsksteel" - Metallurgical Plant" became the first domestic enterprise of the branch which implemented and certified integrated quality, ecology and labour safety management system in compliance with international standards requirements: ISO 9001:2000, ISO 14001:2004 and OHSAS 18001:1999.

Open Hearth Furnace (OHF) is one of the oldest steelmaking technologies in the world, which is still in use only in countries of the former Soviet Union. Nevertheless there are some advantages of OHFs, among them:

- Possibility to use different kinds of feedstock (from 100% scrap to liquid pig-iron, sinter and other materials);
- High efficiency due to direct usage of all energy sources (75-80 %);
- Applicability for different modern metallurgical technologies (Ladle Furnace, Continuous Casting Machine, etc.);
- High level (and high potential) of heat recovery;
- Low noise level;
- Big potential for implementation of automatic process control systems.

One more reason for continuation of OHFs usage is that their substitution with Electric Arc Furnaces (EAF) or Basic Oxygen Furnaces (BOF) requires significant investments. Therefore, it is reasonable to operate OHFs with implementation of modern technologies.

Project purpose
The aim of this project is to reduce GHG due to modern technologies usage in iron and steel production processes. To meet the aims mentioned above, it was envisaged to implement two energy efficient subprojects:

1. Implementation of Pulverized Coal Injection (PCI) for Blast Furnace 1 (BF 1);
2. Implementation of automatic process control system (APCS) for Open Hearth Furnaces (OHF).

Before the project
Pulverized coal injection technology was implemented for Blast Furnace 2 at CJSC "Donetsksteel" since 80s. In Soviet Union neither economical nor technological difficulties were taken into account during the decision making concerning technology implementation. After the implementation significant difficulties were faced. After Soviet Union disintegration the difficulties still have not been solved, moreover, coke-coal needed for PCI technology became the mostly imported source. In 1998 Blast Furnace 2 was stopped and continued its work only in 2002[1], after significant repair works and reconstruction were done. It has to be noted that reconstruction of BF 2 was started in 2000 and was proceeding for 2 years.

Blast Furnace 1 has been in operation since 1975 without overhaul. Actual capacity of BF 1 did not match the nominal one (790 000 t of iron per year). Therefore, it can be considered that equipment was seriously outdated and could not continue its operation without modernization/overhaul. For this purpose on 17 May 2005 BF 1 was stopped[2] in order to be significantly renovated. During the works PCI technology which was implemented for BF 2 was expanded for BF 1. These renovations also allowed increasing the efficiency of the furnace.

As for the 5 existing Open Hearth Furnaces, they were in satisfactory condition and could continue their operation without any modernization. They have already been modernized by implementation of LF and CCM[3] technologies. Therefore, implementation of the APCS is a logical step on the way to reduce negative impact on environment.

Current status
Both subprojects have already been implemented. All the necessary documentation was developed and approved by relevant authorities, as well as all permits and licenses were obtained. Due to the project implementation harm to environment was significantly reduced, including reduction of GHG emissions in the amount of ~1 mil t CO_2 (2005-2008).

Implementation of PCI technology was finished in January 2007.
Implementation of APCS was finished in November 2006.

[1] http://www.dmz.com.ua/news/main/?id=1
[2] http://www.dmz.com.ua/news/actual/?id=160
[3]The main purpose of Ladle Furnace (LF) treatment is to ensure that the molten steel has the required temperature and composition. As a rule, LF usage - results in energy saving because it has lower energy specific consumption than main steelmaking furnace.
The continuous casting machine (CCM) replaces these separate steps of ingot casting, mold stripping, heating in soaking pits and primary rolling with one operation. In some cases, continuous casting also replaces reheating and rerolling steps

Project scenario
The project consists of two subprojects:

1. *Implementation of Pulverized Coal Injection (PCI) for Blast Furnace 1 (BF 1)*. In the result of implementation of this measure a significant saving of coke needed for pig iron production (estimated reduction is about 30%) is expected due to injection of pulverized coal into the furnace. Coke production requires much more energy than PC production. Therefore, positive ecological effect will be achieved due to the substitution of coke with pulverized coal. In the result of the project it becomes possible to increase a part of metal scrap in the metal stock mix. This will also result in decrease of coke consumption. At the moment PCI technology has been implemented only at CJSC "Donetsksteel" – metallurgical plant". Therefore, this project can be considered to be the first of a kind on the territory of Ukraine;

2. *Implementation of automatic process control system (APCS) for Open Hearth Furnaces (OHF)*. In the result of implementation of this measure, significant saving of fuel, electricity and other resources is expected due to technological processes optimization and exclusion of human factor. Implementation of APCS for Open Hearth Furnaces is a unique project which has no analogues in Ukraine. This can be confirmed by relevant patents (No 35552, 26512, 20930), which are owned by CJSC "Donetsksteel" – metallurgical plant".

For both subprojects it is assumed that capacity of furnaces after the project implementation is the same as for the baseline conditions.

Baseline scenario
Baseline scenario for the subproject "Implementation of Pulverized Coal Injection (PCI) for Blast Furnace 1 (BF 1)" is reconstruction of Blast Furnace, but without PCI technology implementation. In this case, after the reconstruction, all parameters except for the ones relevant to PCI technology would be similar to project parameters.

Baseline scenario for the subproject "Implementation of automatic process control system (APCS) for Open Hearth Furnaces (OHF)" is a continuation of existing practice for Open Hearth Furnaces operation without APCS implementation. In this scenario, production level in the OHF is assumed to be equal to production level under the project. Emission factor for steel production calculation is based on average value of relevant parameters (please see Annex 2) for three years before the project implementation.

A.3. Project participants:

Party involved	Legal entity project participant (as applicable)	Please indicate if the Party involved wishes to be considered as project participant (Yes/No)
Ukraine (Host party)	CJSC "Donetsksteel" – metallurgical plant"	No
The Netherlands	Global Carbon BV	No

Role of the project participants:

- CJSC "Donetsksteel" – metallurgical plant" will implement the JI project including the monitoring phase. It invests in the JI project implementation and will own ERUs generated. CJSC "Donetsksteel" – metallurgical plant" is a project participant;
- Global Carbon BV is the leading expert on environmental consultancy and financial brokerage services in the international greenhouse emissions trading market under the Kyoto Protocol. Global Carbon has developed the first JI project that has been registered at the United Nations Framework Convention on Climate Change (UNFCCC). The first verification under JI mechanism was also completed for Global Carbon B.V. The company focuses on Joint Implementation (JI) project development in Bulgaria, Ukraine, Russia. Global Carbon BV is responsible for the preparation of investment project as a JI project including PDD preparation, obtaining Party approvals, monitoring and transfer of ERUs. Global Carbon BV is a potential buyer of the ERUs generated under the proposed project. Global Carbon BV is the project participant.

A.4. Technical description of the project:

A.4.1. Location of the project:

CJSC "Donetsksteel" – metallurgical plant" is the one of the primary taxpayers in Donetsk. It situated in the Leninskiy District of Donetsk. Geographical location of Donetsk is presented in Figure A.4.1.1 below.

Figure A.4.1.1: Map of Europe with location of Donetsk

A.4.1.1. Host Party(ies):

Ukraine

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

Donetsk Oblast is a region (province/oblast) of Eastern Ukraine. Its administrative centre is Donetsk. Historically, the province has always been an important part of the Donbas region.

Donetsk Oblast is located in South-eastern Ukraine. The area of the oblast (26,900 km²) comprises about 4.4% of the total area of the country. The oblast borders on Dnipropetrovsk and Zaporizhzhia oblasts in the south-west, Luhansk Oblast in the north-east, Rostov Oblast of Russia in the east, and on the Sea of Azov in the south.

Its longitude from north to south is 270 km, from east to west – 190 km.

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

Donetsk (former names: Yuzovka, Stalino), is a large city in eastern Ukraine situated on the Kalmius river. Administratively it is the centre of Donetsk Oblast, while historically the city is an unofficial capital and the largest city of the economic and cultural Donets Basin (Donbas) region. Currently Donetsk has a population of over 982,000 inhabitants (2010)[2] and a metropolitan area of over 1 566 000 inhabitants (2004). According to the 2001 Ukrainian Census, Donetsk is the fifth-largest city in Ukraine[4].

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

CJSC "Donetsksteel" – metallurgical plant" is located almost in the centre of the city due to historical reasons (see Figure A.4.1.4.1).

Figure A.4.1.4.1: Location of the CJSC "Donetsksteel" – metallurgical plant"

[4] http://en.wikipedia.org/wiki/Donetsk#cite_note-ukrcensus1-2

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

Proposed JI project aims at GHG reduction due to usage of modern technologies in iron and steel production processes

To achieve all the objectives mentioned, it was envisaged to implement two energy efficient subprojects:

1. Implementation of Pulverized Coal Injection (PCI) for Blast Furnace 1 (BF 1);
2. Implementation of automatic process control system (APCS) for Open Hearth Furnaces (OHF).

1. Implementation of Pulverized Coal Injection (PCI) for Blast Furnace 1 (BF 1)

Injection of pulverized coal remains the most promising energy efficient measure for the Blast Furnace process, since it can substitute 100% of natural gas and 20 ... 40% of coke. Besides, it becomes possible to regulate furnace condition on the fly.

Coke production is an expensive and energy consumptive process. It also envisages high level of emission into the atmosphere. Therefore, substitution of coke consumption will positively influence environmental conditions in the region.

Scheme of technological unit

The principle of the PCI technology operation is described below. Coal is delivered to the store, which is situated next to PC preparation ground. Pulverized coal appears in the result of milling and drying. It is transported from the store to grinding mills where it is converted to coal dust. When milled, pulverized coal is dried by heat from natural gas combustion. This PC is collected and stored in the special pulverising coal bins. Generated pulverized coal fuel is forwarded by compressed air to BF, through the dosing and distribution system.

Scheme of PC preparation unit for Blast Furnace is shown on the Figure 1 below.

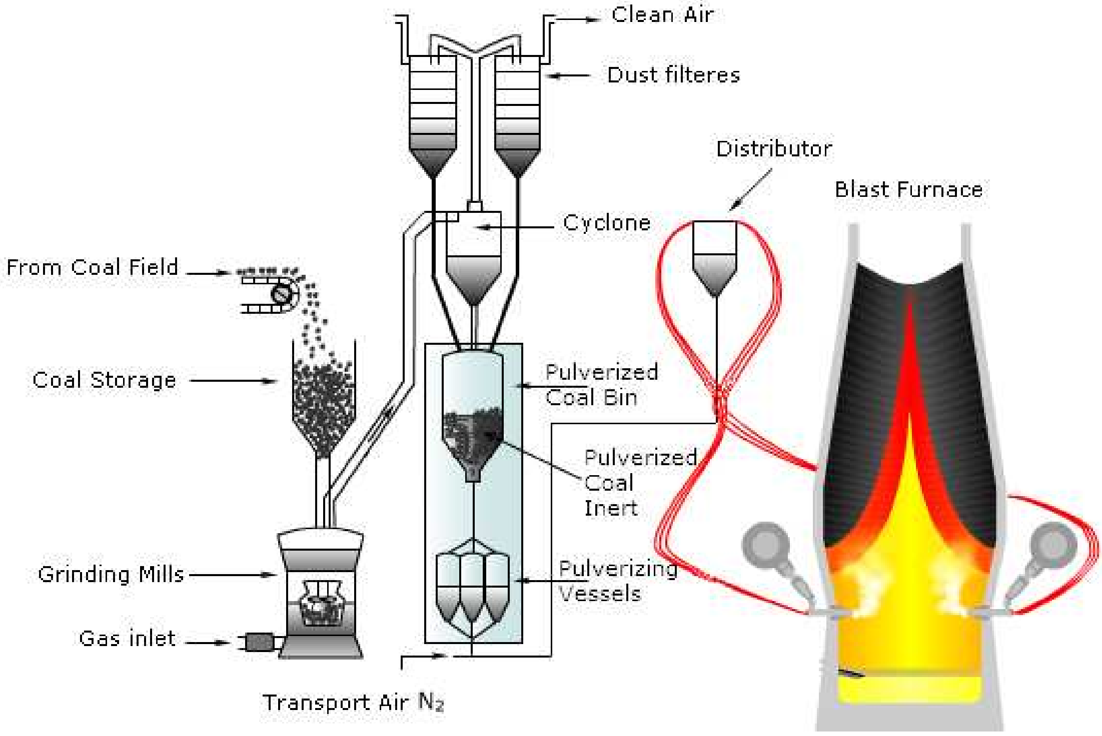


Figure 1 – Scheme of PC preparation unit for Blast Furnace

Advantages of usage of PCI unit for BF:

1. Pulverized coal has lower production costs than coke, therefore this substitution results in saving;
2. In the result of intensification of reductive media inside the furnace the reductive process improves;
3. Pig iron quality improves due to proportional dispersion of temperature inside of the BF iron receiver;
4. In the result of the project it becomes possible to increase a part of metal scrap in the metal stock mix.
5. Decrease of coke consumption positively influences the environment.

2. Implementation of automatic process control system (APCS) for Open Hearth Furnaces (OHF)

The APCS system leads to significant electrical energy and energy carriers saving at the expense of human factor minimization, as well as to monitor actual parameters such as natural gas composition, flow rate and scrap metal quality. The system also allows maintaining working parameters on the level given without worker's involvement.

APCS is based on the following software and hardware modules:
- programmable controllers SIEMENS SIMATIC S7-400;
- two workstations for steel maker (HMI1, HMI2) with visual interface based on WinCC v.5.1 software;
- workstations for laboratory assistances of the quantometrical laboratory;
- INTERBASE database servers;
- EC&I sensors and actuating mechanism.

Scheme of APCS as an example of OHF 5 is shown on the Figure 2.

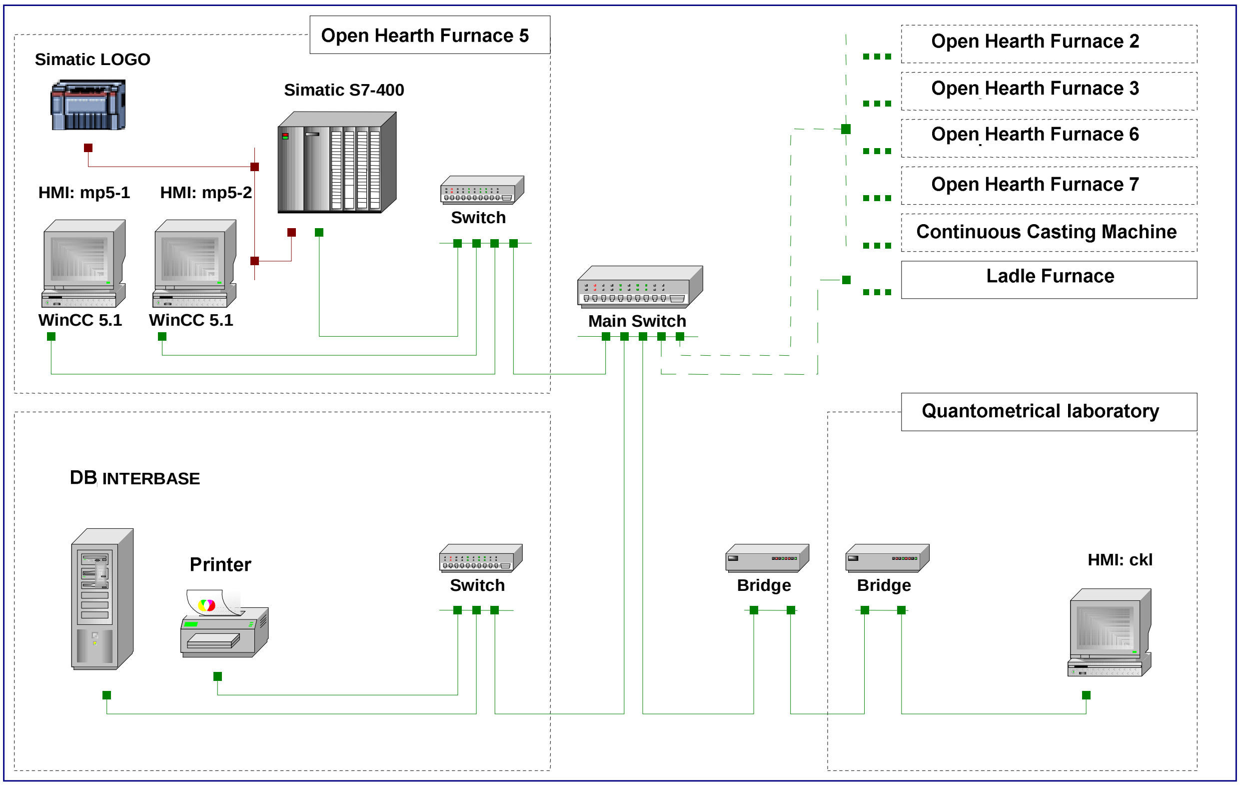


Figure 2 – Scheme of APCS as an example of OHF 5

A steel maker chooses working mode of furnace with help of HMI visual interface of the workstation. The system allows maintaining the necessary ratio "gas-air" for melting on the level given. Due to that fuel saving is achieved. It is also possible to maintain heat load whereby increasing stability of heart.

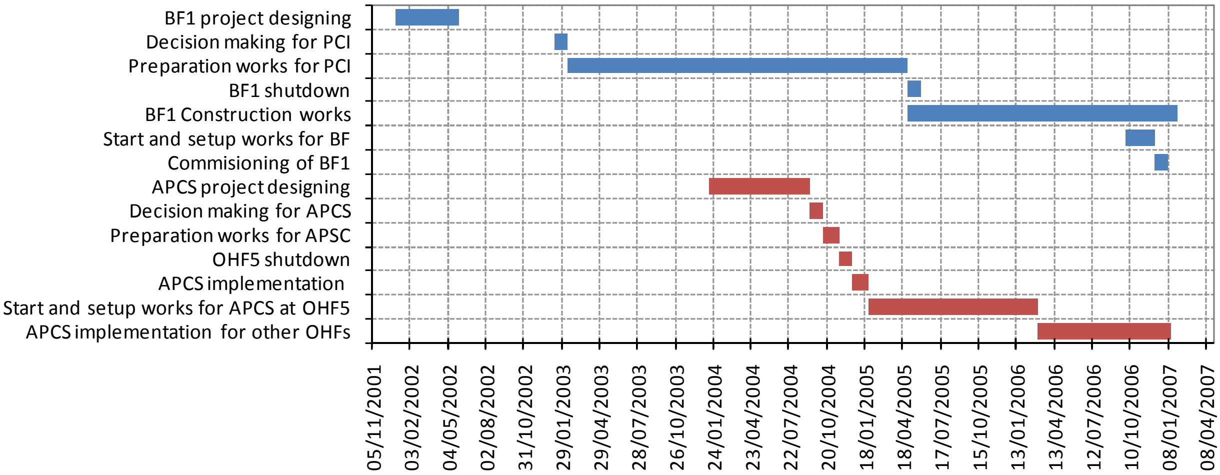
During the work in the local mode, all tasks for energy consumption are set by steelmaker. The system maintains these parameters and calculates value of actual heat load. Remote regime allows controlling the actuating mechanisms by HMI screen buttons. In case a manual mode is chosen, steel maker can control actuating mechanisms directly from EC&I desk. In this case, values of actual consumption are displayed at the HMI screen of workstation.

Optimization of the technologies allows achieving the following results (which can be confirmed by actual results after the test period completion on OHF 5 in 2005):

Parameter	Before the project	After the project
1. Annual capacity, t	157578	157578
2. Specific consumption of coal equivalent, kg/t	161.6	151.2
3. Average equivalent for natural gas	1.149	1.149
4. Annual consumption of natural gas, m^3	22162406	20736113
5. Standard duration of melting, hours	6.57	6.33
6. Annual quantity of melting activities	1035	1035
7. Melting weight, t	152.25	152,25
8. Annual quantity of working hours	6800	6552
9. Momentary natural gas consumption, , l/sec	905.6	879.4

The project implementation schedule is presented in Table A.4.2.2 below.

Table A.4.2.2: Project implementation schedule



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:

All source of feedstock consumed due to steelmaking can be considered as a "pollutant". Emission level of this source can be estimated with help of relevant emission factor. Thus, the emission factor for the relevant process (producing of iron and steelmaking process) will be obtained.
As it was stated above, coke production is an expensive and energy consuming process. It also envisages high level of emissions into the atmosphere. Production of pulverized coal requires less energy. Thus, one can state that coke is more carbon intensive than coal. Implementation of APCS system resulted in significant resources and energy saving. Therefore, as long as it is possible to substitute coke with coal in the BF 1 and decrease energy and raw material consumption in the OHFs, it leads to reduction in energy consumption level and, therefore, to GHG emission reduction.
Taking into account that no national and/or sectoral policies oblige for such activity, in the absence of the proposed JI project, it is assumed that no similar measures will be implemented at Donetsksteel, at least during the Kyoto period.

Information on baseline setting and additionality is also presented in Section B.

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

Estimated amount of emission reductions is presented in the Table A.4.3.1.1 and Table A.4.3.1.2. More detailed calculation of emission reductions is described in Section E.

Table A.4.3.1.1: Estimated emission reductions over the crediting period

	Years
Length of the crediting period	5
Year	Estimate of annual emission reductions in tonnes of CO_2 equivalent
2008	279,847
2009	286,688
2010	278,898
2011	278,898
2012	278,898
Total estimated emission reductions over the crediting period (tonnes of CO_2 equivalent)	1,403,229
Annual average of estimated emission reductions over the crediting period (tonnes of CO_2 equivalent)	280,646

Table A.4.3.1.2: Estimated emission reductions after the crediting period

	Years
Period after 2012, for which emission reductions are estimated	10
Year	Estimate of annual emission reductions in tonnes of CO_2 equivalent
2013	278,898
2014	278,898
2015	278,898
2016	278,898
2017	278,898
2018	278,898
2019	278,898
2020	278,898
2021	278,898
2022	278,898
Total estimated emission reductions over the period indicated (tonnes of CO2 equivalent)	2,788,980
Annual average of estimated emission reductions over the period indicated (tonnes of CO2 equivalent)	278,898

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 will be obtained later. According to the Netherlands legislation, no LoE from the Netherlands is needed. After AIE has completed the Determination Report, the PDD and the Determination Report will be presented to the National Environmental Investment Agency of Ukraine to obtain the Letter of Approval from Ukraine. LoA from the Netherlands can already be applied after PDD publication.

SECTION B. Baseline

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

A baseline for the JI project has to be set in accordance with Appendix B to decision 9/CMP.1 (JI guidelines)[5], and with further guidance on baseline setting and monitoring developed by the Joint Implementation Supervisory Committee (JISC). In accordance with the Guidance on Criteria for Baseline Setting and Monitoring (version 2)[6] (hereinafter referred to as Guidance), the baseline for a JI project is the scenario that reasonably represents the anthropogenic emissions by sources or anthropogenic removals by sinks of GHGs that would occur in the absence of the proposed project. In accordance with the Paragraph 9 of the Guidance the project participants may select either: an approach for baseline setting and monitoring developed in accordance with appendix B of the JI guidelines (JI specific approach); or a methodology for baseline setting and monitoring approved by the Executive Board of the clean development mechanism (CDM), including methodologies for small-scale project activities, as appropriate, in accordance with paragraph 4(a) of decision 10/CMP.1, as well as methodologies for afforestation/reforestation project activities. Paragraph 11 of the Guidance allows project participants that select a JI specific approach to use selected elements or combinations of approved CDM baseline and monitoring methodologies or approved CDM methodological tools, as appropriate.

Description and justification of the baseline chosen is provided below in accordance with the "Guidelines for users of the Joint Implementation Project Design Document Form", version 04[7], using the following step-wise approach:

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

Project participants have chosen the following approach regarding baseline setting, defined in the Guidance (Paragraph 9):

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

The Guidance was applied to this project as the above indicated approach is selected, as mentioned in the Paragraph 12 of the Guidance. The detailed theoretical description of the baseline in a complete and transparent manner, as well as a justification in accordance with Paragraph 23 through 29 of the Guidance, should be provided by the project participants.

The baseline for this project should be established in accordance with appendix B of the JI guidelines. Furthermore, the baseline shall be identified by enumeration and description of plausible future scenarios on the basis of conservative assumptions and selection of the most plausible one on the basis of conservative assumptions and key factors described below.

Key factors that affect the baseline are taken into account:

a) **Sectoral reform policies and legislation.** State program of industry development until 2017[8] foresees metallurgical plants modernization, especially implementation of new EAF plants and new range of sizes introduction. It also foresees the shift to deeper and more technological

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

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

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

[8] http://industry.kmu.gov.ua/control/uk/publish/article?art_id=57967&cat_id=57966

production in the industry sector. In case of existence of any incitement in accordance with this program, they could alleviate the barriers which prevent the project realization. Nevertheless, no definite mechanisms for stimulation were developed. As well as no mentioning of PCI technology usage exists. Therefore, metallurgical plants in Ukraine have no obligations to implement any energy efficient measures. Taking into account the abovementioned, one can consider that no policies and legislation can influence the baseline;

b) **Economic situation/growth and socio-demographic factors in the relevant sector as well as resulting predicted demand. Suppressed and/or increasing demand that will be met by the project can be considered in the baseline as appropriate (e.g. by assuming that the same level of service as in the project scenario would be offered in the baseline scenario)**. It is assumed that the level of iron and steel production and demand is not influenced by the project. The iron and steel industry is a transparent market where standardized types of products exist. Within a certain region or country steel can be transported from the producer to the consumer without constrains. If the facility in question cannot provide the amount of steel or iron that is needed the third party steel producer would have produced the incremental part or it would have produced onsite. In case of the project absence and increased market steel demand, all iron and/or steel needed would be produced onsite at Donetsksteel by increasing the number of run-days, decreasing duration of stops or equipment modernization/reconstruction**;**

c) **Availability of capital (including investment barriers).** Capital is available but high bank rate and high country investment risk make new equipment introduction in Ukraine unprofitable. More information concerning the barriers is given in section B.2, Barrier Analysis;

d) **Local availability of technologies/techniques, skills and know-how and availability of the best available technologies/techniques in the future.** The proposed project can be considered to be the first of its kind on the territory of Ukraine. PCI technology was implemented at first in this project as well as APCS for Open Hearth Furnaces, that can be confirmed by relevant patents owned by CJSC "Donetsksteel" – metallurgical plant";

e) Fuel prices and availability. Electricity, coke and coal are widely used and available in Ukraine. Natural gas is mostly imported from the Russian Federation under special conditions. Therefore, prices for fuels produced in Ukraine are expected to be lower as compared to the world market price. For the natural gas, its price is set by another country and is similar to European values.

The baseline is established in a transparent manner with regard to the choice of approaches, assumptions, methodologies, parameters, data sources and key factors. Most information is taken from the international publicly available sources and is referenced. Uncertainties are taken into account and the following conservative assumptions are used:

1. Conservative emission factors were used for baseline calculations (please see the tables in Annex 3);
2. Baseline emission factors do not take into account usage of CCM (continuous casting machine) which is used under the project activity. Nevertheless, calculations of project emissions are based on the data with CCM consideration, which is conservative;
3. It is assumed that reconstruction of BF 1 without implementation of PCI technology would take place under the baseline. All parameters except for those relevant to PCI unit operation are assumed to be the same as project ones.

The basic principle applied is that demand for iron and steel is not influenced by the project and is identical in the project and the baseline scenario. Therefore, ERUs cannot be earned for decrease in activity levels outside the project or due to force majeure as emission factors based on specific production are used (e.g. tCO_2/t steel).

Step 2. Application of the approach chosen

Pig-iron production
For the pig-iron production the only production technology in the world is Blast Furnace.

BF 1 for which PCI technology was implemented was in operation since 1975 without overhaul. Actual capacity of BF 1 does not match the nominal one (790 th. t of iron per year). Therefore, it can be considered that equipment was seriously outdated and could not continue operating without modernization/overhaul. On the other hand, the major overhaul required could take place without implementation of PCI technology. It can be considered as the most plausible scenario, because the overhaul proceeding will allow continuing the BF 1 operation, while no barriers would prevent this activity.

Injection of pulverized coal remains the most promising energy efficient measure for the Blast Furnace process. Pulverized coal can substitute 100% of natural gas and 20 ... 40% of coke. Besides, it becomes possible to regulate furnace condition on the fly. At the same time, PCI technology introduction leads to a number of risks. The first patent for PCI technology for Blast Furnaces was issued in 1926. For the first time this idea was implemented at the "plant named after F.E. Dzerzhinsky" (Russian Federation) in 1950. In the 70s PCI technology was implemented at "Karagandinskiy metallurgical plant" and "Zapadno-Sibirskiy metallurgical plant". Thereafter the usage of PCI at these plants was stopped due to the low quality of units and simplicity of natural gas usage due to its low price.

Nowadays pulverized coal is used approximately on one third of the metallurgical plants all over the world. In Ukraine the PCI technology is used at Donetsksteel only, on the framework of the proposed JI project. Besides, implementation of PCI technology for four BFs at "Metallurgical plant "Zaporozhstal" is still under implementation. Therefore, proposed project can be considered to be the only plant on the territory of Ukraine where PCI technology had been implemented and is still in use.

Steel production
In Ukraine OHF (45.2%) and BOF (51.0%) methods[9] are a common practice in steel production . EAF steelmaking is not very widespread and its share in the market is only 3.8%.

Open Hearth Furnace is one of the oldest steelmaking technologies in the world, which is still in use only in countries of the former Soviet Union. Nevertheless, there are some advantages of OHFs, among them:

- Possibility to use different kinds of feedstock (from 100% scrap to liquid pig-iron, sinter and others materials);
- High efficiency due to direct usage of all energy sources (75-80 %);
- Applicability for different modern metallurgical technologies (Ladle Furnace, Continuous Casting Machine, etc.);
- High level (and high potential) of heat recovery;
- Low noise level;
- Big potential for implementation of automatic process control systems.

One more reason for continuation the OHFs usage is that implementation of alternative technologies, such as EAF or BOF require significant investments. Therefore, it is reasonable to operate OHFs with implementation of modern technologies.

Technical condition of existing OHFs at Donetsksteel allows using it without any limits. Since this technology is the one of the oldest in the world there were no know-hows developed for it for many years. Therefore, APCS system for OHFs implemented at Donetsksteel has no analogues in Ukraine. This

[9] http://www.worldsteel.org/index.php?action=publicationdetail&id=81

measure allows improving efficiency of the OHFs significantly and reducing negative influence on environment. After the project implementation, all technical operational parameters of the OHFs remained the same but specific consumption of raw material and fuels have been decreased due to automatic maintenance of regimes for steelmaking and exclusion of human factor.

Taking into account the information above, there are eight alternatives (4 for each sub-projects) which are technically feasible at CJSC "Donetsksteel" – metallurgical plant":

1. Implementation of Pulverized Coal Injection (PCI) for Blast Furnace 1 (BF 1)
Alternative 1.1: Continuation of existing practise. Pig-iron production in BF 1 without reconstruction and without PCI technology implementation.

Alternative 1.2: Reconstruction of BF 1 and implementation of PCI technology without JI incentive. This activity is fully similar to proposed sub-project. The only difference is that no incentive from JI mechanism would be obtained.

Alternative 1.3: Reconstruction of BF 1 without PCI technology implementation. Capacity of reconstructed BF 1 assumed to be the same as for the project, but no advantages from PCI technology will be taken into account.

Alternative 1.4: Decommissioning of exhausted BF 1. Pig-iron demand will be covered by purchasing the necessary amount from third parties at the Ukrainian market.

2. Implementation of automatic process control system (APCS) for Open Hearth Furnaces (OHF):

Alternative 2.1: Continuation of existing practise. Steel in the OHFs will be produced in the same amount as for the project scenario. Specific consumption of the raw materials will be different.

Alternative 2.2: Implementation of automatic process control system for OHFs without JI incentive. This activity is completely similar to the proposed sub-project. The only difference is that no incentive from JI mechanism would be obtained.

Alternative 2.3: Implementation of similar technology which have been tested at other plants in Ukraine. Specific consumption of raw materials in OHFs will be reduced with the same steel production level. However, this scenario is absolved from the risks and barriers of the proposed project.

Alternative 2.4: Decommissioning of all or some of the OHFs as outdated technology. Steel demand will be covered by purchasing necessary amount from third parties at the Ukrainian market or implementation of new facilities in accordance with BAT and world trends.

These scenarios are described below in more detail.

Alternative 1.1: Continuation of existing practise.
This scenario foresees pig-iron production in BF 1 without reconstruction and implementation of PCI technology. Technical condition of the BF 1 before the project implementation was unsatisfactory. In fact, BF 1 for which PCI technology was implemented had been in operation since 1975 without major overhaul. Therefore, reconstruction (overhaul) was required for continuation of the furnace operation. Implementation of the PCI technology separately, without overhaul proceeding would not also result in possibility of further operation.

Therefore, this scenario cannot be considered as a plausible sone.

Alternative 1.2: Reconstruction of BF 1 and implementation of PCI technology without JI incentive.
This activity is completely similar to the proposed project. The only difference is that no incentive from JI mechanism would be obtained. In the result of implementation of this measure a significant saving of coke needed for pig iron production is expected (estimated reduction is about 30%) due to injection of pulverized coal into the furnace. The positive effect in this alternative is that coke production requires much more energy than PC production. This will positively influence the region environment.

The following negative effects allow to consider this alternative as not the most plausible:
- as shown in Section B.2, Barrier analysis, there are a lot of risks and barriers preventing realization of this project. Proposed technology is the first of its kind on the territory of Ukraine which means that it was extremely difficult to attract investment for its realization.
- Improper operation of the modernized BF 1 due to unproven technology could result in unplanned stops and downtimes.
- Start and set-up works could take too much time and, therefore, significant losses would be achieved.

Nevertheless, reconstruction (overhaul) of BF 1 is possible without a risky PCI part. The relevant alternative is discussed below.

Alternative 1.3: Reconstruction of BF 1 without PCI technology implementation.
As described above, this alternative is rather plausible, because the reconstructed BF 1 could continue its work and no risky technology would be implemented. In this scenario, the capacity of reconstructed BF 1 is assumed to be the same as for the project, but no advantages from PCI technology will be achieved. No policy and/or legislation prevent this scenario because it fully corresponds to a common practice among metallurgical plants in Ukraine. In this scenario coke will remain the main source of carbon, as well as the main fuel. It also envisages high level of emissions into the atmosphere, since coke production is a highly energy consuming process. Therefore, the level of pollutants emission into the atmosphere can be considered higher than for the proposed project.

This alternative is realistic and can be considered to be a plausible scenario.

Alternative 1.4: Decommissioning of exhausted BF 1.
In the frame of this scenario exhausted BF 1 will be stopped and decommissioned. Pig-iron demand will be covered by purchase of the necessary amount from third parties at the Ukrainian market. Due to this scenario, no changes in the total level of emissions into the atmosphere will be made, because all metallurgical plants in Ukraine produce pig-iron in -Blast Furnaces. Nevertheless, costs for overhaul proceeding will be saved.

This alternative is not the most plausible due to the following:
- CJSC "Donetsksteel" – metallurgical plant" is a full cycle plant which performs onsite all processes necessary for market steel production. Exclusion of such significant process as pig-iron production is hardly possible. Please note that main steelmaking technology at "Donetsksteel" – metallurgical plant" is Open Hearth Furnaces, which requires non-stop iron consumption. OHF technology can be characterized as very sensitive to the load and any irregularity of delivery will critically harm the furnace.
- Overhaul costs are incommensurable with loses which would be achieved due to pig-iron purchase at the market price
- Dismantling works also require some investments, as compared with the overhaul costs.

Thus, this scenario cannot be considered as the most plausible one.

Alternative 2.1: Continuation of existing practise.
Steel in the OHFs will be produced in the same amount as for the project scenario, but specific consumption of raw materials will be different. Open Hearth Furnace is the oldest steelmaking technology

and it is not widespread in the world. Nevertheless, technical condition of existing OHFs at Donetsksteel allows using it without any limits. Moreover, some modern technologies such as LF and CCM have been already implemented for existing OHFs.

No additional costs are required under this scenario, as well as no risks are foreseen. It is assumed that OHFs can be operated at least until 2012 without any limits.

The level of emission for this scenario will be a bit higher than for the proposed project, because of the higher feedstock consumption level.

Thus, scenario 2.1 is feasible and plausible.

Alternative 2.2: Implementation of automatic process control system for OHFs without JI incentive.
This activity is fully similar to proposed sub-project. The only difference is that no incentive from JI mechanism would be obtained. As shown in Barrier Analysis, Section B.2, there are a lot of risks and barriers to prevent realization of this project. The proposed technology is the first of its kind on the territory of Ukraine, which means that it was extremely difficult to attract investment for its realization. Moreover, improper operation of the APCS could result in unplanned stops and downtimes. Start and set-up works could take too much time and, therefore, there would be significant losses.

The abovementioned information shows that such a risky project would not be implemented without additional income that could alleviate the risks. Annual savings for this project were assessed as ~2 mil UAH. While annual revenue from ERUs sales is about 1 mil EUR, which is hi 5 times more. This incentive can be considered to be very significant.

Therefore, alternative 2.2 is hardly realistic without JI incentive and cannot be considered as the most plausible scenario.

Alternative 2.3: Implementation of similar technology which have been tested at other plants in Ukraine.
Specific consumption of raw materials in OHFs will be reduced with the same steel production level. However, this scenario would be absolved from the risks and barriers of the proposed project.

This alternative is the least possible, because no similar technology exists. Proposed project is the first of its kind in Ukraine.

Alternative 2.4: Decommissioning of all or some of the OHFs as outdated technology.
Steel demand will be covered by purchase of necessary amount from third parties at the Ukrainian market or implementation of new facilities in accordance with BAT and world trends.

Technical condition of existing OHFs at CJSC "Donetsksteel" – metallurgical plant" allows using it without any limits. It is assumed that OHFs can be operated at least until 2012 without any limits. One more reason for continuation of OHFs usage is that implementation of alternative technologies, such as EAF or BOF requires significant investments. It is reasonable to operate OHFs with implementation of modern technologies. Therefore, implementation of new facilities based on modern technologies is possible, but not in the nearest future because of investments lack. Moreover, dismantling works also require some investments.

Conclusions

Alternatives 1.3 and 2.1 are the only remaining plausible scenario for corresponding subproject. Therefore, combination of these alternatives can be identified as the baseline.

Baseline emissions are elaborated in Sections D and E, as well as Annex 2 below.

Key parameters

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

As key parameters that can significantly influence ER amount, the following parameters can be considered:

Data/Parameter	Pig iron production
Data unit	tonnes
Description	Annual production of pig iron in the Blast Furnace 1
Time of determination/monitoring	Monitored during crediting period
Source of data (to be) used	Donetsksteel technical reports
Value of data applied (for ex ante calculations/determinations)	Year: 2008 / 2009 / 2010 / 2011 / 2012 t: 614,823 / 699,804 / 699,804 / 699,804 / 699,804
Justification of the choice of data or description of measurement methods and procedures (to be) applied	There are only two ways to determine this parameter for the purpose of estimation of ERUs. One of them is based on the maximum capacity of BF 1. The second way which was applied is based on real expectations of the PO, that is conservative
OA/QC procedures (to be) applied	The relevant metering devices will be calibrated according to the host Party's legislation and requirements of the supplier.
Any comment	

Year	2008	2009	2010	2011	2012
t	614,823	699,804	699,804	699,804	699,804

Data/Parameter	Steel production
Data unit	tonnes
Description	Annual production of steel in the OHFs
Time of determination/monitoring	Monitored during crediting period
Source of data (to be) used	Donetsksteel technical reports
Value of data applied (for ex ante calculations/determinations)	Year: 2008 / 2009 / 2010 / 2011 / 2012 t: 869,494 / 527,623 / 527,623 / 527,623 / 527,623
Justification of the choice of data or description of measurement methods and procedures (to be) applied	There are only two ways to determine this parameter for the purpose of estimation of ERUs. One of them is based on the maximum capacity of BF 1. The second way which was applied is based on real expectations of the PO, that is conservative
OA/QC procedures (to be) applied	The relevant metering devices will be calibrated according to the host Party's legislation and requirements of the supplier.
Any comment	

Year	2008	2009	2010	2011	2012
t	869,494	527,623	527,623	527,623	527,623

Data/Parameter	Emission factor for pig iron production under the baseline
Data unit	tonnes
Description	Emission factor for pig iron production in the BF 1under the baseline
Time of determination/monitoring	Fixed ex ante during determination
Source of data (to be) used	Donetsksteel technical reports
Value of data applied (for ex ante calculations/determinations)	2.551 t CO_2/t iron
Justification of the choice of data or description of measurement methods and procedures (to be) applied	This data is based on actual records obtained three years before the project implementation. This value can be considered as a weighted average between emission factors for pig iron production process calculated for the period 2003-2005. Please see formula (12) for details.
OA/QC procedures (to be) applied	-
Any comment	

Data/Parameter	Emission factor for steel production under the baseline
Data unit	tonnes
Description	Emission factor for pig iron production in the OHFs under the baseline
Time of determination/monitoring	Fixed ex ante during determination
Source of data (to be) used	Donetsksteel technical reports
Value of data applied (for ex ante calculations/determinations)	1.764 t CO_2/t steel
Justification of the choice of data or description of measurement methods and procedures (to be) applied	This data is based on actual records obtained for three years before the project implementation. This value can be considered as a weighted average between emission factors for steel production process calculated for the period 2002-2004. Please see formula (15) for details.
OA/QC procedures (to be) applied	-
Any comment	

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 following stepwise approach is used to demonstrate that the project provides reductions in emissions by sources that are additional to any that would occur otherwise:

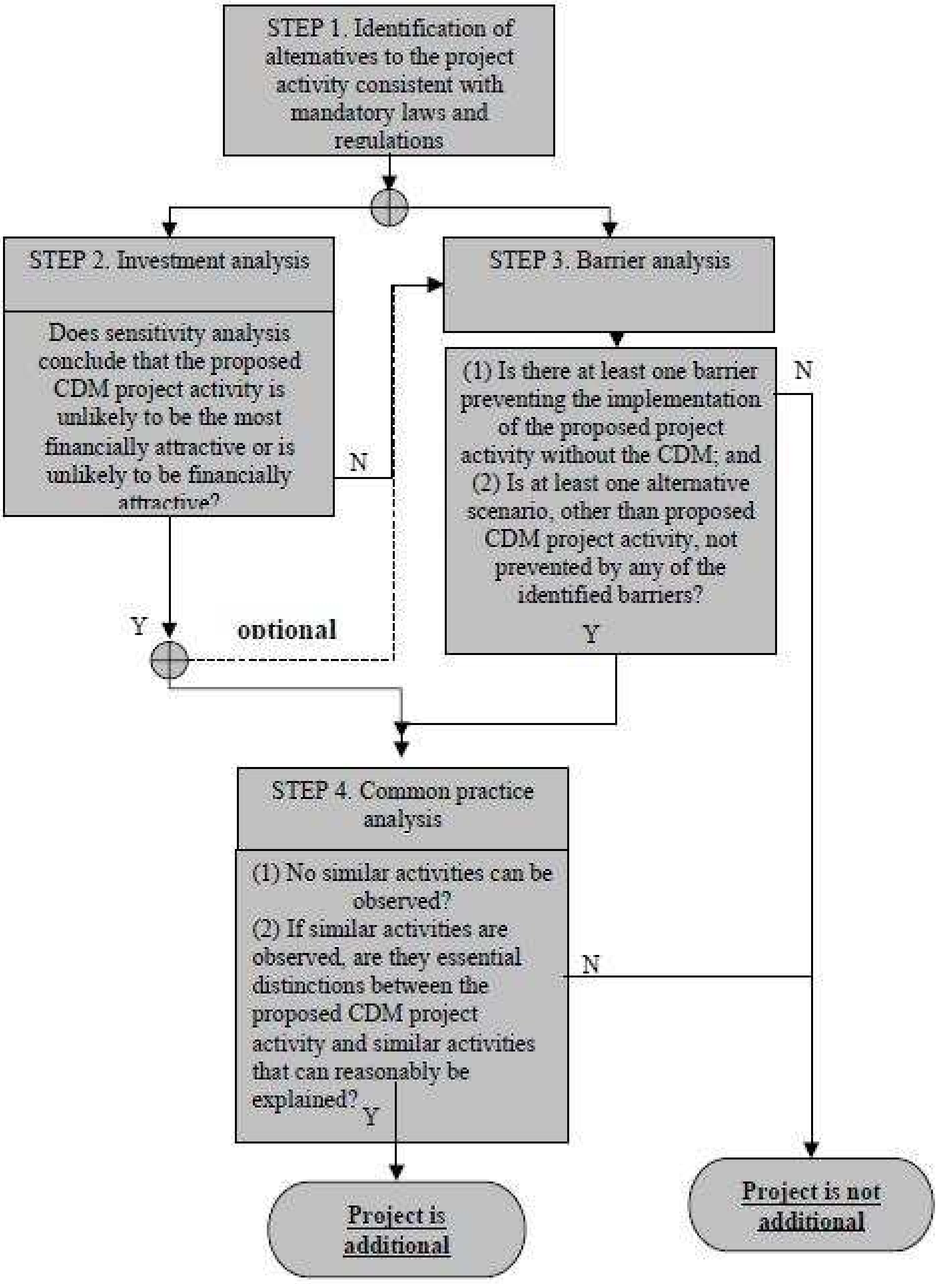
Step 1. Indication and description of the approach applied

As suggested by Paragraph 2 (c) of the Annex 1 of the Guidance the most recent version of the "Tool for the demonstration and assessment of additionality" approved by the CDM Executive Board is used to demonstrate additionality. At the moment of the document completion, the most recent version of the "Tool for the demonstration and assessment of additionality" approved by the CDM Executive Board is version 05.2[10], and it is used to demonstrate additionality of the project activity.

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

Step 2. Application of the approach chosen

The following steps are taken as per "Tool for the demonstration and assessment of additionality" version 05.2:



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

Realistic and credible alternatives to the project activity were defined through the following Sub-steps:

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

The following alternatives to the proposed project were identified:

Alternative 1.1: Continuation of existing practise
Pig-iron production in BF 1 without reconstruction and without PCI technology implementation.

Alternative 1.2: Reconstruction of BF 1 and implementation of PCI technology without JI incentive
This activity iscompletely similar to the proposed project. The only difference is that no incentive from JI mechanism would be obtained;

Alternative 1.3: Reconstruction of BF 1 without PCI technology implementation
Capacity of reconstructed BF 1 assumed the same as for the project, but no advantages from PCI technology will be taken into account.

Alternative 1.4: Decommissioning of exhausted BF 1
Pig-iron demand will be covered by purchase of necessary amount from third parties at the Ukrainian market.

Alternative 2.1: Continuation of existing practice
Steel in the OHFs will be produced in the same amount as for the project scenario. Specific consumption of - raw materials will be different.

Alternative 2.2: Implementation of automatic process control system for OHFs without JI incentive
This activity is completely similar to the proposed project. The only difference is that no incentive from JI mechanism would be obtained.

Alternative 2.3: Implementation of similar technology which have been tested at other plants in Ukraine
Specific consumption of raw materials in OHFs will be reduced with the same steel production level. However, this scenario is absolved from the risks and barriers of the proposed project.

Alternative 2.4: Decommissioning of all or some of the OHFs as outdated technology
Steel demand will be covered by purchase of the necessary amount from third parties at the Ukrainian market or implementation of new facilities in accordance with BAT and world trends.

Outcome of Step 1a: Realistic and credible alternative scenarios to the project activity have been have identified.

Sub-step 1b: Consistency with mandatory laws and regulations
All of the alternatives identified above are consistent with mandatory laws and regulations of the Ukraine.

Outcome of Step 1b: Realistic and credible alternative scenarios to the project activities that are in compliance with mandatory legislation and regulations, taking into account that enforcement in Ukraine has been identified.

Step 2. Investment Analysis

This option is not applicable.

Step 3: Barrier analysis

Sub-step 3a: Identify barriers that would prevent the implementation of the proposed project:

a) Investment barriers

Ukraine is considered to be a risky country for doing business and investment. No private capital is available from domestic or international capital markets for mid to long term investments. And the capital available has a high cost. The table below represents risks of doing business in Ukraine according to various international indexes and studies.

Table 1 International ratings of Ukraine[11]

Indicators	2006	2007	2008	Note
Corruption index of Transparency International	99 position out of 163	118 position out of 180	134 position from 180	Index of corruption
Rating of business practices of The World Bank (The Doing Business)	124 position out of 155	118 position out of 179	139 position out of 178	Rating of business conduct (ease of company establishing, licensing, staff employment, registration of ownership, receipt of credit, defence of interests of investors)
The IMD World Competitiveness Yearbook	46 position out of 55	46 position out of 55	54 position out of 55	Research on competitiveness (state of economy, efficiency of government, business efficiency and state of infrastructure)
Index of Economic Freedom of Heritage Foundation	99 position out of 157	125 position out of 161	133 position out of 157	Determination of degrees of freedom of economy (business, auction, financial, monetary, investment, financial freedom of, labour, freedom from Government, from corruption, protection of ownership rights)
Global Competitiveness Index of World Economic Forum	69 position out of 125	73 position out of 131	72 position out of 134	Competitiveness (quality of institutes, infrastructure, macroeconomic stability, education, development of financial market, technological level, innovative potential)

These data show that both real and perceived risks of investing in Ukraine are in place and influence the availability of capital in Ukraine, both in terms of size of the investments and in terms of capital costs. The comparison of commercial lending rates in Ukraine and in Eurozone for the loans over 5 years in EUR is presented in a figure below:

[11] State Agency of Ukraine for Investments and Innovations
http://www.in.gov.ua/index.php?lang=en&get=225&id=1990

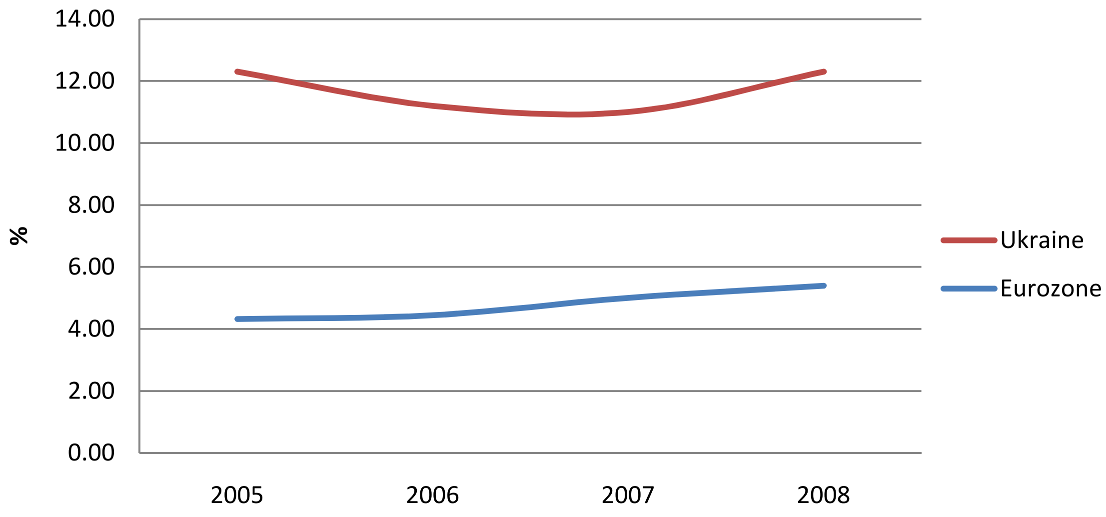


Figure 1 Commercial lending rates, EUR, over 5 years[12]

Cost of debt financing in Ukraine is at least two times higher than in the Eurozone. The risks of investing into Ukraine are additionally confirmed by the country's rating provided by the Moody's international rating agency and the associated country risk premium. Please findthe comparison of country risk premiums for Russia and Ukraine[13] inthe table below

Total Risk Premium, %	2004	2005	2006
Russia	7.02	6.6	6.64
Ukraine	11.59	10.8	10.16

As demonstrated by this table, Russia, while offering a comparable set of investment opportunities, is significantly a less risky country for investments than Ukraine. An assessment of investment process throughout metallurgical sectors shows that in 2000-2003 average investments in $ per 1 tonne of steel, where $30 in the US, $25 in EU, $15 in Russia and $7.8 in Ukraine[14]. In this sector in Ukraine financing is needed but is inadequate, and most of the investments are covered by equity.

As stated at the OECD Roundtable on Enterprise Development and Investment Climate in Ukraine, the current legal basis is not only inadequate, but to a large extent sabotages the development of market economy in Ukraine. Voices in the western press can basically be summarized as follows: The reforms in the tax and legal systems have improved considerably with the adoption of the Commercial Code, Civil Code and Customs Code on 1 January 2004 but still contain unsatisfactory elements and pose a risk for foreign investors[15]. Ukraine is considered to be heading in the right direction with significant reforms having been put into action but still has a long way to go to realize its full potential. Frequent and

[12] Data for Ukraine from National Bank of Ukraine http://www.bank.gov.ua/Statist/Electronic%20bulletin/data/4-Financial%20markets(4.1).xls

Data for Eurozone from European Central Bank http://sdw.ecb.europa.eu/browseSelection.do?DATASET=0&REF_AREA=308&BS_COUNT_SECTOR=2240&node=2018783

[13] Data from Aswath Damodaran, Ph.D., Stern School of Business NYU http://pages.stern.nyu.edu/~adamodar/

[14] Metallurgical Sector of Ukraine Investment Problems, Chentukov Y.I., Problems of foreign economic relations development and attraction of foreign investments: regional aspect., ISSN 1991-3524, Donetsk, 2007. p. 535-538

[15] Foreign Direct Investment in Ukraine – Donbass, Philip Burris, Problems of foreign economic relations development and attraction of foreign investments: regional aspect., ISSN 1991-3524, Donetsk, 2007. p. 507-510

unpredictable changes in the legal system along with conflicting and inconsistent Civil and Commercial Codes do not allow a transparent and stable enforced legal business environment. This is perceived as a great source of uncertainty by international companies, which makes future predictions of business goals and strategy risky.

The conclusion from the abovementioned is as follows: the investment climate of Ukraine is risky and unwelcoming, private capital is not available from domestic or international sources or available at prohibitively high cost due to real and perceived risks of doing business in Ukraine as shown by various sources. Alternative markets, such as Russia, offer similar profile of investment opportunities with lower risk and better business environment. In the concept of the proposed project, needed investment in the amount of ~$95 mil looks like very risky and uncertain.

b) Technological barriers
Both technologies (OHF and BF) are very sensitive to capacity fluctuation. Therefore, improper operation due to untried technology implementation (APCS and PCI) could result in unplanned stops and downtimes. Start and set-up works could take too much time and therefore, significant loses would be achieved. Taking into account the mentioned above, it can be considered that without additional incentive such risky project would not be realized.

c) Barriers due to prevailing practice
Pulverized coal injection technology was implemented for Blast Furnace 2 at CJSC "Donetsksteel" since 1980th. In Soviet Union neither economical nor technological difficulties were taken into account during the decision making for the modern technology implementation. Therefore, significant difficulties were faced during the implementation and exploitation. After Soviet Union disintegration the difficulties still were not solved, moreover, coke-coal needed for PCI technology became the mostly imported source. In 1998 Blast Furnace 2 was stopped and continued its work only in 2002, after significant repairs and reconstruction were done. It has to be noted that reconstruction of BF 2 was started in 2000 and was proceeding for 2 years.

Blast Furnace 1 was in operation since 1975 without overhaul. Actual capacity of BF 1 did not match the nominal one (790 th. t of iron per year). Therefore, it can be considered that equipment was seriously outdated and could not continue its operation without modernization/overhaul. For this purpose at 17 May 2005 BF 1 was stopped to be significantly renovated. During the works PCI technology which has been implemented for BF 2 was expanded for BF 1. At this date PCI technology has been implemented only at CJSC "Donetsksteel" – metallurgical plant". Therefore, this project can be considered as the first of its kind, which was implemented and still in use on the territory of Ukraine.

The proposed sub-project concerning APCS implementation for OHFs can be also considered as the first of its kind due to the following: APCS system which is used under the project is also a unique technology which has no analogues in Ukraine. This can be confirmed by relevant patents (No 35552, 26512, 20930), which are owned by CJSC "Donetsksteel" – metallurgical plant".

The full analysis of prevailing practice is shown below in the Step 4, Common practice analysis.

Outcome of Step 3a. The listed barriers may prevent the alternatives 1.2; 1.3; 1.4; 2.2; 2.3 and 2.4, please see Alternative analysis, Section B.1.

In case of significant investment barriers presence, any kind of factor that can alleviate these barriers can be considered to be important. Estimated JI revenue for this project is about 1/2 from the investment needed. In case of continuation of ERUs generation and selling after the Kyoto period (2013-2022) the value of revenue from ERUs selling will be even higher than project

investments[16]. This allows considering the JI factor to be the one that significantly alleviates described barriers.

Sub-step 3 b: Show that the identified barriers would not prevent the implementation of at least one of the alternatives (except the proposed project activity):

Listed barriers do not prevent Alternative 1.1 and 2.1 (Continuation of existing practice), because no investment is required in this case. However, BF 1 requires overhaul for continuation of its operation. Therefore, investments for this overhaul can be considered to be obligatory.

Step 4: Common practice analysis

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

The first patent for PCI technology for Blast Furnaces was issued in 1926. For the first time this idea was implemented at the "Plant named after F.E. Dzerzhinsky" in 1950. In the 70s of the previous century PCI technology was implemented at "Karagandinskiy metallurgical plant" and "Zapadno-Sibirskiy metallurgical plant". Thereafter the usage of PCI at these plants was stopped due to the low quality of the units and simplicity of natural gas usage due to its low price.

Since 1980th pulverized coal injection technology was implemented for Blast Furnace 2 at CJSC "Donetsksteel" but after facing significant difficulties the furnace was stopped in 1998. Reconstruction works were started in 2000 and were proceeding for 2 years. Implementation of the PCI technology for BF 1 was finished in 2007.

Nowadays pulverized coal is used at approximately on one third of metallurgical plants all over the world. In Ukraine the PCI technology is used at "Donetsksteel" – metallurgical plant" only. Besides, implementation of PCI technology for four BF is being implemented at "Metallurgical plant "Zaporozhstal". Therefore, proposed project can be considered to be the only project which was initiated on the territory of Ukraine where PCI technology has been implemented and is still in use.

As for the APCS system for Open Hearth Furnaces it is envisages a unique technology using which has no analogues in Ukraine. This can be confirmed by relevant patents (No 35552, 26512, 20930), which are owned by CJSC "Donetsksteel" – metallurgical plant".

Sub-step 4b: Discuss any similar Options that are occurring:
This is not applicable, because no similar activities can be observed.

Conclusion: Thus, the additionality analysis demonstrates that project emission reductions are additional to any that would occur otherwise.

[16] Estimated cost for implementation of PCI technology for BF 1 and APCS for OHFs is about 300 mln UAH.
Estimated emission reductions for project period (including early credits) is equal to 1,862,127 t CO_2. This and 2,798,472 t CO_2 will give the sum of 4,660,599. Taking into account the average price for ERU as 10 EUR and average converting course UAH/EUR equal to 10 one can get the total value of incentive, which is equal to 466,059 UAH.

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

There are three different sources of GHG emissions during the iron and steel production:

- Emission from the raw materials (iron, coke, coal, lime etc.) during the production process;
- Fuel (gas) combustion;
- GHG emissions from the Ukrainian electricity grid.

An overview of all emission sources in the steelmaking and iron making processes of proposed project is given in Table B.3.1 below. The subproject boundary should encompass all anthropogenic emissions by sources of GHGs which are:

- Under the control of the project participants;
- Reasonably attributable to the project;
- Significant, i.e., as a rule of thumb, would by each source account on average per year over the crediting period for more than 1 per cent of the annual average anthropogenic emissions by sources of GHGs, or exceed an amount of 2,000 tonnes of CO_2 equivalent, whichever is lower.

The emission sources within the project boundary are also shown in Figures B.3.1 and B.3.2 below.

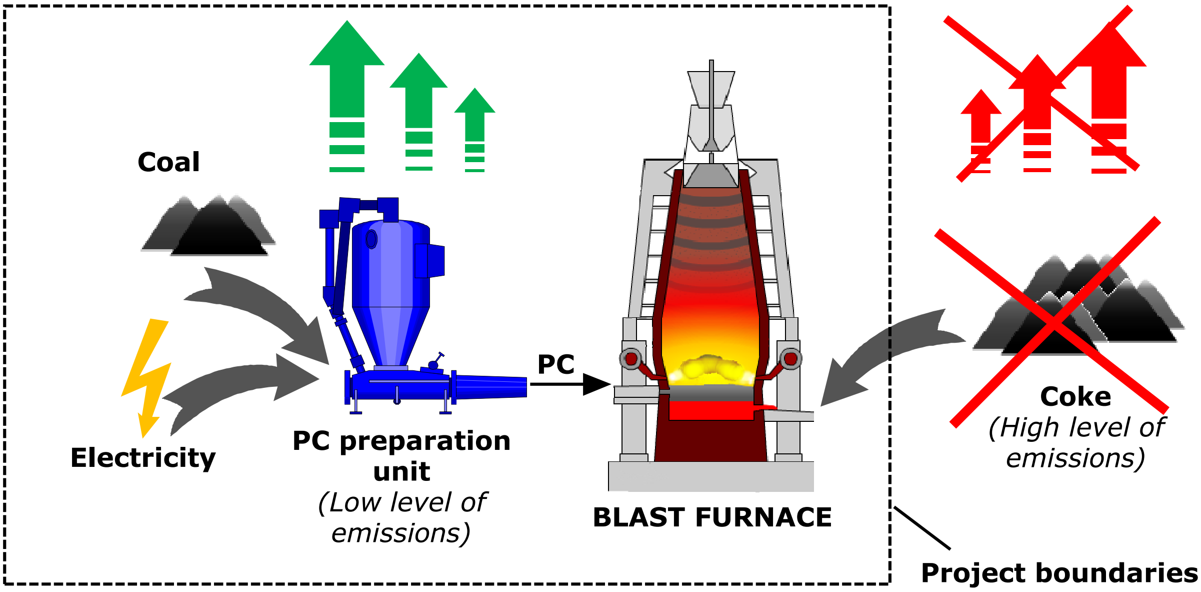


Figure B.3.1: Boundaries of subproject "Implementation of Pulverized Coal Injection (PCI) for Blast Furnace 1 (BF 1)"

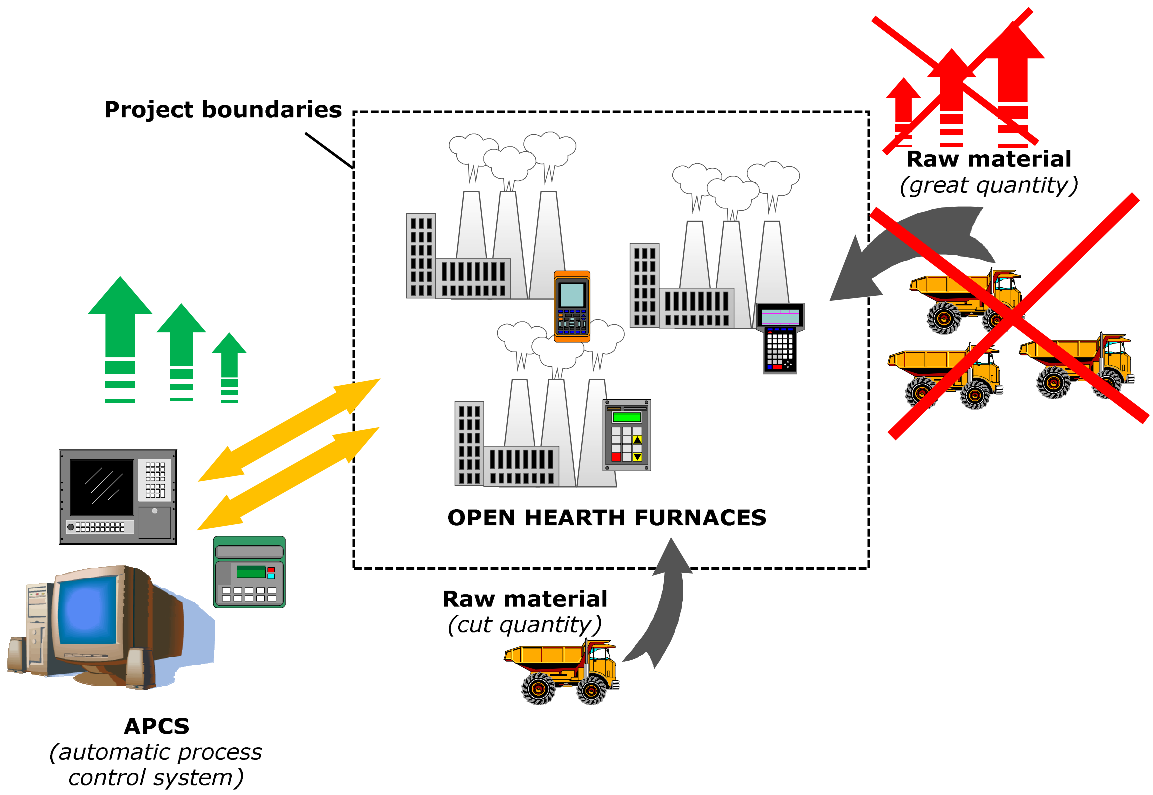


Figure B.3.2: Boundaries of subproject "Implementation of automatic process control system (APCS) for Open Hearth Furnaces (OHF)"

Please see Sections D. and E. for detailed data on the emissions within the project boundary.

Table B.3.1: Sources of emissions

№	Source	Gas	Included/ excluded	Justification/Explanation
1	Electricity consumption during the process of the compressed air and other gases (oxygen, argon, nitrogen)	CO_2	Included	• All steel producers have comparable emissions from these sources, thus including these sources is conservative; • Emissions connected with nitrogen and argon production are not calculated separately, these emissions are included in emissions connected with oxygen production because they are by-products of oxygen production.
2	Electricity consumption during the steelmaking and iron making processes (BF and OHF)	CO_2	Included	• Emissions are calculated using Standardized emission factors for the Ukrainian electricity grid [17].
3	Fuel consumption during the steelmaking and iron making processes	CO_2	Included	• The fossil fuel combustion will decrease.
4	Raw materials (iron, lime, coke) consumption during steelmaking and iron making processes	CO_2	Included	• Raw materials consumption (excluding coal) will be decreased after the project implementation
5	Electricity and raw materials due to the PCI unit operation	CO_2	Included	• Electricity consumption will be increased; • Coal consumption will be increased; • Coke consumption in the BF 1 will be decreased

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: 05 July 2010

Name of person/entity setting the baseline:
Denis Rzhanov
Global Carbon BV

Denis Rzhanov is not a project participant.
Global Carbon BV is a project participant.

SECTION C. Duration of the project / crediting period

C.1. Starting date of the project:

Starting date for “Implementation of Pulverized Coal Injection (PCI) for Blast Furnace 1” subproject is 9 January 2007.
Start date for subproject “Implementation of automatic process control system (APCS) for Open Hearth Furnaces” is 5 March 2006.

[17] “Standardized emission factors for the Ukrainian electricity grid” research (please find in Annex 2, value $EF_{grid,reduced,y}$), made by Global Carbon and positively determined by TÜV SÜD

C.2. Expected operational lifetime of the project:

The operational lifetime of the project is 25 years or 240 months.

C.3. Length of the crediting period:

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

Emission reductions generated before and 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 paragraph 30 of the JISC's Guidance, as part of the PDD of a proposed JI project, a monitoring plan has to be established by the project participants in accordance with appendix B of the JI guidelines. In this context two options are applicable:

a) Project participants may apply approved CDM baseline and monitoring methodologies;
b) Alternatively, a monitoring plan may be established in accordance with appendix B of the JI guidelines, i.e. a JI specific approach may be developed. In this case, inter alia, selected elements or combinations of approved CDM baseline and monitoring methodologies may be applied, if deemed appropriate.

In this PDD, a JI specific approach regarding monitoring is used. As elaborated in Section B.3, the project activity only affects the emissions related to the electricity, the fuel, and the raw materials consumption. Emissions related to the raw material and products transportation and the fuel consumption is excluded.

STEP 1 Indication and description of the approach chosen regarding monitoring
In accordance with the approach chosen and taking into account that proposed project concerns new construction, baseline emissions should be calculated based on project level of steel production and relevant emission factor.

The best practice for monitoring for JI project should not influence (or minimally influence) on common monitoring practice, used in the plant. Therefore, existing statistical documents (Technical Reports, etc.) will be used as a source of data. All metering devices used for metering the data necessary for ER calculations should be regularly checked and calibrated, if necessary, to provide insignificant level of uncertainties. Therefore, all data in the calculation of the baseline and project emissions have insignificant level of uncertainties due to regular calibration of meters.

All data needed for ER calculation will be collected in the official statistic documents used by plant and after that recalculated into the value of emission reduction by method described below.

If the main metering device fails, and there are no reserve metering devices available, the monitoring report will use indirect data and evidence, but only if their applicability (data and evidence) is justifiably proved. Likely, a conservative approach will be used. The possible way to solve some problems in this case is using the reports developed under ISO 9001, which has been implemented on the plant.

The data monitored and required for calculation of the ERUs will be archived and kept for 2 years after the last transfer of ERUs.

STEP 2 Application of the approach chosen

In accordance with the approach chosen, monitoring will concern project data for iron and steel production level and feed stock consumption.

The main source of data will be Technical Reports which are official documents with sufficient level of reliability.

The following parameters have to be continuously monitored:

1 Pig iron production at BF 1
2 Coke consumption at BF 1
3 Natural gas consumption at BF 1
4 Electricity consumption at BF 1
5 Limestone consumption at BF 1
6 Sinter consumption at BF 1
7 Pellets consumption at BF 1
8 Pulverized coal (PC) production
9 Natural gas consumption for PC production
10 Electricity consumption for PC production
11 Steel production at OHFs
12 Pig iron consumption at OHFs
13 Limestone consumption at OHFs
14 Lime consumption at OHFs
15 Coke consumption at OHFs
16 Coal consumption at OHFs
17 Natural gas consumption at OHFs
18 COG consumption at OHFs
19 Electricity consumption at OHFs

Approach used for calculation of emission reduction can be explained as follows. All source of feed-stock consumed due to steelmaking can be considered as a “pollutant”. Emission level of this source can be estimated with help of relevant emission factor. Thus the emission factor relevant for relevant process (producing of iron and steelmaking process) will be obtained. Baseline emission factor for each process will be found as weighted average emission factor for three years before the project implementation. Emission factor for project condition will be compared to emission factors under the baseline, using the following data:

- Emission factors for each processes (producing of iron and steelmaking process) found for baseline and for the project conditions;
- Production level under the project;

- Different auxiliary emission factors needed to calculate emission level from all relevant sources.

The following assumptions for calculation of both baseline and project emissions were used:

- The iron and steel demand in the market is the same in the project and baseline scenario;
- After the reconstruction of BF 1, all technological parameters (specific consumption, production level etc.) except ones relevant to PCI technology would be the similar to project parameters;
- Production level in the OHF without the APCS implementation is assumed equal to production level under the project.

General remarks:

- Social indicators, such as number of people employed, safety records, training records etc., will be available to a verifier, if required;
- Only CO_2 emissions such as GHG are taken into account. Major source of CH_4 and N_2O emission at steelmaking process is the burning of fuel. Given fuel specific consumption, steelmaking process normally has a CH_4 emission of 28 g/tonne of steel and N_2O emissions of 2 g/tonne of steel compared with about 600 kg CO_2/ tonne of steel (2006 IPCC Guidelines for National Greenhouse Gas Inventories, Chapter 4.2). Omitting these two pollutants for a steelmaking process is conservative, because they contribute to less than 0.005 % of the total emissions, far below the confidence level for the CO_2 emission calculation. The CH_4 and N_2O emission reductions will not be claimed. This is conservative.

Data needed for calculations are emission factors, which are not monitored throughout the crediting period, but are determined only once (and thus remain fixed throughout the crediting period).

The values of these parameters are collected in the Table D.1.

Table D.1. – Emission factors used

No	Emissions factor	Variable	Unit	Value	Information source
1	Natural gas combustion	$EF_{CO2,n.gas}$	tCO_2/GJ	0.0561	IPCC[18], Volume 2, Table 1.4
2	COG combustion	$EF_{CO2,COG}$	tCO_2/GJ	0.0444	IPCC, Volume 2, Table 1.4
3	Electricity from the grid consumption	$EF_{CO2,el}$	tCO_2/MWh	0.896	"Standardized emission factors for the Ukrainian electricity grid" research, made by Global Carbon and positively determined by TÜV SÜD
4	Coke production	$EF_{CO2,coke}$	tCO_2/t	0.56	IPCC, Volume 4, Table 4.1 (value for Coke oven)
5	Coal combustion	$EF_{CO2,coal}$	tCO_2/GJ	0.0983	IPCC, Volume 2, Table 1.4
6	Sinter production	$EF_{CO2,sinter}$	tCO_2/t	0.2	IPCC, Volume 4, Table 4.1
7	Pellets production	$EF_{CO2,pellets}$	tCO_2/t	0.03	IPCC, Volume 4, Table 4.1
8	Lime production	$EF_{CO2,lime}$	tCO_2/t	0.77	IPCC, Volume 3, Table 2.4 (value for dolomitic lime for developing countries)
9	Limestone production	$EF_{CO2,lmst}$	tCO_2/t	0.44	IPCC, Volume 3, Table 4.3
10	Pulverized coal (PC) production	$EF_{CO2,PC}$	tCO_2/t	Various	Calculated from official statistic data of the Plant for baseline and project scenarios

[18] http://www.ipcc-nggip.iges.or.jp/public/2006gl/index.html
2006 IPCC Guidelines for National Greenhouse Gas Inventories (IPCC for further)

The following parameters have to be continuously monitored:

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

D.1.1.1. Data to be collected in order to monitor emissions from the project, and how these data will be archived:								
ID number *(Please use numbers to ease cross-referencing to D.2.)*	Data variable	Source of data	Data unit	Measured (m), calculated (c), estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment
1	$P_{iron,PJ,y}^{BF}$ Amount of pig iron produced in the BF 1 under the project	Plant records	T	m	Continuously	100%	Electronic and paper	-
2	$FC_{coke,PJ,y}^{BF}$ Coke consumption in the BF 1	Plant records	t	m	Continuously	100%	Electronic and paper	-
3	$FC_{n.gas,PJ,y}^{BF}$ Natural gas consumption in the BF 1	Plant records	1000 m^3	m	Continuously	100%	Electronic and paper	-
4	$FC_{el,PJ,y}^{BF}$ Electricity consumption in the BF 1	Plant records	MWh	m	Continuously	100%	Electronic and paper	-
5	$FC_{lmst,PJ,y}^{BF}$ Limestone consumption in the BF 1	Plant records	t	m	Continuously	100%	Electronic and paper	-
6	$FC_{sinter,PJ,y}^{BF}$ Sinter	Plant records	t	m	Continuously	100%	Electronic and paper	-

	consumption in the BF 1							
7	$FC^{BF}_{pellets,PJ,y}$ Pellets consumption in the BF 1	Plant records	t	m	Continuously	100%	Electronic and paper	-
8	$FC^{BF}_{PC,PJ,y}$ Pulverized coal consumption in the BF 1	Plant records	t	c	Continuously	100%	Electronic and paper	-
9	$FC^{PCI}_{n.gas,PJ,y}$ Natural gas consumption for PC preparation	Plant records	1000 m^3	m	Continuously	100%	Electronic and paper	-
10	$FC^{PCI}_{el,PJ,y}$ electricity consumption for PC preparation	Plant records	MWh	m	Continuously	100%	Electronic and paper	-
11	$P^{PCI}_{PC,PJ,y}$ Amount of pulverized coal produced under the project	Plant records	t	m	Continuously	100 %	Electronic and paper	-
12	$C_{coke,y}$ Coke carbon content	Plant records	%	m	Continuously	100 %	Electronic and paper	-
13	$P^{OHF}_{steel,PJ,y}$ Amount of steel produced in the OHF under the project	Plant records	t	m	Continuously	100%	Electronic and paper	-
14	$FC^{OHF}_{iron,PJ,y}$ Pig iron consumption in the OHFs	Plant records	t	m	Continuously	100%	Electronic and paper	-

15	$FC_{lmst,PJ,y}^{OHF}$ Limestone consumption in the OHFs	Plant records	t	m	Continuously	100%	Electronic and paper	-
16	$FC_{lime,PJ,y}^{OHF}$ Lime consumption in the OHFs	Plant records	t	m	Continuously	100%	Electronic and paper	-
17	$FC_{coke,PJ,y}^{OHF}$ Coke consumption in the OHFs	Plant records	t	m	Continuously	100%	Electronic and paper	-
18	$FC_{coal,PJ,y}^{OHF}$ Coal consumption in the OHFs	Plant records	t	m	Continuously	100%	Electronic and paper	-
19	$FC_{n.gas,PJ,y}^{OHF}$ Natural gas consumption in the OHFs	Plant records	1000 m^3	m	Continuously	100%	Electronic and paper	-
20	$FC_{COG,PJ,y}^{OHF}$ COG consumption in the OHFs	Plant records	1000 m^3	m	Continuously	100%	Electronic and paper	-
21	$FC_{el,PJ,y}^{OHF}$ Electricity consumption in the OHFs	Plant records	MWh	m	Continuously	100%	Electronic and paper	-

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

As described in Section B and A, there are two subprojects: "*Implementation of Pulverized Coal Injection (PCI) for Blast Furnace 1*" and "*Implementation of automatic process control system (APCS) for Open Hearth Furnaces*".

Therefore, the formula below reflects the project emission from subprojects:

$$PE_y = PE_y^{BF} + PE_y^{OHF} \quad (1)$$

Where:

PE_y Project emissions in year *y* (tCO_2);

PE_y^{BF} Emissions in year *y* due to implementation of PCI for BF 1, tCO_2;

PE_y^{OHF} Emissions in year *y* due to implementation of APCS for OHFs, tCO_2.

Calculation of PCI emissions

Project emissions for subproject "Implementation of Pulverized Coal Injection (PCI) for Blast Furnace 1" consist of emissions due to the fossil fuel combustions as well as carbon content raw material usage.

The following sources of emissions during the pig iron production process can be considered:

$FC_{coke,PJ,y}^{BF}$ Coke consumption at BF 1, t;

$FC_{n.gas,PJ,y}^{BF}$ Natural gas consumption at BF 1, 1000 m^3;

$FC_{el,PJ,y}^{BF}$ Electricity consumption at BF 1, MWh;

$FC_{lmst,PJ,y}^{BF}$ Limestone consumption at BF 1, t;

$FC_{sinter,PJ,y}^{BF}$ Sinter consumption at BF 1, t;

$FC_{pellets,PJ,y}^{BF}$ Pellets consumption at BF 1, t;

$FC_{PC,PJ,y}^{BF}$ Pulverized coal (PC) consumption at BF 1, t.

Therefore, project emissions in year *y* due to implementation of PCI for BF 1 can be calculated the following way:

$$PE_y^{BF} = P_{iron,PJ,y}^{BF} \times \left(EF_{CO2,PJ,y}^{BF} + EF_{CO2,PJ,y}^{PCI}\right), \text{ where:} \quad (2)$$

$P_{iron,PJ,y}^{BF}$ - Pig iron production at BF 1, t;

$EF_{CO2,PJ,y}^{BF}$- Emission factor for pig iron production process under the project, t CO_2 / t iron.

$$EF^{BF}_{CO2,PJ,y} = \Big(\Big(FC^{BF}_{coke,PJ,y} \times \big(EF_{CO2,coke} + C_{coke,y} \times 44/12\big)\Big) + \big(FC^{BF}_{n.gas,PJ,y} \times EF_{CO2,n.gas}\big) + \big(FC^{BF}_{lmst,PJ,y} \times EF_{CO2,lmst}\big) + \big(FC^{BF}_{el,PJ,y} \times EF_{CO2,el}\big) + \big(FC^{BF}_{sinter,PJ,y} \times EF_{CO2,sinter}\big) + \big(FC^{BF}_{pellets,PJ,y} \times EF_{CO2,pellets}\big) + \big(FC^{BF}_{PC,PJ,y} \times EF_{CO2,PC}\big)\Big) / P^{BF}_{iron,PJ,y} \quad (3)$$

where:
$EF_{CO2,PCI,PJ}$ - Emission factor for PC production process under the project, t CO_2 / t PC;
$C_{coke,y} \times 44/12$ - carbon content in coke, %;
$44/12$ - ratio between molecular weights of molecules CO_2 and C;
Value $FC^{BF}_{PC,PJ,y}$ cannot be monitored because PCI unit works for two blast furnaces simultaneously. PC consumption by each BF do not monitored separately.

Therefore average value of specific consumption of pulverized coal multiplied by pig iron production level can be used for this purpose:

$$FC^{BF}_{PC,PJ,y} = \overline{\omega}_{2007-2009} \times P^{BF}_{iron,PJ,y} \quad (4)$$

where:
$\overline{\omega}_{2007-2009}$ - Average specific consumption of pulverized coal by BF 1 for three years before the project implementation. This value is based on actual data and, therefore, can be considered as a constant.

$$\overline{\omega}_{2007-2009} = \frac{\frac{FC^{BF}_{PC,PJ,2007}}{P^{BF}_{iron,PJ,2007}} + \frac{FC^{BF}_{PC,PJ,2008}}{P^{BF}_{iron,PJ,2008}} + \frac{FC^{BF}_{PC,PJ,2009}}{P^{BF}_{iron,PJ,2009}}}{3} = \frac{\frac{78247}{560970} + \frac{82973}{614923} + \frac{91674}{699804}}{3} = 0.135 \quad (5)$$

Emission factor for PC production process under the project can be found the following way:

$$EF_{CO2,PJ,y}^{PCI} = \frac{\left(FC_{n.gas,PJ,y}^{PCI} \times EF_{CO2,n.gas}\right) + \left(FC_{el,PJ,y}^{PCI} \times EF_{CO2,el}\right)}{P_{PC,PJ,y}^{PCI}} \quad (6)$$

where,

$FC_{n.gas,PJ,y}^{PCI}$ - Natural gas consumption for PC production, 1000 m^3;

$FC_{el,PJ,y}^{PCI}$ - Electricity consumption for PC production, MWh;

$P_{PC,PJ,y}^{PCI}$ – Pulverized coal production level at PCI unit, t.

All the other emission factors used are constant and given in the table D.1.

Calculation of APCS emissions

Project emissions for subproject “Implementation of automatic process control system (APCS) for Open Hearth Furnaces” consist of emissions due to the fossil fuel combustions as well as carbon content raw material usage.

The following sources of emissions during the steel production process in the OHFs can be considered:

$P_{steel,PJ,y}^{OHF}$	Steel production at OHFs, t;
$FC_{iron,PJ,y}^{OHF}$	Pig iron consumption at OHFs, t;
$FC_{lmst,PJ,y}^{OHF}$	Limestone consumption at OHFs, t;
$FC_{lime,PJ,y}^{OHF}$	Lime consumption at OHFs, t;
$FC_{coke,PJ,y}^{OHF}$	Coke consumption at OHFs, t;
$FC_{coal,PJ,y}^{OHF}$	Coal consumption at OHFs, t;
$FC_{n.gas,PJ,y}^{OHF}$	Natural gas consumption at OHFs, 1000 m^3;
$FC_{COG,PJ,y}^{OHF}$	COG consumption at OHFs, 1000 m^3;
$FC_{el,PJ,y}^{OHF}$	Electricity consumption at OHFs, MWh.

Therefore, project emissions in year *y* due to implementation of APCS for OHFs can be calculated the following way:

$$PE_y^{OHF} = P_{steel,PJ,y}^{OHF} \times EF_{CO2,PJ,y}^{OHF}, \text{ where:} \quad (7)$$

$P_{steel,PJ,y}^{OHF}$ - Steel production at all OHFs where APCS were installed, t;
$EF_{CO2,PJ,y}^{OHF}$ - Emission factor for steel production process under the project, t CO_2 / t iron.

$$EF_{CO2,PJ,y}^{OHF} = \Big(\big(FC_{iron,PJ,y}^{OHF} \times EF_{CO2,iron}\big) + \big(FC_{lmst,PJ,y}^{OHF} \times EF_{CO2,lmst}\big) + \big(FC_{lime,PJ,y}^{OHF} \times EF_{CO2,lime}\big) + \big(FC_{coke,PJ,y}^{OHF} \times EF_{CO2,coke}\big) + \big(FC_{coal,PJ,y}^{OHF} \times EF_{CO2,coal}\big) + \big(FC_{n.gas,PJ,y}^{OHF} \times EF_{CO2,n.gas}\big) + \big(FC_{COG,PJ,y}^{OHF} \times EF_{CO2,COG}\big) + \big(FC_{el,PJ,y}^{OHF} \times EF_{CO2,el}\big)\Big) / P_{steel,PJ,y}^{OHF} \quad (8)$$

All emission factors needed to calculate this formula are given in the table D.1.

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
22	$P_{iron,BL,y}^{BF}$ Amount of pig iron produced in the BF 1 under the baseline	Plant records	t	c	Annually	100%	Electronic and paper	-
23	$P_{steel,BL,y}^{OHF}$ Amount of steel produced in the OHFs under the baseline	Plant records	t	c	Annually	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):

Similar to project scenario baseline emission includes emissions from relevant processes:

$$BE_y = BE_y^{BF} + BE_y^{OHF} \quad (9)$$

where:

BE_y Baseline emissions in year *y* (tCO_2);
BE_y^{BF} Emissions in year *y* due to exploiting BF 1 without PCI, tCO_2;
BE_y^{OHF} Emissions in year *y* due to exploiting OHF without APCS, tCO_2.

Calculation of BF emissions

Similar to project scenario baseline emission for subproject "Implementation of Pulverized Coal Injection (PCI) for Blast Furnace 1" consists of emissions due to the fossil fuel combustions as well as carbon content raw material usage.

The following sources of emissions during the pig iron production process can be considered:

$FC_{coke,BL,y}^{BF}$ Coke consumption at BF 1, t;
$FC_{n.gas,BL,y}^{BF}$ Natural gas consumption at BF 1, 1000 m^3;
$FC_{el,BL,y}^{BF}$ Electricity consumption at BF 1, MWh;
$FC_{lmst,BL,y}^{BF}$ Limestone consumption at BF 1, t;
$FC_{sinter,BL,y}^{BF}$ Sinter consumption at BF 1, t;
$FC_{pellets,BL,y}^{BF}$ Pellets consumption at BF 1, t;

Therefore, baseline emissions in year *y* due to implementation of PCI for BF 1 can be calculated the following way:

$$BE_y^{BF} = P_{iron,BL,y}^{BF} \times EF_{CO2,BL,y}^{BF}, \text{ where:} \quad (10)$$

$EF_{CO2,BL,y}^{BF}$ - Emission factor for pig iron production process under the baseline, t CO_2 / t iron;
$P_{iron,BL,y}^{BF}$ - Pig iron production at BF 1, t. This value is equal to project level of pig iron production at BF 1.

Therefore:

$$P^{BF}_{iron,BL,y} = P^{BF}_{iron,PL,y} \quad (11)$$

Emission factor for pig iron production process under the baseline is based on actual data received during three years before the project implementation. This value can be considered as a weighted average between emission factors for pig iron production process calculated for the period 2003-2005. For each year in this period emission factor can be found by following formula:

$$EF^{BF}_{CO2,BL,y} = \Big(\big(FC^{BF}_{coke,BL,y} \times (EF_{CO2,coke} + C_{coke,y} \times 44/12)\big) + \big(FC^{BF}_{n.gas,BL,y} \times EF_{CO2,n.gas}\big) + \big(FC^{BF}_{lmst,BL,y} \times EF_{CO2,lmst}\big) + \big(FC^{BF}_{el,BLy} \times EF_{CO2,el}\big) + \big(FC^{BF}_{sinter,BL,y} \times EF_{CO2,sinter}\big) + \big(FC^{BF}_{pellets,BL,y} \times EF_{CO2,pellets}\big)\Big) / P^{BF}_{iron,BL,y} \quad (12)$$

where:

$44/12$ - ratio between molecular weights of molecules CO_2 and C.

All the other emission factors used are constant and given in the table D.1.

Calculation of APCS emissions

Baseline emissions for subproject "Implementation of automatic process control system (APCS) for Open Hearth Furnaces" can be calculated similar to the project emissions. Thus, the sources can be used to calculate baseline emissions:

$P^{OHF}_{steel,Bl,y}$	Steel production at OHFs, t;
$FC^{OHF}_{iron,Bl,y}$	Pig iron consumption at OHFs, t;
$FC^{OHF}_{lmst,PJ,y}$	Limestone consumption at OHFs, t;
$FC^{OHF}_{lime,PJ,y}$	Lime consumption at OHFs, t;
$FC^{OHF}_{coke,PJ,y}$	Coke consumption at OHFs, t;
$FC^{OHF}_{coal,PJ,y}$	Coal consumption at OHFs, t;
$FC^{OHF}_{n.gas,PJ,y}$	Natural gas consumption at OHFs, 1000 m^3;
$FC^{OHF}_{COG,PJ,y}$	COG consumption at OHFs, 1000 m^3;
$FC^{OHF}_{el,PJ,y}$	Electricity consumption at OHFs, MWh;

Therefore, baseline emissions in year *y* due to implementation of APCS for OHFs can be calculated the following way:

$$BE_y^{OHF} = P_{steel,BL,y}^{OHF} \times EF_{CO2,BL,y}^{OHF} \text{ where:} \qquad (13)$$

$EF_{CO2,BL,y}^{OHF}$ - Emission factor for steel production process under the project, t CO_2 / t iron;
$P_{steel,BL,y}^{OHF}$ - Steel production at all OHFs under the baseline, t. This value is equal to project level of steel production.

Therefore:

$$P_{steel,BL,y}^{OHF} = P_{steel,PJ,y}^{OHF} \qquad (14)$$

Emission factor for steel production process under the baseline is based on actual data received during three years before the project implementation. This value can be considered as a weighted average between emission factors for steel production process calculated for the period 2002-2004. For each year in this period emission factor can be found by following formula:

$$EF_{CO2,BL,y}^{OHF} = \Big(\big(FC_{iron,BL,y}^{OHF} \times EF_{CO2,iron}\big) + \big(FC_{lmst,BLy}^{OHF} \times EF_{CO2,lmst}\big) + \big(FC_{lime,BL,y}^{OHF} \times EF_{CO2,lime}\big) + \big(FC_{coke,BL,y}^{OHF} \times EF_{CO2,coke}\big) + \big(FC_{coal,BL,y}^{OHF} \times EF_{CO2,coal}\big) + \big(FC_{n.gas,BL,y}^{OHF} \times EF_{CO2,n.gas}\big) + \big(FC_{COG,BL,y}^{OHF} \times EF_{CO2,COG}\big) + \big(FC_{el,BL,y}^{OHF} \times EF_{CO2,el}\big)\Big) / P_{steel,BL,y}^{OHF} \qquad (15)$$

All emission factors needed to calculate this formula are given in the table D.1.

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):

Not applicable.

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

Not applicable.

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):

$$ER_y = BE_y - PE_y \quad (16)$$

where:

ER_y Emission reductions due to the proposed JI project in year *y* (tCO_2);

BE_y Baseline emissions in year *y* (t CO_2);

PE_y Project emissions in year *y* (t CO_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:

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

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

Data *(Indicate table and ID number)*	Uncertainty level of data (high/medium/low)	Explain QA/QC procedures planned for these data, or why such procedures are not necessary.
Table D.1.1.1, ID 1 $P^{BF}_{iron,PJ,y}$	Low	This parameter is metered by weight bridge “Pulsar”. It also possible to use scale VV-250-50-2 (depending on what kind of transport is used). The devices will be calibrated annually.
Table D.1.1.1, ID 2 $FC^{BF}_{coke,PJ,y}$	Low	This parameter is metered by weight bridge “Pulsar”. It also possible to use scale VV-250-50-2 (depending on what kind of transport is used). The devices will be calibrated annually.
Table D.1.1.1, ID 3 $FC^{BF}_{n.gas,PJ,y}$	Low	This parameter is metered by special flow meter. The device will be calibrated according to the host Party’s legislation and producer’s requirements.
Table D.1.1.1, ID 4 $FC^{BF}_{el,PJ,y}$	Low	This parameter is metered by special electricity meter. The device will be calibrated according to the host Party’s legislation and producer’s requirements.

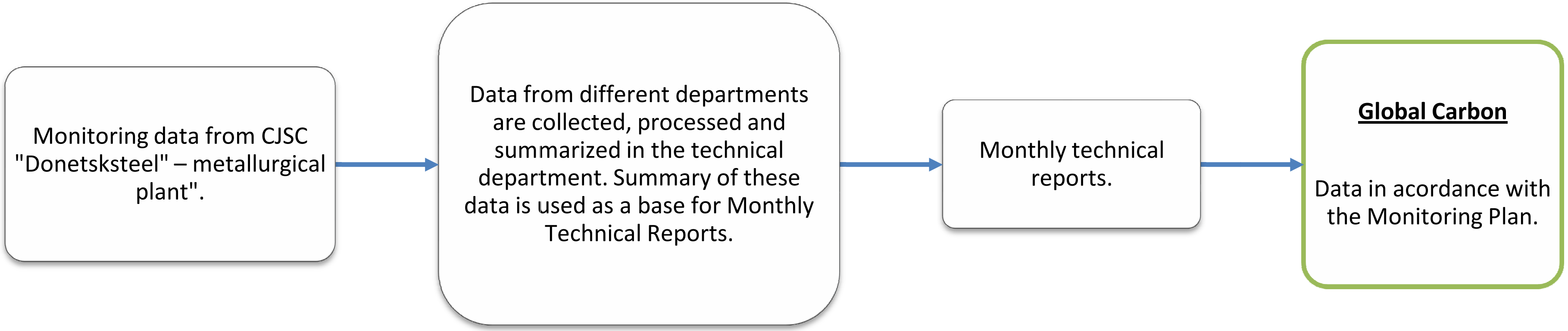
Table D.1.1.1, ID 5 $FC^{BF}_{lmst,PJ,y}$	Low	This parameter is metered by weight bridge "Pulsar". It also possible to use scale VV-250-50-2 (depending on what kind of transport is used). The devices will be calibrated annually.
Table D.1.1.1, ID 6 $FC^{BF}_{sinter,PJ,y}$	Low	This parameter is metered by weight bridge "Pulsar". It also possible to use scale VV-250-50-2 (depending on what kind of transport is used). The devices will be calibrated annually.
Table D.1.1.1, ID 7 $FC^{BF}_{pellets,PJ,y}$	Low	This parameter is metered by weight bridge "Pulsar". It also possible to use scale VV-250-50-2 (depending on what kind of transport is used). The devices will be calibrated annually.
Table D.1.1.1, ID 8 $FC^{BF}_{PC,PJ,y}$	Low	This value cannot be monitored because PCI unit works for two blast furnaces simultaneously. The average value of specific consumption of pulverized coal multiplied by pig iron production level can be used for this purpose. Please see formula (4) for details.
Table D.1.1.1, ID 9 $FC^{PCI}_{n.gas,PJ,y}$	Low	This parameter is metered by special flow meter. The device will be calibrated according to the host Party's legislation and producer's requirements.
Table D.1.1.1, ID 10 $FC^{PCI}_{el,PJ,y}$	Low	This parameter is metered by special electricity meter. The device will be calibrated according to the host Party's legislation and producer's requirements.
Table D.1.1.1, ID 11 $P^{PCI}_{PC,PJ,y}$	Low	This parameter is metered by weight bridge VV-250-50-2. The devices will be calibrated annually.
Table D.1.1.1, ID 12 $C_{coke,y}$	Low	The value of this parameter is included in the detail passport of fuel – the document is enclosed for each of coke. The value is also confirmed by internal accredited laboratory.
Table D.1.1.1, ID 13 $P^{OHF}_{steel,PJ,y}$	Low	This parameter is metered by weight bridge "Pulsar". It also possible to use scale VV-250-50-2 (depending on what kind of transport is used). The devices will be calibrated annually.
Table D.1.1.1, ID 14 $FC^{OHF}_{iron,PJ,y}$	Low	This parameter is metered by scale TP250×9. The devices will be calibrated annually.
Table D.1.1.1, ID 15 $FC^{OHF}_{lmst,PJ,y}$	Low	This parameter is metered by scale TP250×9. The devices will be calibrated annually.
Table D.1.1.1, ID 16 $FC^{OHF}_{lime,PJ,y}$	Low	This parameter is metered by scale TP250×9. The devices will be calibrated annually.
Table D.1.1.1, ID 17 $FC^{OHF}_{coke,PJ,y}$	Low	This parameter is metered by scale TP250×9. The devices will be calibrated annually.
Table D.1.1.1, ID 18 $FC^{OHF}_{coal,PJ,y}$	Low	This parameter is metered by scale TP250×9. The devices will be calibrated annually.

Table D.1.1.1, ID 19	Low	This parameter is metered by special flow meter. The device will be calibrated according to the host Party's legislation and producer's requirements.
Table D.1.1.1, ID 20	Low	This parameter is metered by special flow meter. The device will be calibrated according to the host Party's legislation and producer's requirements.
Table D.1.1.1, ID 21	Low	This parameter is metered by special electricity meter. The device will be calibrated according to the host Party's legislation and producer's requirements.
Table D.1.1.3, ID 22	Low	This data based on level of pig iron produced under the project activity. Please see description of value , ID1, Table D.1.1.1.
Table D.1.1.3, ID 23	Low	This data based on level of steel produced under the project activity. Please see description of value , , ID1, Table D.1.1.13.

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

Technical department is responsible for monitoring, collection, registration, visualization, archiving, reporting of the data monitored. The measurement team from CJSC "Donetsksteel" – metallurgical plant" is responsible for periodical checking of all measurement devices.

In the context of this project the following scheme can be performed:



All data needed for calculation of the emission reduction is collected at the CJSC "Donetsksteel" – metallurgical plant" during the common operation. Resulting statistics is forwarded to Technical Department for recalculation and summarising in the Monthly Technical Reports. These reports will be the main source of monitoring data.

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:

Table E.1.1: Estimated project emissions within the crediting period

	2008	2009	2010	2011	2012	Total
Estimated project emissions within the crediting period, tCO_2/year	2,822,293	2,429,183	2,436,973	2,436,973	2,436,973	12,562,395

Table E.1.2: Estimated project emissions after the crediting period

	2013-2022	Total
Estimated project emissions after the crediting period, tCO_2/year	24,369,730	24,369,730

E.2. Estimated leakage:

Not applicable

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

Table E.3.1: Estimated project emissions including leakage within the crediting period

	2008	2009	2010	2011	2012	Total
Estimated project emissions including leakage within the crediting period, tCO_2/year	2,822,293	2,429,183	2,436,973	2,436,973	2,436,973	12,562,395

Table E.3.2: Estimated project emissions inclusive leakage after the crediting period

	2013-2022	Total
Estimated project emissions including leakage after the crediting period, tCO_2/year	24,369,730	24,369,730

E.4. Estimated baseline emissions:

Table E.4.1: Estimated baseline emissions for the project within the crediting period

	2008	2009	2010	2011	2012	Total
Estimated baseline emissions for the project within the crediting period, tCO_2/year	3,102,140	2,715,871	2,715,871	2,715,871	2,715,871	13,965,624

Table E.4.2: Estimated baseline emissions for the project after the crediting period

	2013-2022	Total
Estimated baseline emissions for the project after the crediting period, tCO_2/year	27,158,710	27,158,710

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

Table E.5.1: Difference representing the emission reductions of the project within the crediting period

	2008	2009	2010	2011	2012	Total
Difference representing the emission reductions of the project within the crediting period, tCO_2/year	279,847	286,688	278,898	278,898	278,898	1,403,229

Table E.5.2: Difference representing the emission reductions of the project after the crediting period

	2013-2022	Total
representing the emission reductions of the project after the crediting period, tCO2/year	2,788,980	2,788,980

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

Table E.6.1: Project, baseline, and emission reductions within the crediting period

Year	Estimated project emissions (tonnes of CO_2 equivalent)	Estimated leakage (tonnes of CO_2 equivalent)	Estimated baseline emissions (tonnes of CO_2 equivalent)	Estimated emission reductions (tonnes of CO_2 equivalent)
Year 2008	2,822,293	0	3,102,140	279,847
Year 2009	2,429,183	0	2,715,871	286,688
Year 2010	2,436,973	0	2,715,871	278,898
Year 2011	2,436,973	0	2,715,871	278,898
Year 2012	2,436,973	0	2,715,871	278,898
Total (tonnes of CO_2 equivalent)	**12,562,395**	**0**	**13,965,624**	**1,403,229**

Table E.6.2: Project, baseline, and emission reductions after the crediting period

Year	Estimated project emissions (tonnes of CO_2 equivalent)	Estimated leakage (tonnes of CO_2 equivalent)	Estimated baseline emissions (tonnes of CO_2 equivalent)	Estimated emission reductions (tonnes of CO_2 equivalent)
Year 2013	2,436,973	0	2,715,871	278,898
Year 2014	2,436,973	0	2,715,871	278,898
Year 2015	2,436,973	0	2,715,871	278,898
Year 2016	2,436,973	0	2,715,871	278,898
Year 2017	2,436,973	0	2,715,871	278,898
Year 2018	2,436,973	0	2,715,871	278,898
Year 2019	2,436,973	0	2,715,871	278,898
Year 2020	2,436,973	0	2,715,871	278,898
Year 2021	2,436,973	0	2,715,871	278,898
Year 2022	2,436,973	0	2,715,871	278,898
Total (tonnes of CO_2 equivalent)	**24,369,730**	**0**	**27,158,710**	**2,788,980**

SECTION F. Environmental impacts

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

The Host Party for this project is Ukraine. Environmental Impact Assessment (EIA) is the part of the Ukrainian project planning and permitting procedures. Implementation regulations for EIA are included in the Ukrainian State Construction Standard DBN A.2.2.-1-2003[19] (Title:"Structure and Contents of the Environmental Impact Assessment Report (EIR) for Designing and Construction of Production Facilities, Buildings and Structures").

The EIA has been completed for the proposed projects and approved by local authority. Analysis of these documents shows that implementation of the proposed technologies will not lead to negative impacts, due to the following:

- Equipment installed under the project activity is modern and efficient;
- The general effect from the implementation of the proposed technology envisages reduction of raw material (APCS project) and energy-intensive feedstock (coke in the subproject concerning the PCI technology) use;
- All project emissions will not exceed MPEs (maximum permit emissions)

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

As shown in the EIA, the proposed projects will not harm the environmental conditions in the region, so no negative transboundary effects are expected.

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:

As it is shown in Section F,1 project does not have significant negative environmental impact.

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

SECTION G. Stakeholders' comments

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

In accordance with Ukrainian legislation, "Donetskstal" – Iron and Steel Works" has consulted the regional authority to obtain the necessary approvals for construction of the Electrostal plant. No stakeholder consultation is required by Host Party. Nevertheless, the press relations service publishes all significant news items concerning the plant operation on the website of the plant.

For the JI project, stakeholder comments will be gathered during the month following the 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

For the emission reduction calculation and monitoring the project developer offers to use a JI specific approach in accordance with the JI Guidance on Criteria for Baseline Setting and Monitoring, Version 02[6]. No approved CDM methodologies are used.

As shown in Section B.1.above, the most plausible baseline scenario is Reconstruction of BF 1 without PCI technology implementation and continuation of existing practise concerning OHFs exploitation. In this scenario, capacity of reconstructed BF 1 assumed to be the same as for the project, but no advantages from PCI technology will be achieved. Any policy and/or legislation prevents this scenario because it fully corresponds to common practice among the metallurgical plants in Ukraine. In this scenario, coke will remain the main source of carbon, as well as the main fuel. Steel in the OHFs will be produced in the same amount as for the project scenario, but specific consumption of -raw materials will be different. Technical condition of existing OHFs at CJSC "Donetsksteel" – metallurgical plant" allows using it without any limits. The general level of emission for this scenario will be higher than for the proposed project, because of higher feedstock consumption level.

Approach used for calculation of emission reduction can be explained as follows. All source of feedstock consumed due to steelmaking can be considered as a “pollutant”. Emission level of this source can be estimated with help of relevant emission factor. Thus, the emission factor for the relevant process (producing of iron and steelmaking process) will be obtained. Baseline emission factor for each process will be found as weighted average emission factor during three years before the project implementation. Emission factor for project condition will be compared to emission factors under the baseline, using the following data:

- Emission factors for each processes (producing of iron and steelmaking process) found for baseline and for the project conditions;
- Production level under the project.

Different auxiliary emission factors needed to calculate emission level from all relevant sources.

All possible leakages which can take place under the project activity would also take place under the baseline and, thus, can be excluded. Among them there are:

- Fugitive emission due to natural gas transportation;
- Emissions due to transportation of raw material to the plant;
- Energy used for auxiliary needs (lighting, etc.).

Due to construction works only temporary leakages during the project implementation can be considered to be additional to baseline. Nevertheless, they can be also excluded as a temporary source.

Summary of the key elements in tabular form:

No	**Parameter**	Data unit	Source of data
1	Pig iron production in the BF 1	t	Electrostal' technical reports
2	Steel production in the OHFs	t	Electrostal' technical reports
3	Emission factor for pig iron production under the baseline	t CO_2/t iron	Electrostal' technical reports
4	Emission factor for steel production under the baseline	t CO_2/t steel	Electrostal' technical reports

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 exist a similar need 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[20];

- The “Operational Guidelines for the Project Design Document”, further referred to as ERUPT approach or baseline[21];

- The approved CDM methodology ACM0002 “Consolidated baseline methodology for grid-connected electricity generation from renewable sources”[22];

- Specific circumstances for Ukraine as described below.

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

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

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

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 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 2: 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 showed 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 3: Electricity demand in Ukraine on 31 March 2005[23]

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

Development of the Ukrainian electricity sector

The National Energy Strategy[24] 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[25]:

- 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.

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 4: Installed capacity[26] 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'[27].

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 5: Peak load in Ukraine in 2001 - 2005[28]

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

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

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

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

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

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

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)[29].

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;
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 6: Imports and exports balance in Ukraine[30]

ACM0002 offers several choices for calculating the OM. Dispatch data analyze cannot be applied, since the grid data is not available[31]. 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.

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

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

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

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 7: Share of power plants in the annual electricity generation of Ukraine[32]

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

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[32] “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.

[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] 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

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[35] 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 8: Grid losses in Ukraine[36]

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[37] 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

purpose of simplicity it was considered that all the electricity generated by the small power plants has the same average emission factor obtained.

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

[36] "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.

[37] 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.

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[38];

- 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:

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

and

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

where:

$EF_{grid,produced,y}$ is the emission factor for JI projects supplying additional electricity to the grid (tCO_2/MWh);

$EF_{grid,reduced,y}$ is the emission factor for JI projects reducing electricity consumptionfrom the grid (tCO_2/MWh)factor of the fuel;

$EF_{OM,y}$ is the simple OM of the Ukrainian grid (tCO_2/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 9: 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).

[38] “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 baseline emissions are calculated as follows:

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

where:
BE_y are the baseline emissions in year y (tCO_2);
$EF_{grid,produced,y}$ is the emission factor of producing projects (tCO_2/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 (tCO_2/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	Pig iron production
Data unit	tonnes
Description	Annual production of pig iron in the Blast Furnace 1
Time of determination/monitoring	Fixed ex ante during determination
Source of data (to be) used	Donetsksteel technical reports
Value of data applied (for ex ante calculations/determinations)	Year: 2008 / 2009 / 2010 / 2011 / 2012 t: 614,823 / 699,804 / 699,804 / 699,804 / 699,804
Justification of the choice of data or description of measurement methods and procedures (to be) applied	There are only two ways to determine this parameter for the purpose of estimation of ERUs. One of them is based on the maximum capacity of BF 1. The second way which was applied is based on real expectations of the PO, that is conservative
OA/QC procedures (to be) applied	The relevant metering devices will be calibrated according to the host Party's legislation and requirements of the supplier.
Any comment	

Data/Parameter	Steel production
Data unit	tonnes
Description	Annual production of steel in the OHFs
Time of determination/monitoring	Fixed ex ante during determination
Source of data (to be) used	Donetsksteel technical reports
Value of data applied (for ex ante calculations/determinations)	Year: 2008 / 2009 / 2010 / 2011 / 2012 t: 869,494 / 527,623 / 527,623 / 527,623 / 527,623
Justification of the choice of data or description of measurement methods and procedures (to be) applied	There are only two ways to determine this parameter for the purpose of estimation of ERUs. One of them is based on the maximum capacity of BF 1. The second way which was applied is based on real expectations of the PO, that is conservative
OA/QC procedures (to be) applied	The relevant metering devices will be calibrated according to the host Party's legislation and requirements of the supplier.
Any comment	

Data/Parameter	Pulverized coal production
Data unit	tonnes
Description	Annual production of pulverized coal in the PCI unit
Time of determination/monitoring	Fixed ex ante during determination
Source of data (to be) used	Donetsksteel technical reports
Value of data applied (for ex ante calculations/determinations)	Year: 2008 / 2009 / 2010 / 2011 / 2012 t: 124,803 / 181,048 / 181,048 / 181,048 / 181,048
Justification of the choice of data or description of measurement methods and procedures (to be) applied	There are only two ways to determine this parameter for the purpose of estimation of ERUs. One of them is based on the maximum capacity of BF 1. The second way which was applied is based on real expectations of the PO, that is conservative
OA/QC procedures (to be) applied	The relevant metering devices will be calibrated according to the host Party's legislation and requirements of the supplier.
Any comment	

Data/Parameter	Emission factor for pig iron production under the project
Data unit	tonnes
Description	Emission factor for pig iron production in the BF 1under the project
Time of determination/monitoring	Monitored during crediting period
Source of data (to be) used	Donetsksteel technical reports
Value of data applied (for ex ante calculations/determinations)	Year: 2008 / 2009 / 2010 / 2011 / 2012 t CO2/t iron: 2.267 / 2.270 / 2.281 / 2.281 / 2.281
Justification of the choice of data or description of measurement methods and procedures (to be) applied	This data is based on forecast of the PO
OA/QC procedures (to be) applied	The relevant metering devices will be calibrated according to the host Party's legislation and requirements of the supplier.
Any comment	

Year	2008	2009	2010	2011	2012
t CO2/t iron	2.267	2.270	2.281	2.281	2.281

Data/Parameter	Emission factor for steel production under the project
Data unit	tonnes
Description	Emission factor for steel production in the OHFs under the project
Time of determination/monitoring	Monitored during crediting period
Source of data (to be) used	Donetsksteel technical reports
Value of data applied (for ex ante calculations/determinations)	Year: 2008 / 2009 / 2010 / 2011 / 2012 t CO2/t steel: 1.643 / 1.593 / 1.593 / 1.593 / 1.593
Justification of the choice of data or description of measurement methods and procedures (to be) applied	This data is based on forecast of the PO
OA/QC procedures (to be) applied	The relevant metering devices will be calibrated according to the host Party's legislation and requirements of the supplier.
Any comment	

Year	2008	2009	2010	2011	2012
t CO2/t steel	1.643	1.593	1.593	1.593	1.593

Data/Parameter	Emission factor for pulverized coal production under the project
Data unit	tonnes
Description	Emission factor for pulverized coal production in the PCI unit under the project
Time of determination/monitoring	Monitored during crediting period
Source of data (to be) used	Donetsksteel technical reports
Value of data applied (for ex ante calculations/determinations)	Year: 2008 / 2009 / 2010 / 2011 / 2012 t CO_2/t PC: 0.061 / 0.060 / 0.060 / 0.060 / 0.060
Justification of the choice of data or description of measurement methods and procedures (to be) applied	This data is based on forecast of the PO
OA/QC procedures (to be) applied	The relevant metering devices will be calibrated according to the host Party's legislation and requirements of the supplier.
Any comment	

Year	2008	2009	2010	2011	2012
t CO_2/t PC	0.061	0.060	0.060	0.060	0.060

Data/Parameter	Pig iron consumption in the OHFs
Data unit	tonnes
Description	Annual consumption of pig iron in the OHFs
Time of determination/monitoring	Monitored during crediting period
Source of data (to be) used	Donetsksteel technical reports
Value of data applied (for ex ante calculations/determinations)	Year: 2008 / 2009 / 2010 / 2011 / 2012 t: 427,435 / 235,979 / 235,979 / 235,979 / 235,979
Justification of the choice of data or description of measurement methods and procedures (to be) applied	There are only two ways to determine this parameter for the purpose of estimation of ERUs. One of them is based on the maximum capacity of BF 1. The second way which was applied is based on real expectations of the PO, that is conservative
OA/QC procedures (to be) applied	The relevant metering devices will be calibrated according to the host Party's legislation and requirements of the supplier.
Any comment	

Year	2008	2009	2010	2011	2012
t	427,435	235,979	235,979	235,979	235,979

Data/Parameter	Coke consumption in the BF 1
Data unit	tonnes
Description	Annual consumption of coke in the BF 1
Time of determination/monitoring	Monitored during crediting period
Source of data (to be) used	Donetsksteel technical reports
Value of data applied (for ex ante calculations/determinations)	see table below
Justification of the choice of data or description of measurement methods and procedures (to be) applied	There are only two ways to determine this parameter for the purpose of estimation of ERUs. One of them is based on the maximum capacity of BF 1. The second way which was applied is based on real expectations of the PO, that is conservative
OA/QC procedures (to be) applied	The relevant metering devices will be calibrated according to the host Party's legislation and requirements of the supplier.
Any comment	

Year	2008	2009	2010	2011	2012
t	268,950	344,714	344,714	344,714	344,714

Data/Parameter	Coke consumption in the OHFs
Data unit	tonnes
Description	Annual consumption of coke in the OHFs
Time of determination/monitoring	Monitored during crediting period
Source of data (to be) used	Donetsksteel technical reports
Value of data applied (for ex ante calculations/determinations)	see table below
Justification of the choice of data or description of measurement methods and procedures (to be) applied	There are only two ways to determine this parameter for the purpose of estimation of ERUs. One of them is based on the maximum capacity of BF 1. The second way which was applied is based on real expectations of the PO, that is conservative
OA/QC procedures (to be) applied	The relevant metering devices will be calibrated according to the host Party's legislation and requirements of the supplier.
Any comment	

Year	2008	2009	2010	2011	2012
t	739	485	485	485	485

Data/Parameter	Natural gas consumption in the BF 1
Data unit	1000 m^3
Description	Annual consumption of natural gas in the BF 1
Time of determination/monitoring	Monitored during crediting period
Source of data (to be) used	Donetsksteel technical reports
Value of data applied (for ex ante calculations/determinations)	Year: 2008 / 2009 / 2010 / 2011 / 2012 1000 m^3: 43,588 / 3,480 / 3,480 / 3,480 / 3,480
Justification of the choice of data or description of measurement methods and procedures (to be) applied	There are only two ways to determine this parameter for the purpose of estimation of ERUs. One of them is based on the maximum capacity of BF 1. The second way which was applied is based on real expectations of the PO, that is conservative
OA/QC procedures (to be) applied	The relevant metering devices will be calibrated according to the host Party's legislation and requirements of the supplier.
Any comment	

Data/Parameter	Natural gas consumption in the OHFs
Data unit	1000 m^3
Description	Annual consumption of natural gas in the OHFs
Time of determination/monitoring	Monitored during crediting period
Source of data (to be) used	Donetsksteel technical reports
Value of data applied (for ex ante calculations/determinations)	Year: 2008 / 2009 / 2010 / 2011 / 2012 1000 m^3: 112,837 / 73,207 / 73,207 / 73,207 / 73,207
Justification of the choice of data or description of measurement methods and procedures (to be) applied	There are only two ways to determine this parameter for the purpose of estimation of ERUs. One of them is based on the maximum capacity of BF 1. The second way which was applied is based on real expectations of the PO, that is conservative
OA/QC procedures (to be) applied	The relevant metering devices will be calibrated according to the host Party's legislation and requirements of the supplier.
Any comment	

Data/Parameter	Natural gas consumption in the PCI unit
Data unit	1000 m^3
Description	Annual consumption of natural gas for PC production
Time of determination/monitoring	Monitored during crediting period
Source of data (to be) used	Donetsksteel technical reports
Value of data applied (for ex ante calculations/determinations)	Year: 2008 / 2009 / 2010 / 2011 / 2012 1000 m^3: 1,334 / 2,070 / 2,070 / 2,070 / 2,070
Justification of the choice of data or description of measurement methods and procedures (to be) applied	There are only two ways to determine this parameter for the purpose of estimation of ERUs. One of them is based on the maximum capacity of BF 1. The second way which was applied is based on real expectations of the PO, that is conservative
OA/QC procedures (to be) applied	The relevant metering devices will be calibrated according to the host Party's legislation and requirements of the supplier.
Any comment	

Data/Parameter	COG consumption in the OHFs
Data unit	1000 m^3
Description	Annual consumption of Coke Oven Gas in the OHFs
Time of determination/monitoring	Monitored during crediting period
Source of data (to be) used	Donetsksteel technical reports
Value of data applied (for ex ante calculations/determinations)	Year: 2008 – 0; 2009 – 0; 2010 – 0; 2011 – 0; 2012 – 0 (1000 m^3)
Justification of the choice of data or description of measurement methods and procedures (to be) applied	It is not supposed to use COG during the crediting period
OA/QC procedures (to be) applied	The relevant metering devices will be calibrated according to the host Party's legislation and requirements of the supplier.
Any comment	

Year	2008	2009	2010	2011	2012
1000 m^3	0	0	0	0	0

Data/Parameter	Electricity consumption in the BF 1
Data unit	tonnes
Description	Annual consumption of electricity in the BF 1
Time of determination/monitoring	Monitored during crediting period
Source of data (to be) used	Donetsksteel technical reports
Value of data applied (for ex ante calculations/determinations)	see table below
Justification of the choice of data or description of measurement methods and procedures (to be) applied	There are only two ways to determine this parameter for the purpose of estimation of ERUs. One of them is based on the maximum capacity of BF 1. The second way which was applied is based on real expectations of the PO, that is conservative
OA/QC procedures (to be) applied	The relevant metering devices will be calibrated according to the host Party's legislation and requirements of the supplier.
Any comment	

Year	2008	2009	2010	2011	2012
MWh	8,924	9,308	9,308	9,308	9,308

Data/Parameter	Electricity consumption in the OHFs
Data unit	Tonnes
Description	Annual consumption of electricity in the OHFs
Time of determination/monitoring	Monitored during crediting period
Source of data (to be) used	Donetsksteel technical reports
Value of data applied (for ex ante calculations/determinations)	see table below
Justification of the choice of data or description of measurement methods and procedures (to be) applied	There are only two ways to determine this parameter for the purpose of estimation of ERUs. One of them is based on the maximum capacity of BF 1. The second way which was applied is based on real expectations of the PO, that is conservative
OA/QC procedures (to be) applied	The relevant metering devices will be calibrated according to the host Party's legislation and requirements of the supplier.
Any comment	

Year	2008	2009	2010	2011	2012
MWh	72,902	62,897	62,897	62,897	62,897

Data/Parameter	Electricity consumption in the PCI unit
Data unit	tonnes
Description	Annual consumption of electricity for PC production
Time of determination/monitoring	Monitored during crediting period
Source of data (to be) used	Donetsksteel technical reports
Value of data applied (for ex ante calculations/determinations)	Year: 2008 / 2009 / 2010 / 2011 / 2012; MWh: 5,632 / 7,786 / 7,786 / 7,786 / 7,786
Justification of the choice of data or description of measurement methods and procedures (to be) applied	There are only two ways to determine this parameter for the purpose of estimation of ERUs. One of them is based on the maximum capacity of BF 1. The second way which was applied is based on real expectations of the PO, that is conservative
OA/QC procedures (to be) applied	The relevant metering devices will be calibrated according to the host Party's legislation and requirements of the supplier.
Any comment	

Year	2008	2009	2010	2011	2012
MWh	5,632	7,786	7,786	7,786	7,786

Data/Parameter	Limestone consumption in the BF 1
Data unit	tonnes
Description	Annual consumption of limestone in the BF 1
Time of determination/monitoring	Monitored during crediting period
Source of data (to be) used	Donetsksteel technical reports
Value of data applied (for ex ante calculations/determinations)	Year: 2008 / 2009 / 2010 / 2011 / 2012; t: 94,554 / 104,679 / 104,679 / 104,679 / 104,679
Justification of the choice of data or description of measurement methods and procedures (to be) applied	There are only two ways to determine this parameter for the purpose of estimation of ERUs. One of them is based on the maximum capacity of BF 1. The second way which was applied is based on real expectations of the PO, that is conservative
OA/QC procedures (to be) applied	The relevant metering devices will be calibrated according to the host Party's legislation and requirements of the supplier.
Any comment	

Year	2008	2009	2010	2011	2012
t	94,554	104,679	104,679	104,679	104,679

Data/Parameter	Limestone consumption in the OHFs
Data unit	tonnes
Description	Annual consumption of limestone in the OHFs
Time of determination/monitoring	Monitored during crediting period
Source of data (to be) used	Donetsksteel technical reports
Value of data applied (for ex ante calculations/determinations)	Year: 2008 / 2009 / 2010 / 2011 / 2012; t: 32,623 / 13,228 / 13,228 / 13,228 / 13,228
Justification of the choice of data or description of measurement methods and procedures (to be) applied	There are only two ways to determine this parameter for the purpose of estimation of ERUs. One of them is based on the maximum capacity of BF 1. The second way which was applied is based on real expectations of the PO, that is conservative
OA/QC procedures (to be) applied	The relevant metering devices will be calibrated according to the host Party's legislation and requirements of the supplier.
Any comment	

Year	2008	2009	2010	2011	2012
t	32,623	13,228	13,228	13,228	13,228

<table>
<tr><td>Data/Parameter</td><td>Lime consumption in the OHFs</td></tr>
<tr><td>Data unit</td><td>tonnes</td></tr>
<tr><td>Description</td><td>Annual consumption of lime in the OHFs</td></tr>
<tr><td>Time of determination/monitoring</td><td>Monitored during crediting period</td></tr>
<tr><td>Source of data (to be) used</td><td>Donetsksteel technical reports</td></tr>
<tr><td>Value of data applied
(for ex ante calculations/determinations)</td><td><table><tr><td>Year</td><td>2008</td><td>2009</td><td>2010</td><td>2011</td><td>2012</td></tr><tr><td>t</td><td>48,970</td><td>39,287</td><td>39,287</td><td>39,287</td><td>39,287</td></tr></table></td></tr>
<tr><td>Justification of the choice of data or description of measurement methods and procedures (to be) applied</td><td>There are only two ways to determine this parameter for the purpose of estimation of ERUs. One of them is based on the maximum capacity of BF 1. The second way which was applied is based on real expectations of the PO, that is conservative</td></tr>
<tr><td>OA/QC procedures (to be) applied</td><td>The relevant metering devices will be calibrated according to the host Party’s legislation and requirements of the supplier.</td></tr>
<tr><td>Any comment</td><td></td></tr>
</table>

<table>
<tr><td>Data/Parameter</td><td>Sinter consumption in the BF 1</td></tr>
<tr><td>Data unit</td><td>tonnes</td></tr>
<tr><td>Description</td><td>Annual consumption of sinter in the BF 1</td></tr>
<tr><td>Time of determination/monitoring</td><td>Monitored during crediting period</td></tr>
<tr><td>Source of data (to be) used</td><td>Donetsksteel technical reports</td></tr>
<tr><td>Value of data applied
(for ex ante calculations/determinations)</td><td><table><tr><td>Year</td><td>2008</td><td>2009</td><td>2010</td><td>2011</td><td>2012</td></tr><tr><td>t</td><td>306,238</td><td>140,809</td><td>140,809</td><td>140,809</td><td>140,809</td></tr></table></td></tr>
<tr><td>Justification of the choice of data or description of measurement methods and procedures (to be) applied</td><td>There are only two ways to determine this parameter for the purpose of estimation of ERUs. One of them is based on the maximum capacity of BF 1. The second way which was applied is based on real expectations of the PO, that is conservative</td></tr>
<tr><td>OA/QC procedures (to be) applied</td><td>The relevant metering devices will be calibrated according to the host Party’s legislation and requirements of the supplier.</td></tr>
<tr><td>Any comment</td><td></td></tr>
</table>

<table>
<tr><td>Data/Parameter</td><td>Pellets consumption in the BF 1</td></tr>
<tr><td>Data unit</td><td>tonnes</td></tr>
<tr><td>Description</td><td>Annual consumption of pellets in the BF 1</td></tr>
<tr><td>Time of determination/monitoring</td><td>Monitored during crediting period</td></tr>
<tr><td>Source of data (to be) used</td><td>Donetsksteel technical reports</td></tr>
<tr><td>Value of data applied
(for ex ante calculations/determinations)</td><td><table><tr><td>Year</td><td>2008</td><td>2009</td><td>2010</td><td>2011</td><td>2012</td></tr><tr><td>t</td><td>605,578</td><td>959,807</td><td>959,807</td><td>959,807</td><td>959,807</td></tr></table></td></tr>
<tr><td>Justification of the choice of data or description of measurement methods and procedures (to be) applied</td><td>There are only two ways to determine this parameter for the purpose of estimation of ERUs. One of them is based on the maximum capacity of BF 1. The second way which was applied is based on real expectations of the PO, that is conservative</td></tr>
<tr><td>OA/QC procedures (to be) applied</td><td>The relevant metering devices will be calibrated according to the host Party’s legislation and requirements of the supplier.</td></tr>
<tr><td>Any comment</td><td></td></tr>
</table>

Data/Parameter	Pulverized coal consumption in the BF 1
Data unit	tonnes
Description	Annual consumption of pulverized coal in the BF 1
Time of determination/monitoring	Monitored during crediting period
Source of data (to be) used	Donetsksteel technical reports
Value of data applied (for ex ante calculations/determinations)	Year: 2008 / 2009 / 2010 / 2011 / 2012; t: 82,973 / 91,674 / 94,576 / 94,576 / 94,576
Justification of the choice of data or description of measurement methods and procedures (to be) applied	There are only two ways to determine this parameter for the purpose of estimation of ERUs. One of them is based on the maximum capacity of BF 1. The second way which was applied is based on real expectations of the PO, that is conservative
OA/QC procedures (to be) applied	The relevant metering devices will be calibrated according to the host Party's legislation and requirements of the supplier.
Any comment	

Year	2008	2009	2010	2011	2012
t	82,973	91,674	94,576	94,576	94,576

Data/Parameter	Coal consumption in the OHFs
Data unit	tonnes
Description	Annual consumption of coal in the OHFs
Time of determination/monitoring	Monitored during crediting period
Source of data (to be) used	Donetsksteel technical reports
Value of data applied (for ex ante calculations/determinations)	Year: 2008 / 2009 / 2010 / 2011 / 2012; t: 1,887 / 2,517 / 2,517 / 2,517 / 2,517
Justification of the choice of data or description of measurement methods and procedures (to be) applied	There are only two ways to determine this parameter for the purpose of estimation of ERUs. One of them is based on the maximum capacity of BF 1. The second way which was applied is based on real expectations of the PO, that is conservative
OA/QC procedures (to be) applied	The relevant metering devices will be calibrated according to the host Party's legislation and requirements of the supplier.
Any comment	

Year	2008	2009	2010	2011	2012
t	1,887	2,517	2,517	2,517	2,517

Data/Parameter	Coke carbon content
Data unit	Units
Description	Coke carbon content
Time of determination/monitoring	Monitored during crediting period
Source of data (to be) used	Donetsksteel technical reports
Value of data applied (for ex ante calculations/determinations)	Year: 2008 / 2009 / 2010 / 2011 / 2012; Units: 0.82 / 0.816 / 0.816 / 0.816 / 0.816
Justification of the choice of data or description of measurement methods and procedures (to be) applied	There are only two ways to determine this parameter for the purpose of estimation of ERUs. One of them is based on the maximum capacity of BF 1. The second way which was applied is based on real expectations of the PO, that is conservative
OA/QC procedures (to be) applied	The relevant metering devices will be calibrated according to the host Party's legislation and requirements of the supplier.
Any comment	

Year	2008	2009	2010	2011	2012
Units	0.82	0.816	0.816	0.816	0.816