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

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SECTION A. General description of the project

A.1. Title of the project:

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Installation of a new waste heat recovery system in Alchevsk Coke Plant, Ukraine
Sectoral scope: (4) manufacturing industries
Version 7, 22/12/2009

A.2. Description of the project:

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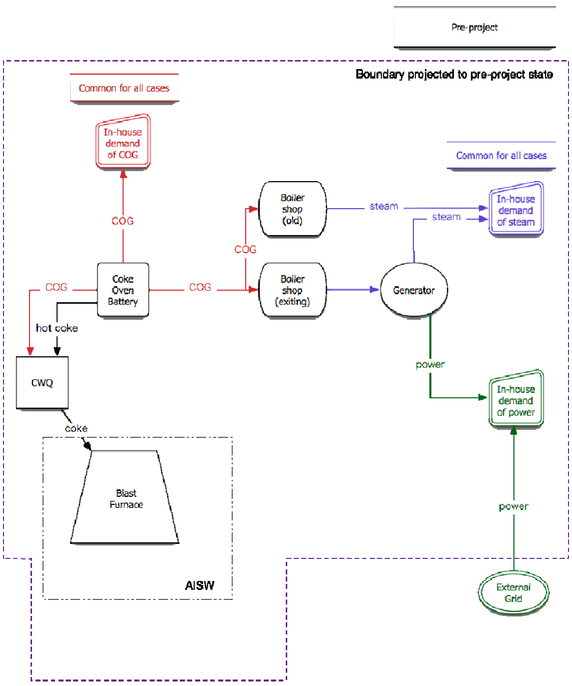
The project activity is to reduce greenhouse gas (GHG) emissions through the introduction of captive co-generation with waste heat recovery technology by using Coke Dry Quenching (CDQ) system—instead of conventional Coke Wet Quenching (CWQ) system—with 9.13 MW captive generator at Alchevsk Coke Plant (Alchevskkoks) when it expands its coke oven battery. The 75 t/h highly-efficient boiler firing coke oven gas (COG) and blast furnace gas (BFG) and new steam turbine is also installed at Alchevskkoks as a part of establishing industrial synthesis in energy source with its neighbouring Steel Plant (Alchevsk Iron and Steel Works).

Pre-project



Pre-Project

Historically, Alchvskkoks generated around 1,100,000 t/y of steam by the existing boiler shop with three 50 t/h boilers and the old boiler shop 1 with five 50 t/h boilers which is about being abolished due to overage. Both boiler shops are firing COG from 6 existing coke battery ovens.

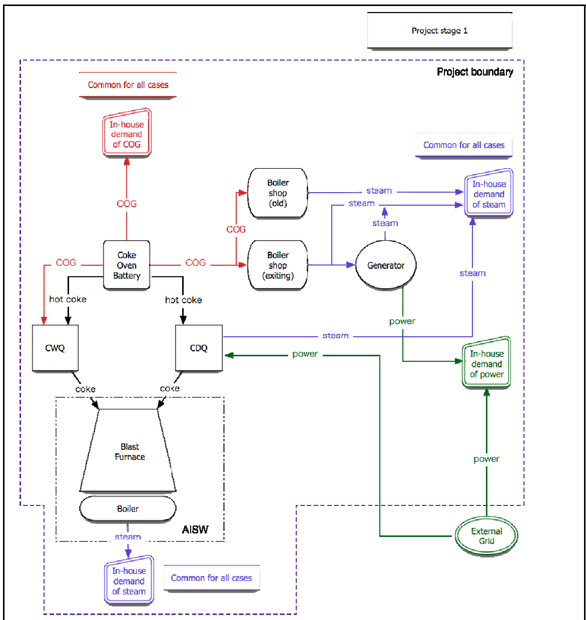
As for the electricity, around 15,000 MWh of electricity has been generated by the existing two 2.15 MW captive power steam generators and around 130,000 MWh/y has been imported to meet internal electricity demand. Refer to the left figure.

Project activity

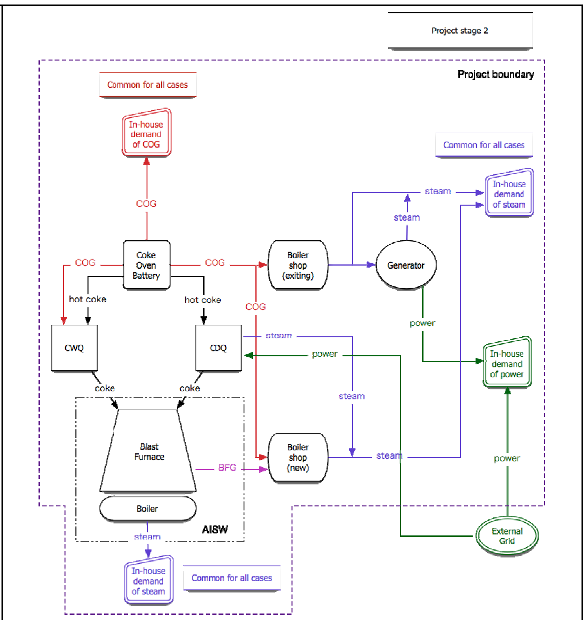
The project activity is split into three stages, i.e. stage 1, 2 & F due to construction schedule as shown figures below.

In the stage 1 of the project activity, only the CDQ system with boilers (35 t/h x 3 units) is installed while a new boiler and a new generator are not in service although internal demands are increased to 1,680,000 t/y for steam and 181,200 MWh/y for electricity due to production capacity expansion by installing a new coke oven battery.
For steam demand, 390,000 t/y is generated with CDQ boilers, 941,000 t/y with the existing boiler shop and the old boiler firing all COG available. The rest 349,000 t/y is imported from AISW.

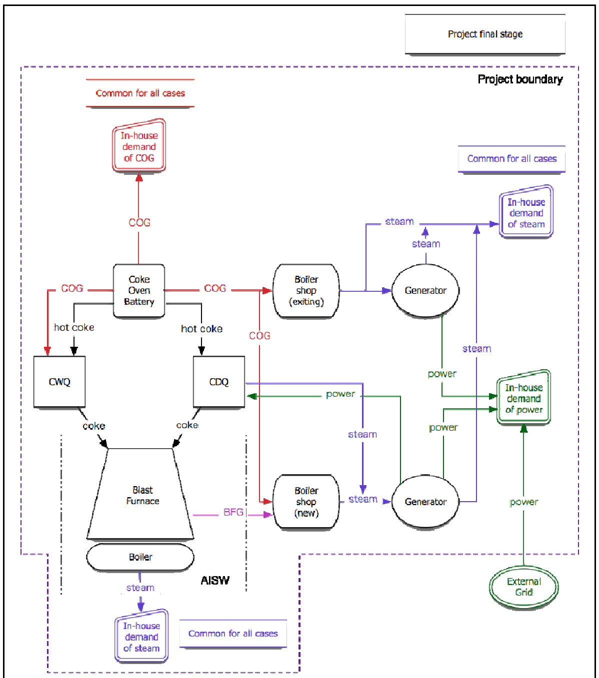
In the stage 2, a new 75 t/h boiler will be put in service and BFG will be introduced from AISW. Then the new boiler will start to generate 588,000 t/y of steam firing about 10% of available COG and all BFG available. The remaining 90% 0f COG will be kept fired in the existing boiler as the old boiler is abolished and stops generating steam as it is planned. Total steam and electricity generation will maintain the same as that in the stage 1.



Project Stage 1



Project Stage 2



Project Stage F

In the stage F which is the final stage of the project activity, in addition to the CDQ system and a new 75 t/h boiler, a new 9.13 MW captive generator will be put in service.

Internal demands for steam and electricity are the same as those in the stage 2 of the project activity, i.e. 1,680,000 t/y and 181,200 MWh/y respectively.

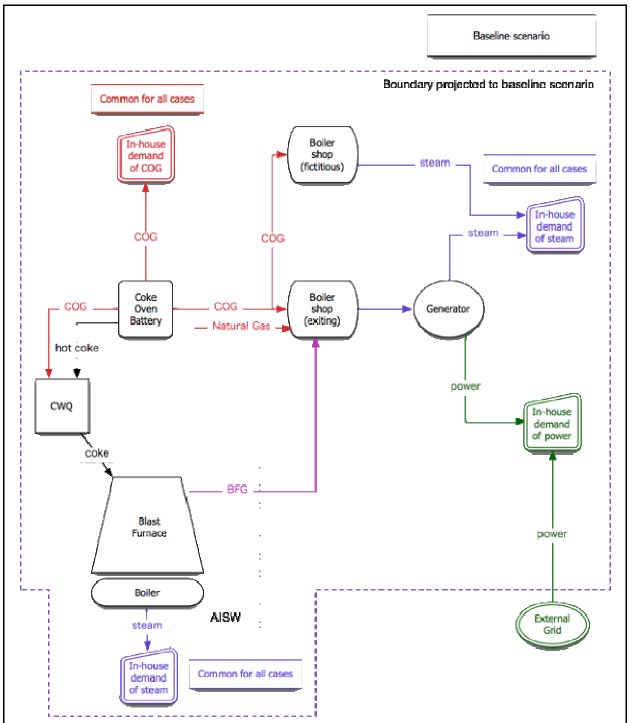
For steam demand, 390,000 t/y of steam is generated with CDQ boilers, 588,000 t/y with new 75 t/h boiler firing COG and BFG, and 353,000 t/y with the existing boiler shop firing COG only. The rest 349,000 t/y is imported from AISW.

For electricity demand, 54,200 MWh of net electricity is to be generated from the new 9.13 MW captive generator connected to CDQ boilers and the new boiler shop, and 8,640 MWh from the one set of existing 2.15 MW, and the rest 118,360 MWh/y is imported from the national grid to meet total demand, annually.

In this stage, the project activity generates 1,330,000 t/y of steam and more electricity than that in the baseline so that electricity import from the national electricity grid is reduced by 30,830 MWh/y.

By putting a new boiler and captive generator in service, this reduction will be made without firing natural gas which would have been used in the baseline. The amounts of COG and BFG utilized are common for the baseline and the project.

Baseline



Baseline

In the baseline, the same amount of steam import (349,000 t/y) and generation (1,331,000 t/y) as those in the project activity would have been occurred in the absence of the project activity. Without the project activity, for quenching cokes, conventional Coke Wet Quenching (CWQ) technology would be applied without recovering the waste heat; in place of CDQ boiler, Alchevskkoks would installed the second boiler shop (fictious) consisting of two 50 t/h boilers firing only COG[1] as the most economical solution to meet its steam demand, as old boiler shop is going to be abolished. This fictious boiler shop would generate 291,000 t/y of steam.
And also the existing boiler shop would increase its steam generation by firing all BFG from AISW and the balance of COG together with natural gas which is to make up COG firing. This boiler shop would generate 1,040,000 t/y of steam.
Since the existing boiler shop is connected to the two sets of captive power generators, 32,010 MWh/yr of electricity would be also supplied to Alchevskkoks for internal use. In order to meet internal electricity demand, around 149,190 MWh/y of electricity would be imported from the national electricity grid. Refer to the figure below.

The other benefit from installing CDQ is to produce harder and drier coke compared with the conventional Coke Wet Quenching technology (CWQ), which would have installed without the project activity. It has been empirically proved that this quality improvement results in reducing coke input per unit of pig iron production at the blast furnace. Accordingly, CO_2 emissions derived from burning coke is alleviated at the blast furnace of the Alchevsk Iron and Steel Works (AISW).

In summary, the project activity comprises three components of GHG emissions reductions as follows:

1. GHG emissions reductions due to dismissing natural gas that would have been burnt at the baseline boilers for steam generation by installing CDQ waste heat recovery technology together with high-efficient boiler.
2. GHG emissions reductions due to replacing grid electricity by installing the power generator with CDQ waste heat recovery technology together with high-efficient boiler by improving the efficient use of COG and BFG.
3. GHG emissions reductions due to reducing coke input per unit of pig iron production at the blast furnace by installing CDQ waste heat recovery technology.

[1] The required volume of COG is supplied in prioritised rank to the neighbouring AISW to cover energy balances of the Steel Plant that belongs to the same owner (IUD) as Alchevskkoks.

Other than GHG emissions the project activity entails significant environmental co-benefits. While CDQ enables Alchevskkoks to utilize waste heat and promote energy conservation, it also reduces emissions of air pollutants such as nitrogen oxides (NOx) and particulates from CWQ, boilers, and grid-connected power plants by replacing natural gas burning and grid electricity. In addition, the reduction of coke consumption at the blast furnace contributes to resource conservation.

History of the project activity

The project activity took shape first in 2003, with serious consideration of JI. The following table shows important project milestones since the beginning of the project.

Date	Event
December, 2003	Board Resolution to proceed with the project as a JI project activity
April, 2004	Signing of feasibility study contract between Alchevskkoks and "Azovimpeks" Ltd with involvement of Giprokoks
November, 2004	Notice of stakeholder meeting in a newspaper
August, 2005	Completion of feasibility study with independent expertise
June, 2006	Submission of project idea note to Ukrainian government
November, 2006	Issue of Letter of Endorsement from Ukrainian government
February, 2008	Letter of interest/confirmation by SG bank
March, 2008	Letter of support for the JI project activity from local city administration
September, 2007	CDQ hot run (Stage 1)
September, 2009	75 t/h efficient boiler operation starts (Stage 2)
December, 2009	9.13 turbine generator operation starts (Stage 2)

A.3. Project participants:

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Name of party involved	Legal entity project participant (as applicable)	Please indicate if the Party involved wishes to be considered as project participant
Party/Country: Ukraine (host Party)	OJSC Alchevskkoks OJSC Alcehvsk Iron and Steel Works Institute for Environment and Energy Conservation (IPEE)	No
Party/Country: Japan	Sumitomo Corporation	No

A.4. Technical description of the project:

A.4.1. Location of the project:

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A.4.1.1. Host Party(ies):

>>
Ukraine

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

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Luhanvsk Oblast

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

>>
Alchevsk

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

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Krasnykh Partyzan str. 1, Alchevsk, Lugansk Region, 94223, Ukraine

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

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The project activity involves the installation of CDQ with 9.13 MW captive generator, and 75 t/h boiler firing coke oven gas (COG) and blast furnace gas (BFG). The major specifications of these project facilities are as follows:

CDQ system	
Manufacturer	Giprokoks, Kharkov, Ukraine
Major specifications	-Coke processing capacity: to 70 t/h -Steam capacity: 35 t/h * 3 units -Pressure: 3.9 MPa -Steam temperature: 440 ^{0}C
Commissioning date	September 30, 2007
Lifetime	25 years
Types of services	-cools down red hot coke -recovers waste heat to generate steam
Relation to other manufacturing equipments	-provides cokes to blast furnace -provides steam to 9.13 MW captive co-generator -receives electricity from the captive co-generator

75 t/h high-efficient boiler	
Manufacturer	Energomash Ltd, Belgorod, Russia
Major specifications	-Steam capacity: 75 t/h unit -Pressure: 3.9 MPa -Steam temperature:440 ^{0}C
Commissioning date	In April to June of 2009 (Expected)
Lifetime	20 years
Types of services	-generate steam with COG and BFG gas
Relation to other manufacturing equipments	-receives COG and BFG from coke oven and blast furnace -provides steam to 9.13 MW co-generator

9.13 MW captive co-generator	
Manufacturer	Siemens
Major specifications	-Generator capacity: 9.13 MW -Steam consumption 37–114.6 t/h
Commissioning date	In October to December of 2009 (Expected)
Lifetime	25 years
Types of services	-generate electricity with provided steam
Relation to other manufacturing equipments	-receives steam from CDQ and 75 t/h boiler -provides steam to Alchevskkoks industrial process -provides electricity to Alchevskkoks for internal use

The CDQ technology is considered to be the most up-to-date technology with outstanding environmental benefits which can be proved by the letter from Giprokoks dated on 03.02.2009.

For today CWQ is a prevailing technology in Ukraine. Practical experience of CWQ utilization at majority coke plants shows there is a small probability that CDQ technology at Alchevsk coke plant will be replaced by other technology, especially when there are no indications that newer technology will appear in closest future.

The proposed CDQ system is capable of processing 1.3 million tons of cokes per year produced at No.9 and 10 coke ovens. As shown in Figure 1, after coking process at these coke ovens is done, red-hot cokes with 1,050 ^{0}C are discharged from the coke oven, transported in a bucket car, and charged into the top of the CDQ chamber. Inert gas, blown into the lower part of the chamber, circulates and cools the coke as it moves down through the chamber. After cooling down to approximately 200 ^{0}C, the quenched coke is discharged onto a conveyor belt situated at the bottom of the CDQ chamber.

Meanwhile, the circulating gas heated to approximately 980 ^{0}C is sent to the CDQ boiler. The boiler is able to generate 96 t/h steam (40 at, 440 ^{0}C), which is then directed to a 9.13 MW_e cogeneration unit together with supplemental steam from a new 75 t/h boiler to generate electricity. Cooled inert gas is redirected back to the CDQ chamber for recirculation.
The introduction of CDQ technology allows waste heat, which used to be released to atmosphere from CWQ process, to be utilized for steam and power generation, and to reduce consumption of natural gas that would have been burnt at baseline boilers, and replace grid electricity.

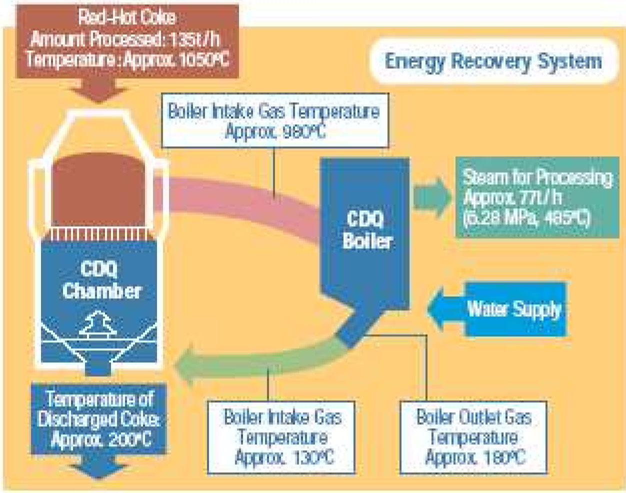

Figure 1 Schematic figure of CDQ system

The other benefit of CDQ system is the production of high-quality coke than that of the conventional CWQ technology. This quality improvement leads to reducing coke consumption per unit of pig iron production at AISW. Major differences in coke quality between CDQ and CWQ are as follows:

(1) Water content
Coke produced by CWQ contains 3 to 10 per cent of water due to the watering method in quenching process, whereas coke from CDQ contains nearly 0% of water. Water contained in coke deprives heat in the blast furnace by evaporation process in the form of both sensible and latent heat.

(2) Hardness
Coke processed in CWQ is subject to aqueous gasification and surface cracking due to the rapid water quenching process. Thus, CWQ coke has more pores and cracks on its surface than CDQ one, which results in decline in hardness.

Therefore, by installing CDQ system, less heat is taken up by water evaporation since less amount of water is contained in coke. Also, coke is able to stay longer in the furnace due to increased hardness. It has been also empirically proved that this improvement of coke quality results in reducing coke consumption per unit of pig iron production at the blast furnace. As a result, less amount of coke is burnt through CDQ installation, which leads to reduction of CO_2 emissions.

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:

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The project activity aims to reduce GHG emissions through the installation of captive co-generation with CDQ system together with new high-efficient boiler. Specifically, emissions reduction occurs due to (1) dismissing natural gas that would have been burnt at the baseline boilers, (2) replacing grid electricity by installing the power generator with CDQ waste heat recovery technology and (3) reducing coke input per unit of pig iron production at the blast furnace, by installing CDQ waste heat recovery technology.

The installation of the CDQ technology under the project activity is "first-of its-kind in Ukraine because such state-of-the-art CDQ technology has been never installed. Therefore, it is foreseen that the project activity faces various difficulties due to the fact that it is the first case in the country, ranging from the non-availability of domestic technology and non-existence of trained personnel. These difficulties are expected to be alleviated under technological and financial incentives from JI scheme.

More details are described in the section B.2.

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

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	Years
Length of the crediting period (01/01/2008– 31/12/2012)	5 years 0 months
Year	Estimate of annual emissions reductions in tonnes of CO_2 equivalent
2008	134,590
2009	208,051
2010	253,735
2011	253,735
2012	253,735
Total estimated emission reductions over the crediting period (tonnes of CO_2 equivalent)	1,103,846
Annual average of emission reductions over the crediting period (tonnes of CO_2 equivalent)	220,7692

A.5. Project approval by the Parties involved:

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The letter of endorsement (LoE) from the Ukrainian government was issued on 9th of November 2006.

According to the national regulations in Ukraine, the letter of approval (LoA) for the proposed JI project activity can be issued only after completion of determination report. The LoA from the Japanese government is expected to be issued in September 2009.

SECTION B. Baseline

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

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Indication and description of the approach chosen regarding baseline setting

The baseline of the project activity should be set in accordance with Appendix B of JI guidelines and further guidance on baseline setting and monitoring developed by JISC. In general there are two ways to quench the coke, i.e. coke wet quenching (CWQ) and coke dry quenching (CDQ). In conventional wet-type-coke-quenching systems, the sensible heat of the hot coke from the cokemaking process is lost to the environment in the form of steam during quenching. This is not only a source of dust pollution to the surroundings, but is also a waste of energy. In other words if Project Entity does not use CDQ, which corresponds to the current practice in Ukraine, CWQ would be used and then waste heat from hot (red) coke can not be utilized when using CWQ. That's to say, in absence of the project activity the waste heat from hot coke can not be utilized, even not to mention selling waste heat as an energy source.

As described above, the project activity consists of three components:

1. GHG emissions reductions due to dismissing natural gas that would have burnt at the baseline boilers by installing CDQ waste heat recovery technology together with high-efficient boiler.
2. GHG emissions reductions due to replacing grid electricity by installing the power generator with CDQ waste heat recovery technology together with high-efficient boiler.
3. GHG emissions reductions due to reducing coke input per unit of pig iron production at the blast furnace by installing CDQ waste heat recovery technology.

For the components of 1 and 2, the approved CDM methodology ACM0012 Version 03.1 (Consolidated baseline methodology for GHG emission reductions from waste energy recovery projects) is fully applied. The project activity falls on "Type-1", *i.e.*, all the waste energy in identified WECM stream/s that will be utilized in the project activity would be flared in the absence of the project activity at a new facility". The waste energy is an energy source for cogeneration. The project activity reasonably satisfies the applicability conditions of ACM0012 as shown in the table below.

Also, for the emissions factor of electricity grid, the value previously calculated by Global Carbon B.V. and verified by TÜV SÜD Industrie Service is utilized as shown in Annex II. This calculation was conducted based on ACM0002 (Consolidated methodology for grid-connected electricity generation from renewable sources) Version 8.

Applicability of ACM0012	The Project
If the project activity is based on the use of waste pressure to generate electricity, electricity generated using waste pressure should be measurable	Not applicable since the project activity utilizes waste heat only.
Energy generated in the project activity may be used within the industrial facility or exported from the industrial facility	All of the heat and electricity generated in the project activity will be used for the operation of the coke plant within the industrial facility.
The electricity generated in the project activity may be exported to the grid or used for captive purposes	The electricity generated in the project activity will be used for captive purposes without exporting to the grid, while displacing the purchased electricity from grid.
Energy in the project activity can be generated by the	Energy in the project activity will

owner of the industrial facility producing the waste energy or by a third party (e.g. ESCO) within the industrial facility	be generated by Alchevskkoks, which is the owner of the industrial facility producing waste heat.
Regulations do not constrain the industrial facility that generates waste energy from using fossil fuels prior to the implementation of the project activity	There are no regulations that constrain Alchevskkoks from using fossil fuels.
The methodology covers both new and existing facilities. For existing facilities, the methodology applies to existing capacity. If capacity expansion is planned, the added capacity must be treated as a new facility;	The project activity takes place in a new CDQ system and existing boilers and power generators. (necessary to rewrite)
The emission reductions are claimed by the generator of energy using waste energy	Alchevskkoks will claim the emission reductions.
In cases where the energy is exported to other facilities, an official agreement exists between the owners of the project energy generation plant (henceforth referred to as generator, unless specified otherwise) with the recipient plant(s) that the emission reductions would not be claimed by recipient plant(s) for using a zero-emission energy source	Energy is not exported to other facilities.
For those facilities and recipients included in the project boundary, that prior to implementation of the project activity (current situation) generated energy on-site (sources of energy in the baseline), the credits can be claimed for minimum of the following time periods: The remaining lifetime of equipments currently being used; and Credit period.	Grid: more than 5 years New boiler shop: more than 5 years Boiler shop #1: Boilers were put into operation in 1994. In 2002 they were reconstructed and their lifetime is expected to be ended in 2022.
Waste energy that is released under abnormal operation (for example, emergencies, shut down) of the plant shall not be accounted for.	Waste heat that is released under abnormal operation of the plant will not be accounted for.
This methodology is not applicable to projects where the waste gas/heat recovery project is implemented in a single-cycle power plant (e.g. gas turbine or diesel generator) to generate power.	The Project takes place in a coke plant, not a single-cycle power plant.
For Type-1 project activities: It shall be demonstrated that the waste energy utilized in the project activity was flared or released into the atmosphere (or wasted in case of project activity recovering waste pressure) in the absence of the project activity at the existing facility by either one of the following ways: *• By **direct measurements** of the energy content and amount of the waste energy produced for at least three years prior to the start of the project activity;* *• Providing an **Energy balance** of the relevant sections of the plant to prove that the waste energy was not a source of energy before the implementation of the project activity. For the energy balance applicable process parameters are required. The energy balance must demonstrate that the waste energy was not used and also provide conservative estimations of the energy content and amount of waste energy released;* ***Energy bills** (electricity, fossil fuel) to demonstrate*	In the absence of the project activity, the waste heat from red hot coke can not be captured nor used as the conventional CWQ system is not equipped with any facility to capture waste heat. This can be proved by steam balance of the project site.

that all the energy required for the process (e.g. based on specific energy consumption specified by the manufacturer) has been procured commercially. Project participants are required to demonstrate through the financial documents (e.g. balance sheets, profit and loss statement) that no energy was generated by waste energy and sold to other facilities and/or the grid. The bills and financial statements should be audited by competent authorities; *• **Process plant** manufacturer's original design specifications and layout diagrams from the facility could be used as an estimate of the quantity and energy content of the waste energy produced for the rated plant capacity/per unit of product produced;* *• On site checks conducted by the DOE prior to project implementation can confirm that no equipment for waste energy recovery and utilization, on the WECM stream recovered under the project activity, had been installed prior to the implementation of the CDM project activity.*	

Application of the approach chosen

According to ACM0012, the baseline scenario is identified as the most plausible scenario among all realistic and credible alternatives. For the Project, the baseline scenarios are to be determined for

- Waste energy use in the absence of the project activity; and
- Power generation in the absence of the project activity; and
- Steam/heat generation in the absence of the project activity.

Step 1: Define the most plausible baseline scenario for the generation of heat and electricity using the following baseline options and combinations

As described in section B.2., the CDQ technology faces technological and procedural/institutional barriers to be implemented. Therefore, in the following analysis, we omit the case where CDQ would be applied as a part of the baseline scenario.

For the ***use of waste energy***:

Possible baseline scenario	Comments	Conclusion
W1: WECM is directly vented to atmosphere without incineration or waste heat is released to the atmosphere or waste pressure energy is not utilized	The same alternative as W2.	To be discussed in W2.
W2: WECM is released to the atmosphere (for example after incineration) or waste heat is released to the atmosphere or waste pressure energy is not utilized	Applicable. This is a current practice, and meets all current legal and regulatory requirements in Ukraine.	Plausible baseline scenario.
W3: Waste energy is sold as an energy source	Not applicable. Waste heat from red-hot coke cannot be utilized in the absence of the proposed project	Not a part of the baseline scenario.

	because there are no other available technologies than CDQ to utilize the waste energy (sensible heat of red-hot coke).	
W4 Waste energy is used for meeting energy demand	Not applicable. Waste heat from red-hot coke cannot be utilized in the absence of the proposed project because there are no other available technologies than CDQ to utilize the waste energy.	Not a part of the baseline scenario.
W5: A portion of the waste gas produced at the facility is captured and used for captive electricity generation, while the rest of the waste gas produced at the facility is vented/flared.	Not applicable. The waste energy source of the proposed project is heat, not waste gas	Not a part of the baseline scenario.
W6: All the waste gas produced at the industrial facility is captured and used for export electricity generation.	Not applicable. The waste energy source of the proposed project is heat, not waste gas	Not a part of the baseline scenario.

For ***power generation***:

Possible baseline scenario	Comments	Conclusion
P1: Proposed project activity not undertaken as a JI project activity	Not applicable. Although this is in compliance with all legal and regulatory requirements, CDQ technology faces technological and procedural/institutional difficulties as described in the section B.2.	Not a part of baseline scenario.
P2: On-site or off-site existing/new fossil fuel fired cogeneration plant	Not applicable. There is no available cogeneration system other than one existing captive generation. It is more economical and technically convenient to procure grid electricity than to build an additional cogeneration system.	Not a part of baseline scenario.
P3: On-site or off-site existing/new renewable energy based cogeneration plant	Not applicable. There is no available cogeneration system with renewable energy, and renewable energy such as wind, hydro, and biomass is not available around the project site.	Not a part of baseline scenario.
P4: On-site or off-site existing/new fossil fuel based existing captive or identified plant	Not applicable. There is no available power generator other than one existing captive generation. To build a new fossil fuel fired captive power plant is less economical and convenient than to purchase electricity from the grid.	Not a part of baseline scenario.
P5: On-site or off-site existing/new renewable energy or other waste energy based existing captive or identified plant	Not applicable. There is no available power generator with renewable energy, and renewable energy such as wind, hydro, and biomass is not available around the project site.	Not a part of baseline scenario.
P6: Sourced Grid-connected power plants	Applicable. This is the current practice.	Plausible baseline scenario
P7: Captive electricity generation using	Not applicable. This is not realistic	Not a part of

waste energy (with lower efficiency than the project activity.)	because it is more economical and technically convenient to procure grid electricity than to build an additional cogeneration system.	baseline scenario.
P8: Cogeneration using waste energy (if project activity is cogeneration with waste energy, this scenario represents cogeneration with lower efficiency than the project activity);	Not applicable. This is not realistic because it is more economical and technically convenient to procure grid electricity than to build an additional cogeneration system.	Not a part of baseline scenario.
P9: Existing power generating equipment (used previous to implementation of project activity for captive electricity generation from **a captured portion** of waste gas) is either decommissioned to build new more efficient and larger capacity plant or modified or expanded (by installing new equipment), and resulting in higher efficiency, to produce and only export electricity generated from waste gas. The electricity generated by existing equipment for captive consumption is now imported from the grid.	Not applicable. The waste energy source of the proposed project is heat, not waste gas.	Not a part of baseline scenario.
P10: Existing power generating equipment (used previous to implementation of project activity for captive electricity generation from **a captured portion** of waste gas) is either decommissioned to build new more efficient and larger capacity plant or modified or expanded (by installing new equipment), and resulting in higher efficiency, to produce electricity from waste gas (already utilized portion plus the portion flared/vented) for own consumption and for export	Not applicable. The waste energy source of the proposed project is heat, not waste gas.	Not a part of baseline scenario.
P11: Existing power generating equipment is maintained and additional electricity generated by grid connected power plants.	Not applicable. While electricity is generated from the existing captive power plant, the rest of electricity is already sourced from the grid, and no additional power is generated by grid connected power plants.	Not a part of baseline scenario.

For ***heat generation***:

Possible baseline scenario	**Comments**	**Conclusion**
H1: Proposed project activity not undertaken as a CDM project activity	Not applicable. Although this is in compliance with all legal and regulatory requirements, CDQ technology faces technological and procedural/institutional difficulties as described in the section B.2.	Not a part of baseline scenario.
H2: On-site or off-site existing/new	Not applicable. There is no available	Not a part of

fossil fuel fired cogeneration plant	cogeneration system other than one captive generation system. It is more economical and technically convenient to install new boiler shop than to build an additional cogeneration system.	baseline scenario.
H3: On-site or off-site existing/new renewable energy based cogeneration plant	Not applicable. There is no available cogeneration system with renewable energy, and renewable energy such as wind, hydro, and biomass is not available around the project site.	Not a part of baseline scenario.
H4: An existing or new fossil fuel based boilers	At the coke plant, an existing COG and BFG-fuelled boilers provides the steam, and new boiler shop is planned to be installed to cover the increased steam demand at the coke plant, which is technically and economically feasible.	Plausible baseline scenario
H5: An existing or new renewable energy or other waste energy based boilers	Not applicable. There is no available captive power generator with renewable energy, renewable energy such as wind, hydro, and biomass is not available around the project site.	Not a part of baseline scenario.
H6: Any other source such as district heat	There are no other sources in the vicinity of the project site that could supply the necessary heat.	Not a part of baseline scenario.
H7: Other heat generation technologies (e.g. heat pumps or solar energy)	Heat pumps or solar energy technology is not widely available in Ukraine, and too costly to provide the amount of steam required.	Not a part of baseline scenario.
H8: Steam/Process heat generation from waste energy, but with lower efficiency	Not applicable. Waste heat from red-hot coke cannot be utilized in the absence of the proposed project.	Not a part of baseline scenario.
H9: Cogeneration with waste energy, but at a lower efficiency	Not applicable. Not applicable. Waste heat from red-hot coke cannot be utilized in the absence of the proposed project.	Not a part of baseline scenario.

Step 2: Identify the fuel for the baseline choice of energy source taking into account the national and/or sectoral policies as applicable

For grid electricity, the baseline choice of energy source corresponds to the fuel mix of Ukrainian national grid. For natural gas, it is relatively abundant energy source with the 47% occupancy in primary energy supply in Ukraine[2], and no supply constraint is foreseen there.

Step 3: Step 2 and/or Step 3 of the latest approved version of the "Tool for the demonstration and assessment of additionality" shall be used to identify the most plausible baseline scenarios by eliminating non-feasible options (e.g. alternatives where barriers are prohibitive or which are clearly economically unattractive).

Barrier analysis is conducted in Step 3 in section B.2

[2] "Energy Balances of OECD Countries", IEA 2007 – http://browse.oecdbookshop.org/oecd/pdfs/browseit/6107033E.PDF

Step 4: If more than one credible and plausible alternative scenario remain, the alternative with the lowest baseline emissions shall be considered as the most likely baseline scenario

Since only one scenario from each category, *i.e.*, W2, P6, and H4 is identified, this Step 4 is not conducted.

Key information and data used for selection of baseline for the components 1 and 2

Data/Parameter	B-1 f_{wcm}
Data unit	N/A
Description	Fraction of total electricity generated by the project activity using waste energy.
Time of determination/monitoring	At preparation of PDD
Source of data (to be) used	Design specification
Value of data applied (for ex ante calculations/determinations)	1
Justification of the choice of data or description of measurement methods and procedures (to be) applied	Since the electricity generation is purely from use of waste energy, this fraction is 1.
QA/QC procedures (to be) applied	See Chapter D.2
Any comment	This parameter is required to calculate the baseline emissions due to displacement of electricity (equation 1a-1).

Data/Parameter	B-2 $EG_{PJ,y}$
Data unit	MWh
Description	Total amount of electricity generated in the project activity.
Time of dete rmination/monitoring	Continuously
Source of data (to be) used	Power meters at new and existing turbine generators in Alchevskkoks.
Value of data applied (for ex ante calculations/determinations)	13,501 in 2008, 18,942 in 2009 84,840 in 2010-2012.
Justification of the choice of data or description of measurement methods and procedures (to be) applied	Before the final stage of the project (to 2010), the new generator will not be in service. Therefore power only from the existing turbine generator set will be generated before 2010.
QA/QC procedures (to be) applied	See Chapter D.2
Any comment	This parameter is required to calculate the quantity of electricity supplied to the recipient by the newly installed generator that in the absence of the project activity would have been sourced from grid (equation 1a-1-1).

Data/Parameter	B-3 $EC_{CDQ,y}$
Data unit	MWh
Description	Amount of electricity self-consumed by CDQ.
Time of determination/monitoring	continuously
Source of data (to be) used	Power meters at new turbine generators in

	Alchevskkoks.
Value of data applied (for ex ante calculations/determinations)	16,748 in 2008 & 2009 22,000 in 2010-2012.
Justification of the choice of data or description of measurement methods and procedures (to be) applied	Coke production by CDQ was and is estimated to be less than its design capacity before 2010, and own electricity consumption was and is reduced from its original design.
QA/QC procedures (to be) applied	See Chapter D.2
Any comment	This parameter is required to calculate the quantity of electricity supplied to the recipient by the newly installed generator that in the absence of the project activity would have been sourced from grid (equation 1a-1-1).

Data/Parameter	B-4 $EG_{hist,BL}$
Data unit	MWh
Description	Average amount of electricity generated in the most recent three years prior to the project activity
Time of determination/monitoring	At preparation of PDD
Source of data (to be) used	Historical data of power generation measured by power meter in Alchevskkoks
Value of data applied (for ex ante calculations/determinations)	15,321
Justification of the choice of data or description of measurement methods and procedures (to be) applied	15,321 MWh/y is applied from the data of the most recent three years prior to the project activity.
QA/QC procedures (to be) applied	See Chapter D.2
Any comment	This parameter is required to calculate the quantity of electricity supplied to the recipient by the newly installed generator that in the absence of the project activity would have been sourced from the grid (equation 1a-1-1).

Data/Parameter	B-5 $h_{PJ,y}$
Data unit	Hours per year
Description	CDQ system operation hours during the year in hours.
Time of determination/monitoring	Continuously
Source of data (to be) used	Historical data of power generation in Alchevskkoks.
Value of data applied (for ex ante calculations/determinations)	8,640
Justification of the choice of data or description of measurement methods and procedures (to be) applied	The same figure of B-6 $h_{hist,BL}$ is applied just for ex-ante calculation.
QA/QC procedures (to be) applied	See Chapter D.2
Any comment	This parameter is required to calculate the quantity of electricity supplied to the recipient by the newly installed generator that in the absence of the project activity would have been sourced from the

	grid (equation 1a-1-1).

Data/Parameter	B-6 $h_{hist,BL}$
Data unit	Hours per year
Description	Average operating hours of existing captive power generators in the most recent three years prior to the project activity.
Time of determination/monitoring	At preparation of PDD
Source of data (to be) used	Historical data of power generation in Alchevskkoks.
Value of data applied (for ex ante calculations/determinations)	8,640
Justification of the choice of data or description of measurement methods and procedures (to be) applied	8,640 hours/y is applied from the data of the most recent three years prior to the project activity.
QA/QC procedures (to be) applied	See Chapter D.2
Any comment	This parameter is required to calculate the quantity of electricity supplied to the recipient by the newly installed generator that in the absence of the project activity would have been sourced from the grid (equation 1a-1-1).

Data/Parameter	B-7 $EF_{elec,gr}$
Data unit	tCO_2/MWh
Description	The CO_2 emission factor for the electricity source, national electricity grid, displaced due to the project activity, during the project activity.
Time of determination/monitoring	At preparation of PDD
Source of data (to be) used	Annex 2 of “Ukraine – Assessment of new calculation of CEF”.
Value of data applied (for ex ante calculations/determinations)	0.896
Justification of the choice of data or description of measurement methods and procedures (to be) applied	Based on Annex 2 of “Ukraine – Assessment of new calculation of CEF”.
QA/QC procedures (to be) applied	See Chapter D.2
Any comment	This parameter is required to calculate the baseline emissions due to displacement of electricity (equation 1a-1).

Data/Parameter	B-8 $Q_{OE,BL}$
Data unit	Tones per year
Description	Output/intermediate energy that can be theoretically produced (in appropriate unit), to be determined on the basis of maximum recoverable energy from the WECM, which would have been released (or WECM would have been flared or energy content of WECM would have been

	wasted) in the absence of project activity.
Time of determination/monitoring	At preparation of PDD
Source of data (to be) used	Manufacturer's specification
Value of data applied (for ex ante calculations/determinations)	907,200
Justification of the choice of data or description of measurement methods and procedures (to be) applied	Based on manufacturer's specification
QA/QC procedures (to be) applied	See Chapter D.2
Any comment	This parameter is required to calculate the energy that would have been produced in project year using waste energy generated in base year expressed as a fraction of total energy produced using waste source. The ratio is 1 if the waste energy generated in project year is same or less than that generated in base year (equation 1h).

Data/Parameter	B-9 $SG_{PJ,CDQ,y}$
Data unit	Tones per year
Description	Amount of steam generated in CDQ boiler in the project activity.
Time of determination/monitoring	Continuously
Source of data (to be) used	Manufacturer's specification
Value of data applied (for ex ante calculations/determinations)	392,525 in 2008, 381,127 in 2009 588,000 in 2010-2012.
Justification of the choice of data or description of measurement methods and procedures (to be) applied	In accordance with assigned schedules of verification.
QA/QC procedures (to be) applied	See Chapter D.2
Any comment	This parameter is required to calculate the quantity of actual output/intermediate energy (equation 1h-1).

Data/Parameter	B-10 $H_{steam,CDQ,y}$
Data unit	kcal/kg
Description	Specific enthalpy of steam generated in CDQ boiler in the project activity.
Time of determination/monitoring	Continuously
Source of data (to be) used	Thermometer & pressure instrument in steam line from boiler of Alchevskkoks.
Value of data applied (for ex ante calculations/determinations)	685 in 2008 790 in 2009-2011.
Justification of the choice of data or description of measurement methods and procedures (to be) applied	In accordance with assigned schedules of verification.
QA/QC procedures (to be) applied	See Chapter D.2
Any comment	This parameter is required to calculate the net quantity of heat supplied to the recipient plant by the project activity (CDQ boilers) during the year (In case of steam this is expressed as difference of energy content between the steam supplied to the

	recipient plant and the condensate returned by the recipient plant(s) to element process of cogeneration plant. This includes steam supplied to recipients that may be used for generating mechanical energy) (equation 1a-2-1).

Data/Parameter	B-11 $H_{water,CDQ,y}$
Data unit	kcal/kg
Description	Specific enthalpy of feed water in CDQ boiler in the project activity.
Time of determination/monitoring	Continuously
Source of data (to be) used	Thermometer in boiler feed water line of Alchevskkoks.
Value of data applied (for ex ante calculations/determinations)	104
Justification of the choice of data or description of measurement methods and procedures (to be) applied	In accordance with assigned schedules of verification.
QA/QC procedures (to be) applied	See Chapter D.2
Any comment	This parameter is required to calculate the net quantity of heat supplied to the recipient plant by the project activity (CDQ boilers) during the year (In case of steam this is expressed as difference of energy content between the steam supplied to the recipient plant and the condensate returned by the recipient plant(s) to element process of cogeneration plant. This includes steam supplied to recipients that may be used for generating mechanical energy) (equation 1a-2-1).

Data/Parameter	B-12 $EF_{CO2,NG}$
Data unit	tCO_2/TJ
Description	The CO_2 emission factor per unit of energy of natural gas in the baseline used in the existing boiler used by Alchevskkoks in absence of the project activity.
Time of determination/monitoring	At preparation of PDD
Source of data (to be) used	Table 1.4 of 2006 IPCC guidelines for national greenhouse gas inventories.
Value of data applied (for ex ante calculations/determinations)	56.1
Justification of the choice of data or description of measurement methods and procedures (to be) applied	In accordance with Table 1.4 of 2006 IPCC guidelines for national greenhouse gas inventories.
QA/QC procedures (to be) applied	See Chapter D.2
Any comment	This parameter is required to calculate the CO_2 emission factor of the element process supplying heat that would have supplied the recipient plant in absence of the project activity (equation 1a-22).

Data/Parameter	B-13 $\eta_{Ex\text{-}Boiler}$
Data unit	%
Description	Efficiency of the existing boiler that would have supplied heat to Alchevskkoks in the absence of the project activity.
Time of determination/monitoring	At preparation of PDD
Source of data (to be) used	Manufacturer's specification
Value of data applied (for ex ante calculations/determinations)	88%
Justification of the choice of data or description of measurement methods and procedures (to be) applied	In accordance with manufacturer's specification.
QA/QC procedures (to be) applied	See Chapter D.2
Any comment	This parameter is required to calculate the CO_2 emission factor of the element process supplying heat that would have supplied the recipient plant in absence of the project activity (equation 1a-22).

Data/Parameter	B-14 $ws_{Ex\text{-}Boiler}$
Data unit	N/A
Description	Fraction of total heat that is used by Alchevskkoks in the project that in absence of the project activity would have been supplied by the existing boiler.
Time of determination/monitoring	At preparation of PDD
Source of data (to be) used	Baseline scenario identification.
Value of data applied (for ex ante calculations/determinations)	1
Justification of the choice of data or description of measurement methods and procedures (to be) applied	1 is applied because there is only one boiler using natural gas in the baseline.
QA/QC procedures (to be) applied	See Chapter D.2
Any comment	This parameter is required to calculate the CO_2 emission factor of the element process supplying heat that would have supplied the recipient plant in absence of the project activity (equation 1a-22).

Key information and data used for selection of baseline for the component 3

Data/Parameter	B-17 $M_{25,BL}$
Data unit	%
Description	Index for coke hardness of produced wet coke in the baseline.
Time of determination/monitoring	Monthly
Source of data (to be) used	Alchevskkoks (coke quality certificates)
Value of data applied (for ex ante calculations/determinations)	88.1
Justification of the choice of data or description of measurement methods and procedures (to be) applied	Measured in 2008 and used just for ex-ante estimation.
QA/QC procedures (to be) applied	See Chapter D.2
Any comment	This parameter is required to calculate the level of increased pig iron production due to dry coke input in a blast furnace and the level of decreased coke consumption due to dry coke input in a blast furnace (faction) (equation 5a and 5b).

Data/Parameter	B-18 $M_{10,BL}$
Data unit	%
Description	Index for reduced coke abrasion for produced wet coke in the baseline.
Time of determination/monitoring	Monthly
Source of data (to be) used	Alchevskkoks (coke quality certificates)
Value of data applied (for ex ante calculations/determinations)	6.0
Justification of the choice of data or description of measurement methods and procedures (to be) applied	Measured in 2008 and used just for ex-ante estimation.
QA/QC procedures (to be) applied	See Chapter D.2
Any comment	This parameter is required to calculate the level of increased pig iron production due to dry coke input in a blast furnace and the level of decreased coke consumption due to dry coke input in a blast furnace (faction) (equation 5a and 5b).

Data/Parameter	B-19 $M_{80,BL}$
Data unit	%
Description	Index for reduced coke faction content over 80mm for produced wet coke in the baseline.
Time of determination/monitoring	Monthly
Source of data (to be) used	Alchevskkoks (coke quality certificates)
Value of data applied (for ex ante calculations/determinations)	5.4
Justification of the choice of data or description of measurement methods and procedures (to be) applied	Measured in 2008 and used just for ex-ante estimation.
QA/QC procedures (to be) applied	See Chapter D.2
Any comment	This parameter is required to calculate the level of increased pig iron production due to dry coke input in a blast furnace and the level of decreased

	coke consumption due to dry coke input in a blast furnace (faction) (equation 5a and 5b).

Data/Parameter	3.1
Data unit	tCO_2/t_{coke}
Description	Conversion factor for ton-coke to CO_2.
Time of determination/monitoring	At preparation of PDD
Source of data (to be) used	Table 1.2 and 1.4 of 2006 IPCC guidelines for national greenhouse gas inventories.
Value of data applied (for ex ante calculations/determinations)	3.1
Justification of the choice of data or description of measurement methods and procedures (to be) applied	This figure is calculated by multiplying NCV of coke 28.2 (TJ/Gg) given in Tale 1.2 and effective CO_2 emission factor of coke 107,000 (kg/TJ) given in Tale 14.
QA/QC procedures (to be) applied	See Chapter D.2
Any comment	This parameter is required to calculate the baseline emissions from coke consumption (equation 5).

Data/Parameter	B-15 $F_{pigiron}$
Data unit	N/A
Description	Increased pig iron production due to dry coke input in a blast furnace (faction).
Time of determination/monitoring	Monthly
Source of data (to be) used	Calculation (in accordance with equation 5a)
Value of data applied (for ex ante calculations/determinations)	1.82
Justification of the choice of data or description of measurement methods and procedures (to be) applied	Calculated in accordance with the equation 5a and taken from Management directive “blast furnaces, standards for coke consumption” issued in 1987 by USSR Ministry of ferrous metallurgy.
QA/QC procedures (to be) applied	See Chapter D.2
Any comment	This parameter is required to calculate the baseline emissions from coke consumption (equation 5).

Data/Parameter	B-16 F_{coke}
Data unit	N/A
Description	Decreased coke consumption due to dry coke input in a blast furnace (faction)
Time of determination/monitoring	Monthly
Source of data (to be) used	Calculation (in accordance with equation 5b)
Value of data applied (for ex ante calculations/determinations)	1.82
Justification of the choice of data or description of measurement methods and procedures (to be) applied	Calculated in accordance with the equation 5b and taken from Management directive “blast furnaces, standards for coke consumption” issued

	in 1987 by USSR Ministry of ferrous metallurgy.
QA/QC procedures (to be) applied	See Chapter D.2
Any comment	This parameter is required to calculate the baseline emissions from coke consumption (equation 5).

Data/Parameter	P-2 $M_{25,PJ}$
Data unit	%
Description	Index for coke hardness of produced dry coke by CDQ.
Time of determination/monitoring	Monthly
Source of data (to be) used	Alchevskkoks (coke quality certificates)
Value of data applied (for ex ante calculations/determinations)	89.1
Justification of the choice of data or description of measurement methods and procedures (to be) applied	Measured in 2008 and used just for ex-ante estimation.
QA/QC procedures (to be) applied	See Chapter D.2
Any comment	This parameter is required to calculate the level of increased pig iron production due to dry coke input in a blast furnace and the level of decreased coke consumption due to dry coke input in a blast furnace (faction) (equation 5a and 5b).

Data/Parameter	P-3 $M_{10,PJ}$
Data unit	%
Description	Index for reduced coke abrasion for produced dry coke by CDQ.
Time of determination/monitoring	Monthly
Source of data (to be) used	Alchevskkoks (coke quality certificates)
Value of data applied (for ex ante calculations/determinations)	5.6
Justification of the choice of data or description of measurement methods and procedures (to be) applied	Measured in 2008 and used just for ex-ante estimation.
QA/QC procedures (to be) applied	See Chapter D.2
Any comment	This parameter is required to calculate the level of increased pig iron production due to dry coke input in a blast furnace and the level of decreased coke consumption due to dry coke input in a blast furnace (faction) (equation 5a and 5b).

Data/Parameter	P-4 $M_{80,PJ}$
Data unit	%
Description	Index for reduced coke faction content over 80mm

	for produced dry coke by CDQ.
Time of determination/monitoring	Monthly
Source of data (to be) used	Alchevskkoks (coke quality certificates)
Value of data applied (for ex ante calculations/determinations)	4.3
Justification of the choice of data or description of measurement methods and procedures (to be) applied	Measured in 2008 and used just for ex-ante estimation.
QA/QC procedures (to be) applied	See Chapter D.2
Any comment	This parameter is required to calculate the level of increased pig iron production due to dry coke input in a blast furnace and the level of decreased coke consumption due to dry coke input in a blast furnace (faction) (equation 5a and 5b).

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:

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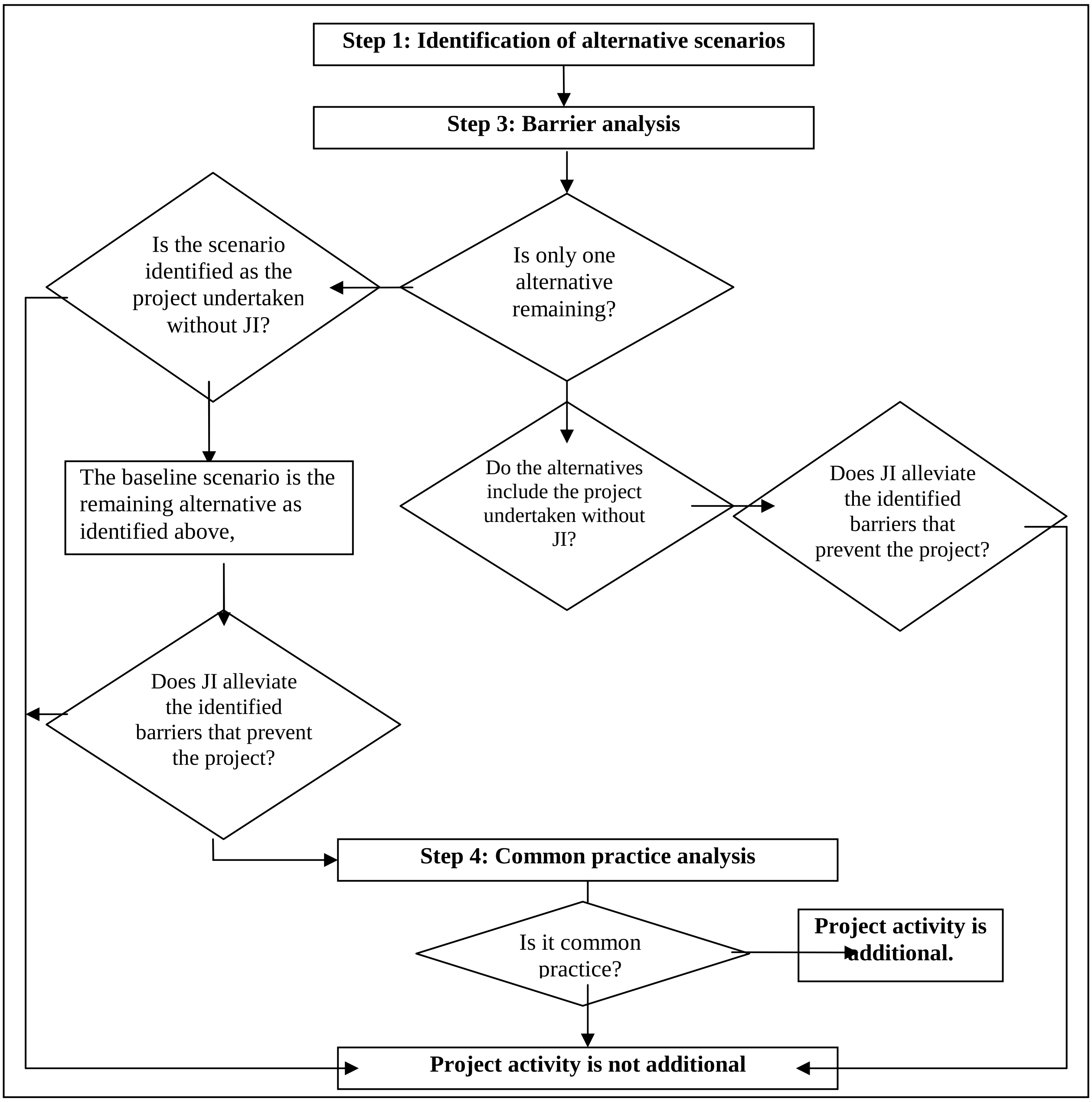
The approach applied

For the components of 1 and 2 described in Step 1 of B.2., according to ACM0012, additionality of the project activity is to be demonstrated using the latest version of the "Tool for the demonstration and assessment of additionality, Version 5.2".

For the component 3 of emission reductions, JI specific approach is applied only for the calculation method of emission reductions in accordance with the Appendix B of the JI guidelines and further guidance on criteria for baseline setting and monitoring because no existing CDM methodology is relevant and applicable to this portion of the project activity. The component 3 of emission reductions is a completely new element, particular to the JI project. Hence, there is no applicable approved CDM methodology available. This portion of emissions reduction is taken place by use of the product of the project activity, i.e. coke, in blast furnace in AISW with out any additional investment. The emission reductions occur at the Blast Furnace as a result of enhanced quality of coke produced by the new dry quenching technology, thus the emission reduction is highly dependent on technology selection. The selection of quenching technology is self explanatory by following the choice of the use of waste energy for component 1 and 2 of emission reductions. In this sense, the baseline identification and additionality argument of the component 3 of emission reductions are proven in consequence of conclusion of component 1 and 2 in accordance with the approved CDM methodology ACM0012.
Therefore, if additionality of the project activity for the components 1 and 2 is demonstrated, the additionality of the component (3) is automatically proven since no additional investment is required.

The procedure to demonstrate Additionality is summarized in the indicative flow chart below.



Application of the approach chosen

The additionality of the project activity is demonstrated by taking the step-wise approach of “Tool for the demonstration and assessment of additionality” as follows.

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

According to Section B.1, the following alternatives are identified as realistic and credible alternatives. They are both consistent with current laws and regulations in Ukraine.

	Baseline scenario
For waste heat	W2
For power generation	P6
For heat generation	H4

Step 3. Barrier analysis (Step 2. is not selected)

In this step, it shows that the proposed project activity faces barriers that:

(a) Prevent the implementation of this type of proposed project activity; and
(b) Do not prevent the implementation of at least one of the alternatives.

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

In this sub-step, it is demonstrated that there are realistic and credible barriers that would prevent the implementation of the proposed project activity from being carried out if the project activity was not registered as a JI project.

<u>Financial barrier</u>

First, loan availability is very limited in Ukraine. Banks generally require reliable guarantees and short repayment period. As Alchevsk coke plant already has significant amount of debts, it cannot implement the project by its own resources. In addition, the debt makes it much more difficult to receive financial support. In fact, Ukrainian banks expressed its support for the project only on the condition that it is developed under the JI scheme. The letter from a bank could be made available to an AIE upon onsite visit.

In the sense of initial investment, which is much more important than the running cost saving for Alchevsk, the initial investment cost of CDQ technology engineered with captive co-generator and high efficient boiler is approximately US$40 million in total. On the other hand, the initial cost of the conventional CWQ technology is estimated to be US$ 7.62 million. This means that CDQ installation costs more than five times higher than the conventional and proven CWQ technology. Therefore, under business-as-usual decision-making, CDQ would not have been chosen without any additional financial support.

Therefore, without the JI financial incentive, it is reasonably concluded that Alchevskkoks would not have been able to install CDQ technology.

<u>Barrier due to prevailing practice</u>

The installation of the CDQ technology engineered with captive generator and high efficient boiler under the project activity is "first-of its-kind" in Ukraine because such state-of-the-art CDQ technology has never been installed. Although old CDQ technology, which were installed in 1980s and 90s, has been utilized at a few other steel works, their technology and performance is by far different from modern CDQ. These facts are proved by the confirmation letter from Giprokkoks, which can be shown to the AIE during site visit. Giprokkoks is the governmental body, which has been authorized to control cokes quenching technologies in Ukraine.

Therefore, it is reasonably foreseen that the project activity faces various difficulties due to the fact that it is the first case in the country, ranging from the non-availability of domestic technology and non-existence of trained personnel. However, under JI scheme, CDQ technology is adequately transferred, and extensive training for Alchevskkoks engineers is offered by technological providers. Thus, technological risk entailing CDQ technology is expected to be substantially alleviated by taking advantage of JI scheme.

Also the national legal requirements and policies regarding coke production are summarized in the document called "Decree regarding govern sanitary rules for crude steel producing plants (#38 from

01.12.1999[3])". According to this legal text, coke quenching can be realized either by wet or dry methods. However, there are no particular legislative requirements for mandatory implementing of CDQ.

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):

In the above section, it is proved that the project activity faces barriers because financial circumstance surrounding Alchevvskkoks is harsh, and it is "first-of-its-kind" practice in Ukraine. However, these barriers would not prevent the combination of baseline alternatives W2, P6, and H4 from occurring.

The baseline alternative W2 corresponds to the scenario that waste heat would be released into the atmosphere. This alternative does not involve any advanced or new technologies, thus would not face the barriers faced by the project activity. Similarly the alternative P6 corresponds to the purchase of electricity from the grid, which is current practice and quite normal in the operation of an industrial facility. The alternative H4 refers to utilizing existing or new fossil fuel based boilers for heat generation. This is also current practice, and the installation of new fossil fuel boilers for increasing steam demand is not expected to entail any financial and technological difficulties as stated above.

Step 4. Common practice analysis

As described in Step3 above, the project activity is the first of its kind in Ukraine; therefore, there are no other activities that utilize state-of-the-art CDQ technology engineered with captive generator and high efficient boiler to recover waste heat in Ukraine.

Through the above analysis, it is concluded that the project activity would not have taken place without the JI incentive, as it faces barriers associated with financial difficulty and the fact that it is the very first effort of installing state-of-the-art CDQ technology to recover waste heat for steam and electricity generation.

Sub-step 4a: Analyze other activities similar to the proposed project activity:
The project technology is the "First-of-its-kind" in Ukraine, i.e., there is no similar project in host country.

Sub-step 4b: Discuss any similar Options that are occurring:
Not applicable since no similar project exist in Ukraine.

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

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As per ACM0012, the geographical extent project boundary shall including the following, as depicted below:

1. The industrial facility where waste energy is generated, including the part of the industrial facility where the waste gas was utilized for generation of captive electricity prior to implementation of the project activity;

For the project activity, the CDQ system installed after coke oven process is the industrial facility where waste heat is generated and recovered. Since this is a Type I project, "*the part of the industrial facility*

[3] www.uazakon.com/big/text1148/pg2.htm

where the waste gas was utilized for generation of captive electricity prior to implementation of the project activity" does not apply to the project activity.

2. The facility where process heat in the element process/steam/electricity/mechanical energy is generated (generator of process heat/steam/electricity/mechanical energy). Equipment providing auxiliary heat to the waste energy recovery process shall be included within the project boundary

For the project activity, the facilities where electricity and steam are generated includes the 75 t/h boiler and 9.13 MW steam turbine engineered with CDQ system, and three 50 t/h existing boilers with two 2.15 MW captive generators.

For baseline scenario, instead of he 75 t/h boiler and 9.13 MW steam turbine engineered with CDQ system, two conventional 50 t/h boilers that would have been installed without the project activity are included as heat generation source, and all the power plants connected to Ukrainian national electricity grid as electricity source.

3. The facility/s where the process heat in the element process/steam/electricity/mechanical energy is used (the recipient plant(s)) and/or grid where electricity is exported, if applicable.

The facilities that use electricity and heat generated by the project activity will be Alchevsk Coke Plant.

In addition to the above three elements, blast furnace at Alchevsk Iron and Steel Works (AISW) shall be included in the project boundary because indirect GHG emissions reduction occurs there due to improvement of coke quality leading to reducing coke input per unit of pig iron production.

The gases and sources included in the project boundary are summarized in the table below.

	Source	Gas	Included?	Justification/Explanation
Baseline	Electricity generation, grid or captive source	CO_2	Included	Main emission source
		CH_4	Excluded	Excluded for simplification. This is conservative.
		N_2O	Excluded	Excluded for simplification. This is conservative.
	Fossil fuel consumption in boiler for thermal energy	CO_2	Included	Main emission source
		CH_4	Excluded	Excluded for simplification. This is conservative.
		N_2O	Excluded	Excluded for simplification. This is conservative.
	Fossil fuel consumption in cogeneration plant	CO_2	Included	Not applicable since no fossil fuel is consumed in cogeneration plant.
		CH_4	Excluded	Excluded for simplification. This is conservative.
		N_2O	Excluded	Excluded for simplification. This is conservative.
	Baseline emissions from generation of steam used in the flaring process, if any	CO_2	Included	Not applicable since waste energy recovered is heat, not gas.
		CH_4	Excluded	Excluded for simplification. This is conservative.
		N_2O	Excluded	Excluded for simplification. This is conservative.
Project Activity	Supplemental fossil fuel consumption at the project plant	CO_2	Included	Not applicable since no supplemental fossil fuel consumption is foreseen in the Project.
		CH_4	Excluded	Excluded for simplification.
		N_2O	Excluded	Excluded for simplification.
	Supplemental electricity consumption	CO_2	Included	Not applicable since no supplemental electricity consumption is foreseen in the Project.
		CH_4	Excluded	Excluded for simplification.
		N_2O	Excluded	Excluded for simplification.
	Electricity import to replace captive electricity, which was generated using waste gas in absence of project activity			Not applicable
	Project emissions from cleaning of gas			Not applicable

In addition to the above list from ACM0012, the following emissions source is taken into account as the original emissions source of the project activity.

	Source	Gas	Included?	Justification/Explanation
Baseline/ Project Activity	Blast Furnace in AISW	CO_2	Included	Main emission source
		CH_4	Excluded	Excluded for simplification.
		N_2O	Excluded	Excluded for simplification.

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 application of the baseline study and monitoring methodology
The baseline study and monitoring plan above were completed in 30/03/2009.

Name of person(s)/entity(ies) responsible for the application of the baseline and monitoring methodology to the project activity

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Pacific Consultants Co., Ltd. and Climate Experts, Ltd. are consulting firms with CDM/JI-related expertise. The firm is not a project participant.

SECTION C. Duration of the project / crediting period

C.1. Starting date of the project:

>>

April 2004 (Signing of feasibility study contract between Alchevskkoks and "Azovimpeks" Ltd with involvement of Giprokoks)

C.2. Expected operational lifetime of the project:

>>

20 years (240 months)

C.3. Length of the crediting period:

>>

5 years (01/01/2008 to 31/12/2012 – 60 months)
The crediting period is possible to be extended upon approval by the host country.

SECTION D. Monitoring plan

D.1. Description of monitoring plan chosen:

>>

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

As described in section B.1, the project activity is composed of three parts:(1) dismissing natural gas that would have burnt at the baseline boilers, (2) replacing grid electricity by installing the power generator with CDQ waste heat recovery technology and (3) reducing coke input per unit of pig iron production at the blast furnace, by installing CDQ waste heat recovery technology.

For (1) and (2), the approved CDM methodology ACM0012 is applied to the project monitoring plan. As described in section B.1, (1) and (2) parts of the project activity fully satisfy the applicability conditions of ACM0012. For (3), JI specific approach is applied in accordance with the Appendix B of the JI guidelines and further guidance on criteria for baseline setting and monitoring because no existing CDM methodology is relevant and applicable to this portion of the project activity.

Step 2. Application of the approach chosen

The approach chosen above are applied to the project activity in the following sections.

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

Not applicable as there is no project emissions for the project activity.

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
P-1	$Q_{Coke,PJ,y}$	*AISW*	*t/y*	*m*	*monthly*	*100%*	*Electronic*	*Coke production is measured as part of its business operation in*

								accordance with its standard
P-2	$M_{25,PJ}$	*Alchevskkoks*	*%*	*m*	*monthly*	*sampling*	*Electronic/paper*	*Monitoring is done with scales. Regular verification (calibration) in accordance with standards.*
P-3	$M_{10,PJ}$	*Alchevskkoks*	*%*	*m*	*monthly*	*sampling*	*Electronic/paper*	*Monitoring is done with scales. Regular verification (calibration) in accordance with standards.*
P-4	$M_{80,PJ}$	*Alchevskkoks*	*%*	*m*	*monthly*	*sampling*	*Electronic/paper*	*Monitoring is done with scales. Regular verification (calibration) in accordance with standards.*

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

>> Consideration on "what are common for baseline and project" shall be described incl. how COG and BFG are used in both cases…

For the components (1) and (2) described in B.1., according to ACM0012, Project Emissions include emissions due to (1) combustion of auxiliary fuel to supplement waste gas/heat and (2) electricity emissions due to consumption of electricity for cleaning of gas before being used for generation of energy or other supplementary electricity consumption; and (3) emissions due to consumption of imported electricity that in the absence of project activity would have been supplied by captive electricity generated (only for Type-2 project activities).

In the project activity, (1) is not applicable since there will be no auxiliary fuel to supplement waste heat at the CDQ system. (2) is for gas, and therefore irrelevant to the project activity. Since this is a Type-1 project, (3) above does not apply.

Therefore, for this Project, there will be no project emissions from the components (1) and (2) to be accounted for.

For the component (3), the project emissions are expressed as follow:

$$PE_{,y} = PE_{coke,,y} = Q_{coke,PJ,y} * 3.1 \qquad (4)$$

Where:
PE_y - The project emissions during the year y in tons of CO_2
$PE_{coke,y}$ - Project emissions from coke consumption during the year y in tons of CO_2
$Q_{coke,PJ,y}$ - Amount of coke consumed in a blast furnace in year y (t/y)

D.1.1.3. Relevant data necessary for determining the baseline of anthropogenic emissions of greenhouse gases by sources within the project boundary, and how such data will be collected and archived:

ID number *(Please use numbers to ease cross-referencing to D.2.)*	Data variable	Source of data	Data unit	Measured (m), calculated (c), estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment
B-1	f_{wcm}	*N/A*	*N/A*	*c*	*N/A*	*0%*	*N/A*	*Electricity/Heat generation considered is from waste energy.*
B-2	$EG_{PJ,y}$	*Alchevskkoks*	*MWh*	*m*	*continuously*	*100%*	*electronically*	*Monitoring is done with power meters at plant. Regular verification of the meter in accordance with the standard.*

B-3	$EC_{CDQ,y}$	*Alchevskkoks*	*MWh*	*m*	*continuously*	*100%*	*electronically*	*Monitoring is done with power meters at plant. Regular verification of the meter in accordance with the standard.*
B-4	$EG_{hist,BL}$	*Alchevskkoks*	*MWh*	*c*	*N/A*	*0%*	*electronically*	*15,321 MWh/y is applied from the data of the most recent three years*
B-5	$h_{PJ,y}$	*Alchevskkoks*	*hours per year*	*m*	*continuously*	*100%*	*electronically*	*Operating hours will be monitored as a part of its business operation*
B-6	$h_{hist,BL}$	*Alchevskkoks*	*hours per year*	*c*	*N/A*	*0%*	*N/A*	*8,640 hours is applied from the data of the most recent three years*
B-7	$EF_{elec,gr}$	*Annex 2 of "Ukraine – Assessment of new calculation of CEF"*	*tCO2/MWh*	*e*	*N/A*	*0%*	*N/A*	*0.896 is applied.*
B-8	$Q_{OE,BL}$	*Manufacturer's Specification*	*tonnes per year*	*e*	*N/A*	*0%*	*N/A*	*907,200 t/y is applied in accordance with manufacturer's specifications.*

B-9	$SG_{PJ,CDQ,y}$	*Alchevskkoks*	*tonnes per year*	*m*	*continuously*	*100%*	*electronically*	*Monitoring is done with flow meter. Regular calibration in accordance with standards.*
B-10	$H_{steam,CDQ,y}$	*Alchevskkoks*	*kcal/kg*	*m*	*continuously*	*100%*	*electronically*	*Monitoring is done with thermometer & pressure instrument. Regular verification in accordance with standards.*
B-11	$H_{water,CDQ,y}$	*Alchevskkoks*	*kcal/kg*	*m*	*continuously*	*100%*	*electronically*	*Monitoring is done with thermometer. Regular verification in accordance with standards.*
B-12	$EF_{CO2,NG}$	*IPCC2006*	*tCO2/TJ*	*e*	*N/A*	*0%*	*N/A*	*56.1 is applied*
B-13	$\eta_{Ex\text{-}Boiler}$	*Manufacturer's Specification*	*%*	*e*	*N/A*	*0%*	*N/A*	*88% is applied as manufacturer's specification.*
B-14	$ws_{Ex\text{-}Boiler}$	*N/A*	*N/A*	*c*	*N/A*	*0%*	*N/A*	*1 is applied because there is one baseline boiler using natural gas*

B-15	$F_{pigiron}$	*Alchevskkoks*	*N/A*	*c*	*monthly*	*sampling*	*Electronic/paper*	*Calculated in accordance with management directive "blast furnaces, standards for coke consumption" issued in 1987 by USSR Ministry of ferrous metallurgy and based on parameters – B-17, 18 and 19 below.*
B-16	F_{coke}	*Alchevskkoks*	*N/A*	*c*	*monthly*	*sampling*	*Electronic/paper*	*Calculated in accordance with management directive "blast furnaces, standards for coke consumption" issued in 1987 by USSR Ministry of ferrous metallurgy and based on parameters – B-17, 18 and 19 below.*

B-17	$M_{25,BL}$	*Alchevskkoks*	*%*	*e*	*monthly*	*sampling*	*Electronic/paper*	*Monitoring is done with scales. Regular verification (calibration) in accordance with standards.*
B-18	$M_{10,BL}$	*Alchevskkoks*	*%*	*e*	*monthly*	*sampling*	*Electronic/paper*	*Monitoring is done with scales. Regular verification (calibration) in accordance with standards.*
B-19	$M_{80,BL}$	*Alchevskkoks*	*%*	*e*	*monthly*	*sampling*	*Electronic/paper*	*Monitoring is done with scales. Regular verification (calibration) in accordance with standards.*

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

>>

1. Baseline emissions

For the project activity of which the emission reductions consist of three components as described in A.2. of this PDD and the baseline scenario is identified as scenario 1 in B.1. of this PDD, i.e. no waste gas is used in the project activity, the baseline emissions for year y are expressed by the following formula with modification to the equation (1) of ACM0012.
The modifications are deletion of $BE_{flst,y}$ and addition of $BE_{coke,y}$ due to the reasons mentioned above.
Note that equations hereinafter are referred by the equation number of ACM0012.

$$BE_y = BE_{En,y} + BE_{coke,y} \quad (1)$$

Where,

BE_y = The total baseline emissions during the year y in tons of CO_2

$BE_{En,y}$ = The baseline emissions from energy generated by the project activity during the year y in tons of CO_2
$BE_{Coke,y}$ = Baseline emissions from coke processed by CWQ used in blast furnace of AISW during the year y in tons of CO_2

1-1. The baseline emissions from energy generated by the project activity, $BE_{En,y}$

As the baseline situation of the project activity is that the electricity is obtained from the grid and the heat from fossil fuel steam boilers, $BE_{En,y}$ is calculated as follows:

$$BE_{En,y} = BE_{Elec,y} + BE_{Ther,y} \quad (1a)$$

Where,
$BE_{Elec.y}$ = Baseline emissions from electricity during the year *y* in tons of CO_2
$BE_{Ther,y}$ = Baseline emissions from thermal energy (due to heat generation by element process) during the year *y* in tons of CO_2

(a)Baseline emissions from the electricity, $BE_{Elec.y}$
In the project activity, grid electricity is replaced by installing one power generator with CDQ waste heat recovery technology together with high-efficient boiler, i.e. one recipient and one source, the equation (1a-1) for "Case-1: Waste energy is used to generate electricity" is applied under ACM0012 is applied with simplification as follow:.

$$BE_{Elec,y} = f_{cap} * f_{wcm} * (EG_y * EF_{elec,gr}) \quad (1a\text{-}1)$$

Where,
$BE_{elec,y}$ = Baseline emissions due to displacement of electricity during the year y in tons of CO_2
EG_y = The quantity of electricity supplied to the recipient by the newly installed generator, that in the absence of the project activity would have been sourced from grid during the year *y* in MWh
$EF_{elec,gr}$ = The CO_2 emission factor for the electricity source, national electric grid, displaced due to the project activity, during the project activity in tons CO_2/MWh. Apply 0.896 given in Annex 2 "Baseline information".
f_{wcm} = Fraction of total electricity generated by the project activity using waste energy. Since the electricity generation is purely from use of waste energy, this fraction is 1.
f_{cap} = Energy that would have been produced in project year *y* using waste energy generated in base year expressed as a fraction of total energy produced using waste source in year *y*. The ratio is 1 if the waste energy generated in project year *y* is same or less than that generated in base year. The value is estimated using equations (1h) in ACM0012.

Replaced grid-sourced electricity, $EG_{,y}$

In the project activity, emission reduction shall be claimed based on additional electricity supplied to the Akchevskkoks compared with baseline for conservativeness. Also, some electricity generated by CDQ system is self-consumed by CDQ itself. Therefore, EG_y is calculated as follows:

$EG_y = EG_{PJ,y} - EC_{CDQ,y} - EG_{hist,BL} \bullet h_{PJ,y} / h_{hist,BL}$	(1a-1-1)

Where,

$EG_{pj,y}$ = Total amount of electricity generated in the project activity during the year y in MWh

$EC_{CDQ,y}$ = Amount of electricity self-consumed by CDQ during the year y in MWh

$EG_{hist,BL}$ = Average amount of electricity generated in the most recent three years prior to the project activity in MWh/y

$h_{PJ,y}$ = CDQ system operation hours during the year y in hours

$h_{hist,BL}$ = Average operating hours of existing captive power generators in the most recent three years prior to the project activity in hours/y

Capping of baseline emissions f_{cap}

There are three available methods to calculate the capping of baseline emissions under ACM0012. In case of the project activity, Method 1 is not applicable because the historical data on energy by the waste energy carrying medium is unavailable. Also, Applying Method 2 is also unrealistic since there are technical limitations to directly monitor waste heat. Heat from red hot coke is around 1,000 degree C and there is no devises suitable for measuring this. Therefore, Method-3 is used to estimate f_{cap}.

$fcap = Q_{OE,BL} / Q_{OE,y}$	(1h)

Where,

$Q_{OE,BL}$ = Output/intermediate energy that can be theoretically produced (in appropriate unit), to be determined on the basis of maximum recoverable energy from the WECM, which would have been released (or WECM would have been flared or energy content of WECM would have been wasted) in the absence of CDM project activity. Apply 907,200 t/y given by manufacture's specification.

$Q_{OE,y}$ = Quantity of actual output/intermediate energy during year y (in appropriate unit)

Quantity of actual output/intermediate energy $Q_{OE,y}$

In the project activity, $Q_{OE,y}$ is equivalent to Amount of steam generated in CDQ boiler in the project activity. Therefore,

$Q_{OE,y} = SG_{PJ,CDQ,y}$	(1h-1)

Where,

$SG_{PJ,CDQ,y}$ = Amount of steam generated in CDQ boiler in the project activity during the year y in tonnes

(b) Baseline emissions from thermal energy $BE_{Ther,y}$

In the project activity, thermal energy from CDQ waste heat recovery technology together with high-efficient boiler will replace natural gas combustion for steam generation in the baseline boilers. Namely, one recipient and no mechanical energy is supplied by the project activity.

Therefore, the equation (1a-2) under ACM0012 is applied with simplification as follow:

$BE_{Ther,y} = f_{cap} * f_{wcm} * HG_{CDQ,y} * EF_{heat,CDQ}$	(1a-2)

Where,

$BE_{Ther,y}$ = Baseline emissions from thermal energy (as steam) during the year y in tons of CO_2

$HG_{CDQ,y}$ = Net quantity of heat supplied to the recipient plant by the project activity (CDQ boilers) during the year y in TJ (In case of steam this is expressed as difference of energy content between the steam supplied to the recipient plant and the condensate returned by the recipient plant(s) to element process of cogeneration plant. This includes steam supplied to recipients that may be used for generating mechanical energy

f_{wcm} = Fraction of total heat generated by the project activity using waste energy. This fraction is 1 since the heat generation is purely from use of waste energy.

f_{cap} = Energy that would have been produced in project year *y* using waste energy generated in base year expressed as a fraction of total energy produced using waste source in year *y*. The ratio is 1 if the waste energy generated in project year *y* is same or less than that generated in base year. The value is estimated using equations (1h) above.

$EF_{heat,CDQ}$ = The CO_2 emission factor of the element process supplying heat that would have supplied the recipient plant in absence of the project activity, expressed in tCO_2/TJ and calculated as follows:

Net quantity of heat supplied from CDQ boiler $HG_{j,y}$

This is expressed as difference of energy content between the steam supplied to the recipient plant and feed water to the boiler. The calculation is as follows:

$HG_{CDQ,y} = SG_{PJ,CDQI,y} * (H_{steam,CDQ,y} - H_{water,CDQ,y}) * 4.187 * 10^{-6}$	(1a-2-1)

Where,

$SG_{PJ,CDQ,y}$ = Amount of steam generated in CDQ boiler in the project activity during the year y in tonnes

$H_{steam,CDQ,y}$ = Specific enthalpy of steam generated in CDQ boiler in the project activity during the year y in kcal/kg

$H_{water,CDQ,y}$ = Specific enthalpy of feed water in CDQ boiler in the project activity during the year y in kcal/kg

$4.187 * 10^{-6}$ = Conversion factor from kcal to TJ

CO_2 emissions factors of natural gas combustion $EF_{heat,CDQ,y}$

As the baseline fuel to be replaced is only natural gas and the recipient is also only the Alchevskkoks (i.e. one recipient), $EF_{heat,CDQ}$ is calculated by the simplified equation (1a-22) under ACM0012 as follows:

$$EF_{heat,CDQ} = ws_{Ex\text{-}Boiler} * EF_{CO2,NG} / \eta_{ExBoiler} \quad (1a\text{-}22)$$

Where,

$EF_{CO2,NG}$ = The CO_2 emission factor per unit of energy of natural gas in the baseline used in the existing boiler used by Alchevskkoks in tCO_2/TJ, in absence of the project activity

$\eta_{ExBoiler–}$ = Efficiency of the existing boiler that would have supplied heat to Alchevskkoks in the absence of the project activity

$ws_{Ex\text{-}Boiler}$ = Fraction of total heat that is used by Alchevskkoks in the project that in absence of the project activity would have been supplied by the existing boiler

1-2. Baseline emissions from the blast furnace without the project activity, $BE_{coke,y}$

Emission reduction that takes place in the blast furnace by using dry coke produced from CDQ system instead of CWQ system is explained in the formula below. At the same time, baseline emissions from blast furnace with conventional coke (coke quenched with CWQ system) are calculated as below.

$$BE_{coke,y} = Q_{coke,PJ,y} * (1 + F_{pigiron}) / (1 - F_{coke}) * 3.1 \quad (5)$$

Where:

$BE_{coke,y}$ Baseline emissions from coke consumption

$Q_{coke,PJ,y}$ Amount of coke consumed in a blast furnace in year y (t/y)

$F_{pigiron}$ Increased pig iron production due to dry coke input in a blast furnace (faction)

F_{coke} Decreased coke consumption due to dry coke input in a blast furnace (faction)

3.1 Conversion factor for ton-coke to ton CO_2

Where,

$$F_{pigiron} = [(M_{25,PJ} – M_{25,BL}) * 0.6 + (M_{10,PJ} – M_{10,BL}) * -2.8 + (M_{80,PJ} –M_{80,BL}) * -0.2]/100 \quad (5a)$$

$M_{25,PJ}$ Index for coke hardness of coke produced in the project activity

$M_{25,BL}$ Index for coke hardness of coke produced in the baseline activity

$M_{10,PJ}$ Index for reduced coke abrasion for coke produced in the project activity
$M_{10,BL}$ Index for reduced coke abrasion for coke produced in the baseline activity
$M_{80,PJ}$ Index for reduced coke faction content over 80mm for coke produced in the project activity
$M_{80,BL}$ Index for reduced coke faction content over 80mm for coke produced the baseline activity
0.6 Default value (Management directive "blast furnaces, standards for coke consumption" issued in 1987 by USSR Ministry of ferrous metallurgy)
-2.8 Default value (Management directive "blast furnaces, standards for coke consumption" issued in 1987 by USSR Ministry of ferrous metallurgy)
-0.2 Default value (Management directive "blast furnaces, standards for coke consumption" issued in 1987 by USSR Ministry of ferrous metallurgy)

$$F_{coke} = [(M_{25,PJ} – M_{25,BL}) * 0.6 + (M_{10,PJ} – M_{10,BL}) * -2.8 + (M_{80,PJ} – M_{80,BL}) * -0.2]/100 \quad (5b)$$

$M_{25,PJ}$ Index for coke hardness of coke produced in the project activity
$M_{25,BL}$ Index for coke hardness of coke produced in the baseline activity
$M_{10,PJ}$ Index for reduced coke abrasion for coke produced in the project activity
$M_{10,BL}$ Index for reduced coke abrasion for coke produced in the baseline activity
$M_{80,PJ}$ Index for reduced coke faction content over 80mm for coke produced in the project activity
$M_{80,BL}$ Index for reduced coke faction content over 80mm for coke produced the baseline activity
0.6 Default value (Management directive "blast furnaces, standards for coke consumption" issued in 1987 by USSR Ministry of ferrous metallurgy)
-2.8 Default value (Management directive "blast furnaces, standards for coke consumption" issued in 1987 by USSR Ministry of ferrous metallurgy)
-0.2 Default value (Management directive "blast furnaces, standards for coke consumption" issued in 1987 by USSR Ministry of ferrous metallurgy)

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

Option 2 is not chosen for the project activity.

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
N/A								

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):

>>
N/A

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
N/A								

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

>>
No leakage is applicable in the project activity since no leakage is applicable under ACM0012, and there is not any element leading to carbon leakage involved in emission reductions due to reducing coke input per unit of pig iron production at the blast furnace.

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):

>>
Emissions reduction in the project activity is calculated as follows:

$$ER_y = BE_y - PE_y \quad (3)$$

Where,

ER_Y = Total emissions reductions during the year *y* in tons of CO_2
PE_y = Emissions from the project activity during the year *y* in tons of CO_2
BE_y = Baseline emissions for the project activity during the year *y* in tons of CO_2, applicable to Scenario 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:

>>

Raw data on environmental performance are collected and stored at Alchevsk Coke Plant and can be provided additionally. All required forms concerning environmental impacts are filled in and sent to the local environmental protection authority of Alchevsk.

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.
P-1	*Low*	*Coke production is the main business of the company and it has precise measurement system for weighing the coke. Verification (calibration) is also conducted in accordance with assigned schedules of verification (calibration). In case of data deficiency, commercial invoice for coke production can be used to compensate the data.*
P-2, 3, 4	*N/A*	*As a part of its business operation, Alchevskkoks has measured and will measure the data in accordance with the national standards.*
B-1	*N/A*	*N/A*
B-2	*Low*	*Values will be measured by kW meters set at new and existing turbine generators. Verification is conducted in accordance with assigned schedules of verification. In case of data deficiency, these values are estimated from measured data by stand-by meters.*
B-3	*Low*	*Values will be measured by kW meters set at new and existing turbine generators. Verification is conducted in accordance with assigned schedules of verification. In case of data deficiency, these data are estimated from measured data by stand-by meters.*
B-4	*N/A*	*N/A*
B-5	*Low*	*Value will be measured by hour meters set at CDQ turbine generator. Verification is conducted in accordance with assigned schedules of verification. In case of data deficiency, these data are estimated from measured data by stand-by meter.*
B-6	*Low*	*Value was measured by hour meters set at the existing turbine generator. Verification was conducted in accordance with assigned schedules of verification. In case of data deficiency, these data are estimated from measured data by stand-by meter.*
B-7	*N/A*	*The figure is taken from official publication. When the source of data is revised, the figure is to be revised.*
B-8	*N/A*	*N/A*
B-9	*Low*	*Value will be measured by steam flow meter set at CDQ boiler. Verification is conducted in accordance with assigned schedules of verification. In case of data deficiency, the data is estimated from measured data by stand-by meter.*
B-10	*Low*	*Value will be measured by thermometer set at CDQ boiler. Verification is conducted in with assigned schedules of verification. In case of data deficiency, the data is estimated from steam pressure.*

B-11	*Low*	*Value will be measured by thermometer set at CDQ boiler. Verification is conducted in accordance with assigned schedules of verification. In case of data deficiency, the data is estimated from the water temperature in feed water tank.*
B-12	*N/A*	*The figure is taken from official publication. When the source of data is revised, the figure is to be revised.*
B-13	*N/A*	*N/A*
B-14	*N/A*	*N/A*
B-15, 16	*Low*	*The figure is taken from official publication. When the source of data is revised, the figure is to be revised.*
B-17,18, 19	*N/A*	*As a part of its business operation, Alchevskkoks has measured and will measure the data in accordance with the national standards.*

All initial data is received and stored at the Plants. It is stored in electronic database and in paper format. All data can be checked by the determination team. Calculations are done in Excel tables and are given to AIE. All data regarding initial data and calculations will be stored at Alchevsk Coke Plant for at least 3 year after the end of the first commitment period of Kyoto protocol.

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

>>

Data handling and reporting

The Maintenance unit called as Unit for Control of Measuring Devices and Equipment (CMDEU) and Unit of Chief Energy Specialist (CESU) and Facility's Departments at Alchevskkoks will be in charge of a series of monitoring activities. The data and parameters monitored will be measured, collected, and recorded at the designated frequency described in the section D.1.1.1.These data will be recorded in hard copy and some of them electronically in MS-Excel format and archived at CESU and CMDEU and Facility department's after verified by the responsible dispatcher , and finally reports of chief of changes . All the system of data handling and reporting is in compliance with ДСТУ ISO 9001:2001. Data will be validated in reference to the amount of cokes production. The whole data during the crediting period will be stored until two years after the end of the crediting period.

The data will then be reported in the monthly report of the Alchevskkoks coke plant. Monthly reports will be compiled into a monitoring report for the verification and certification process periodically.

Maintenance of facility and monitoring equipment

While daily facility check will be conducted by the Maintenance unit of Alchevskkoks, periodic inspection and audit will also be implemented by facility suppliers. These routines are based on the Alchevskoks facility inspection standards.

The inspection and verification (calibration) of monitoring equipment will be conducted in accordance with assigned schedules of verification. Generally, while inspection frequency will be once a year at the initial stage, it will be adjusted based on a series of inspection results.

All facility check and inspection records will be archived electronically in MS-Word format at the Facility department of Alchevskkoks.

Corrective Actions

When any monitored value is found uncertain, Alchevskkoks will immediately report to manufacturers of the monitoring equipment, and inspect the consistency with back-up instruments, which were already verified (calibrated) in accordance with assigned schedules of verification., to limit the period of effective data. Manufacturers of monitoring equipment will verify (calibrate) the monitoring equipment and re-adjust or re-set transmitters if necessary. To avoid data deficiency, monitoring will continue by back-up instruments until repair and verification (calibration) is completed.

List and description of monitoring equipment for projectline and baseline indicators:

Classification number	Object and name of the measured parameter	Measurement range	Accuracy	Date of the last verification (calibration)	Date of next verification (calibration)	Responsible for the maintenance and verification (calibration)	Place of storage of the results of measurements and people who use the results
P-1	Scales for weighing coal, coke, coal dust and lime at blast furnace shop	4t-150t	±0,25%	09.09.2009	09.09.2010	Deputy Head of the blast furnace shop charge; Engineer metrologist of the weighing equipment shop	Electronic database of AISW; people who have access to the website of AISW
P-1	Scales for weighing coal, coke, coal dust and lime at blast furnace shop	4t-150t	±0,25%	10.09.2009	10.09.2010	Deputy Head of the blast furnace shop charge; Engineer metrologist of the weighing equipment shop	Electronic database of AISW; people who have access to the website of AISW
B-2	Production of electricity by electricity	Connected through measuring transformers	0,5	Technical accounting device	Not applicable	Electrician of thermal shop	Chief power engineer department

	generators, kW-h						
B -3	CDQ electricity consumption	Connected through measuring transformers	2	Technical accounting device	Not applicable	Main power equipment repair shop	Chief power engineer department
B -5	CDQ operation, hours						maintenance staff of CDQ
B -9	CDQ. Boiler №1 Steam generation	250 kPa, 4-20mA	0,5 %	21.08.09	21.08.10	Monitoring equipment specialist	Monitoring equipment shop, chief power engineer department
B -9	CDQ. Boiler №1 Steam pressure before main steam gate	0-6 MPa, 4-20mA	0,5 %	18.08.09	18.08.10	Monitoring equipment specialist	Monitoring equipment shop, chief power engineer department
B -9	CDQ. Boiler №2 Steam generation	250 kPa, 4-20mA	0,5 %	22.07.09	22.07.10	Monitoring equipment specialist	Monitoring equipment shop, chief power engineer department
B -9	CDQ. Boiler №2 Steam pressure before main steam gate	0-6 MPa, 4-20mA	0,5 %	21.07.09	21.07.10	Monitoring equipment specialist	Monitoring equipment shop, chief power engineer department
B -9	CDQ. Boiler №3 Steam generation	250 kPa, 4-20mA	0,5 %	08.10.09	08.10.10	Monitoring equipment specialist	Monitoring equipment shop, chief power engineer department
B -9	CDQ. Boiler №3 Steam pressure before main steam	0-6 MPa, 4-20mA	0,5 %	20.10.09	20.10.10	Monitoring equipment specialist	Monitoring equipment shop, chief power

	gate						engineer department
B -10	CDQ. Boiler №1 Steam temperature before main steam gate	0-600°C, 4-20mA	1 %	27.02.09	27.02.10	Monitoring equipment specialist	Monitoring equipment shop, chief power engineer department
B -10	CDQ. Boiler №2 Steam temperature before main steam gate	0-500°C, 4-20mA	1 %	24.03.09 24.03.09	24.03.10 24.03.10	Monitoring equipment specialist	Monitoring equipment shop, chief power engineer department
B -11	CDQ. Boiler №1 Steam temperature before main steam gate	0-600°C, 4-20mA		27.02.09	27.02.10	Monitoring equipment specialist	Monitoring equipment shop, chief power engineer department
B -10	CDQ. Boiler №3 Steam temperature before main steam gate	0-500°C, 4-20mA	1%	16.06.09 16.06.09	16.06.10 16.06.10	Monitoring equipment specialist	Monitoring equipment shop, chief power engineer department
B -11	CDQ. Boiler №1 feed water temperature before economizer after deaerator	0-150°C, 4-20mA	1%	19.02.09	19.02.10	Monitoring equipment specialist	Monitoring equipment shop, chief power engineer department
B -11	CDQ. Boiler №2 feed water temperature before economizer after	0-150°C, 4-20mA	1%	17.03.09	17.03.10	Monitoring equipment specialist	Monitoring equipment shop, chief power engineer department

	deaerator						
B -11	CDQ. Boiler №3 feed water temperature before economizer after deaerator	0-200°C, 50M 0-200°C, 4-20mA	1%	19.02.09	19.02.10	Monitoring equipment specialist	Monitoring equipment shop, chief power engineer department

Classification number	Object and name of the measured parameter	Accuracy	Date of the last verification (calibration)	Date of next verification (calibration)	Monitoring frequency	Place of storage of the results of measurements and people who use the results
P-2, B-17	M_{25} Cylindric steel drum needed to determine the mechanical strength. Rotor sieve for grading samples of coke. Scales RR-200 SH-13M	0,1kg	15.05.08 15.05.08 25.09.09	15.05.11 15.05.11 25.09.10	3 times per day, every 8 hours	quality control department
P-3, B-18	M_{10} Cylindric steel drum needed to determine the mechanical strength. Rotor sieve for grading samples of coke. Scales RR-200 SH-13M	- 0,1kg	15.05.08г. 15.05.08г. 25.09.09г.	15.05.11г. 15.05.11г. 25.09.10г.	3 times per day, every 8 hours	quality control department

P-4, B-19	M_{80} Rotor sieve for grading samples of coke. Scales RR-200 SH-13M	0,1kg	15.05.08г. 25.09.09г.	15.05.11г. 25.09.10г.	3 times per day, every 8 hours	quality control department

Emergency

When any substantial accidents happen regarding the CDQ facilities, the technical manager and specilly created commission will immediately conduct accident inspection and report to the Alchevskkoks director. Also, facility manufacturers will be asked for prompt counter-measures.

The record of accidents will be archived electronically in MS-Word format at the Facility department of Alchevskkoks. All Emergency measures will be stipulated in the operation and maintenance manual of Alchevskkoks.

Training Programs

A series of training programs necessary for the operation and maintenance of CDQ system have been conducted by facility suppliers with the support from Sumitomo Corporation. The classroom lectures about the JI project have been already held in [December 2008, April 2008 etc..

At the test run stage, the following training will be implemented for local employees:

- Classroom lecture about operation and maintenance
- Classroom lecture about monitoring procedure
- Practical operation training
- Practical maintenance training
- Practical monitoring training such as data measurement, collection, archiving, and verification

In addition, quality assurance and quality control (QA/QC) training will be implemented at an appropriate timing. Practical training programs will continue on-the-job even after commercial operation starts.

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

>>

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Naoki Matsuo
Climate Experts, Ltd.
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Pacific Consultants Co., Ltd. and Climate Experts, Ltd. are consulting firms with CDM/JI-related expertise. The firm is not a project participant.

SECTION E. Estimation of greenhouse gas emission reductions

E.1. Estimated project emissions:

>>

1) Emissions from the components (1) & (2)
   As described in the section D.1.1.2, no project emission is considered in the project activity.
2) Emissions from the components (3)
   For the component (3), the project emissions are calculated in Annex 2, B. Emission reductions and results are shown in the table below:

Year	Estimated project emissions (tonnes of CO_2 equivalent)
2008	2,068,189
2009	2,176,741
2010	2,821,000
2011	2,821,000
2012	2,821,000
Total tonnes of CO_2 equivalent	12,707,930

E.2. Estimated leakage:

>>

As described in the section D.1.3.2, no leakage is considered in the project activity both for components (1) & (2), and component (3). .

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

>>

The sum of E.1 and E.2 is shown in the Table below during the crediting period

Year	Estimated project emissions (tonnes of CO_2 equivalent)
2008	2,068,189
2009	2,176,741
2010	2,821,000
2011	2,821,000
2012	2,821,000
Total tonnes of CO_2 equivalent	12,707,930

E.4. Estimated baseline emissions:

>>

The baseline emissions are calculated in Annex 2, B. Emission reductions and the results are shown in the table below:

Year	Estimated baseline emissions (tonnes of CO_2 equivalent)
2008	2,202,779
2009	2,384,792
2010	3,074,735
2011	3,074,735
2012	3,074,735

Total tonnes of CO_2 equivalent	13,811,186

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

>>

The differences are shown in the table below.

Year	Difference between E.4 and E 3. (tonnes of CO_2 equivalent)
2008	134,590
2009	208,051
2010	253,735
2011	253,735
2012	253,735
Total tonnes of CO_2 equivalent	1,103,846

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

>>

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)
2008	2,068,189	0	2,202,189	134,590
2009	2,176,741	0	2,384,792	208,051
2010	2,821,000	0	3,074,735	253,735
2011	2,821,000	0	3,074,735	253,735
2012	2,821,000	0	3,074,735	253,735
Total tonnes of CO_2 equivalent	12,707,930	0	13,811,186	1,103,846

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 project has been subject to a formal environmental impact assessments or OVOS undertaken in accordance with the applicable legislation and regulations of Ukraine. These include: the Laws of Ukraine: “On Protection of Environment", "On Ecological Expertise", "On Protection of Atmospheric Air", "On Wastes", "On Ensuring Sanitary and Epidemic Welfare of the Population", "On Local Councils and Local Government", as well as the Water Code, Land Code, Forest and a number of other Governmental Regulations, a project environmental impact assessment (EIA) has been prepared as a part of the Feasibility Study for the project. This assessment was a thorough study of all environmental impacts linked to the project.

The results of the environmental assessment were presented in second volume of the Feasibility Study prepared by “Giprokoks”, the State Institute for Coke Plants’ Engineering, of the Ministry of Industrial Policy of Ukraine. It was prepared in 2004 and marked as ПЗ-96424 (The hard copy of the document on 143 pages in Russian is available upon request from AIEs).

The project will not have negative transboundary environmental impacts. CDQ would significantly improve sanitation work environment not only at the Project Company but also at the neighboring territories of the city of Alchevsk. Because of the project activity such substances as phenol, ammonia, sulfuric and cyanic compounds, hydrocarbons etc would not be discharged as in case of wet quenched coke treatment. Besides the CDQ would save fuel alternatively needed to be burnt for the steam production at the Plant. This would also lead to decrease of emissions into atmosphere.

For the exclusion of powder gas mixture emission into the atmosphere, the gas pipes of CDQ blocks are made impermeable.

It is envisaged that the facility will have the option of dust-free upload of burning hot coke into the quenching chambers and the option of dust-free unload of already quenched coke, which will also be equipped with aspiration systems.

The vacuum method of dust abatement from the CDQ intermediate dust collecting bunkers prevents dust emission into the atmosphere.

Dust emissions will be reduced to the level lower than 50 mg/m3 in a bag filter house, which is equivalent to less than 0.09 kg of dust per ton of quenched coke. This is in full conformance with statutory regulations. Because the quenching gas is recirculated in a closed system, there are no airborne coke emissions from gas cooling. No dust-laden cooling water or steam clouds are released to the environment with the dry-quenching system, contributing to improved working and living conditions.

For the decrease of toxic emissions it is envisaged that the circulating gases will be incinerated in the gas pipes of CDQ facility and also the system of gas pressure automatic adjustment in the crest of quenching chambers will be implemented.

The CDQ chamber would be constructed in a way that makes impossible the emissions of powder gas mixture into atmosphere. For this purpose it will be equipped with modern aspiration systems. In order to decrease the emissions of pollutants, the CDQ would use special system for regulation of gas pressure and in its gas pipes outflow gas will be after-burnt.

The CDQ would improve the quality of coke, decrease its costs and strengthen competitiveness of the Plant at the market. The project would increase the earnings of local municipal budget allowing it to increase the expenditures for social and economic needs of the local population.

The Feasibility Study has envisaged a number of renovations and additions on the coke batteries related to upgrading aspiration systems and oven lids to reduce emissions as well as coke gas desulphurization. In general the projects activities lead to significant energy savings, improved general emissions performance and GHG reductions.

The CDQ project is a part of total investment program of IUD involved USD 2.2 billion up to 2010 with financing of currently committed components in part being supplied by IFC through a USD 100 million direct loan and participation in a syndicated loan facility in the amount of USD 250 million.

The results of the project activity are in line with an Environmental Corrective Action Plan (ECAP) adopted by IUD and provisions for its monitoring are documented in the published IFC Environmental

Review Summary used to support the IFC loan's board approval[4]. The principal requirements of the ECAP relate to setting emission specifications meeting World Bank Group Guidelines and approaching if not meeting EU BAT, designation of additional environmental investments and in having assurance that the latter upstream investments be undertaken either under a JI or GIS mechanisms.

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:

>>

The environmental impact of the proposed project activity is considered to friendly by the project participants. However, as per local development controls and Ukrainian Environmental Regulation the environmental impact assessments during construction and operation of CDQ was conducted.

NA- As stated in F1 the EIA found the project to have a completely positive environmental impact.

SECTION G. Stakeholders' comments

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

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Public Consultation and Disclosure process is prescribed as the Ukrainian project planning and permitting procedures as set out in the Ukrainian EIA implementation regulation (State Construction Standard ДБН А.2.2-1-2003[5]). EIA denoted above is to include the rationale of the proposed project and assess the environmental effects on the natural, social and built environment. It should also describe possible alternatives, establish the environmental baseline, develop mitigation measures to minimize environmental effects, and ensure the project is compliant with environmental, sanitary and other relevant legislation.

According to the national Ukrainian regulations before the project implementation the related information about the project as well as its intentions had to be made publicly available to invite public comments from the relevant stakeholders. The public was invited for comments through a number of announcements by means of local newspapers, Plant's website, local radio and television. Dedicated telephone line was also established for public consultation of the project.

The information on stakeholder's comments is given as part of the Feasibility Study prepared according to the Ukrainian legislation.

Besides as it was indicated above a separate environmental study has been developed by the IFC. The study contains information on influence of the project activities on local communities.

The Mayor of the city of Alchevsk has signed a letter supporting the realisation of the proposed JI project. The letter was addressed to al relevant authorities (available on request).

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[4] "Environmental Review Summary, Project 24685", IFC, May 2, 2006.

http://www.ifc.org/ifcext/spiwebsite1.nsf/0/c7c3ef9e3563d70d85257162007370c3?OpenDocument

[5] In Ukrainian standard is on web-site: http://www.budinfo.com.ua/dbn/8.htm

Annex 1

CONTACT INFORMATION ON PROJECT PARTICIPANTS

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ANNEX 2

BASELINE INFORMATION

A. Emission factor for Ukrainian electricity grid

The baseline emission factor of the Ukrainian electricity system that the proposed JI project directly connected can be summarized as indicated in Table Ann. 2.A.1 for both components of power delivery to the grid and conservation of power consumption in Alchevskkoks. The approach and assumptions employed are broadly similar to those stipulated in the approved consolidated CDM methodology, ACM0002, taking account "Guidance on criteria for baseline setting and monitoring for JI projects" issued by JISC, "Operational Guidelines for the Project Design Document, ERUPT" issued by the Ministry of Economic Affairs of the Netherland, and also country specific circumstances of Ukraine. The estimation of baseline emission factor is assessed by TUEV SUED for its validity. The scheme of the estimation is represented below.

Table Ann. 2.A.1 Baseline carbon emission factors for JI projects for Ukrainian grid 2006 - 2012. (Source: "Standardized emission factors for the Ukrainian electricity grid", Annex 2 of "Ukraine – Assessment of new calculation of CEF", assessed by TUEV SUED, 2007.)

Year	unit	2008	2009	2010	2011	2012
Baseline carbon emission factor for generation	[tCO_2/MWh]	0.807	0.807	0.807	0.807	0.807
Baseline carbon emission factor for reduction of consumption	[tCO_2/MWh]	0.896	0.896	0.896	0.896	0.896

Consolidated baseline methodology, ACM0002, takes combination of the Operating Margin, OM, and the Build Margin, BM, to estimate the emission in absent of the CDM project activity. OM accounts for the reduction in power generation plants that provide the electricity to the grid while BM accounts the potential delay in construction of future addition of power plants in the grid.

For OM calculation, it is therefore necessary to identify the group of power plants operating "on margin" that could most likely reduce their output when additional power is delivered to the grid. On the other hand, strict application of BM calculation specified in ACM0002 is not realistic and lead to distorted picture of the Ukrainian grid since most recent capacity addition to be identified is nuclear plants. Therefore, the Operating Margin only will be used to develop the baseline emission factor.

Following assumptions to calculate emission factor of Ukrainian grid are employed,
1) the grid must constitute of all power plants servicing the grid,
2) there is no significant electricity import to the grid,
3) electricity export is not accounted and not excluding from the calculations.

All of above are in compliance with ACM0002.

Following four options are provided for calculation of OM in ACM0002,
(a) Simple OM, or
(b) Simple adjusted OM, or
(c) Dispatch Data Analysis OM, or
(d) Average OM.

Though "Dispatch Data Analysis" (c) is the first methodological choice as per ACM0002, this option is not applicable because of the data availability.[6] "Simple adjusted OM" (b) is not applicable either for the same reason. The "Average OM" (d) would not present a realistic picture since nuclear power plants always work as the base load and constitute up to 48% of overall electricity generation during past five years as indicated in Table Ann. 2.A.2, and 2.A.3, respectively.

Table Ann.2.A.2 Electricity demand and generation in Ukrainian on March 2005[b].

		Minimum demand (03:00)	Peak demand (19:00)
Consumption (MW)		21,287	27,126
Generation (MW)		22,464	28,354
	Thermal power palnts	10,049	13,506
	Hydro power plants	527	3,971
	Nuclear power plants	11,888	10,877
Balance import/export (MW)		-1,177	-1,228

Table Ann.2.A.3 Share of power generation by source in the annual power generation.[c]

Year	2001	2002	2003	2004	2005
Nuclear plant generation	44.23	45.08	45.32	47.99	47.92
Thermal power generation	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 generation	7.04	5.58	5.15	6.47	6.65

In Ukraine the low-cost must-run power plants are nuclear power plants and their contribution to the total electricity generation is below 59% as indicated in Table Ann.2.A.3. Therefore, the "Simple OM" is only applicable option for the Ukrainian grid.

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

Where:

$F_{i,j,y}$ is the amount of fuel i (in a mass or volume unit) consumed by power plant source 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 CO_2 emission coefficient of fuel i (tCO_2e /mass or volume unit of the fuel), taking into account the carbon content of the fuels used by power sources j and the percent oxidation of the fuel in

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6 Dource: State Committee of Statistics of Ukraine. Fuel and Energy resources of Ukraine 2001-2003, Kyiv, 2004.

b "Ukraine – Assessment of new calculation of CEF", 2007 – http://ji.unfccc.int/UserManagement/FileStorage/46JW2KL36KM0GEMI0PHDTQF6DVI514

c "Overview of data on electric power plants in Ukraine 2001-2005", Ministry of Fuel and Energy of Ukraine, 31 October 2006 and 16 November 2006.

year(s) '*y*', and

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

$$COEF_i = NCV_i \cdot EF_{CO_2,i} \cdot OXID_i \tag{A.2}$$

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 CO_2 emission factor per unit of energy of the fuel *i* (tCO_2e /TJ).

Individual data for power generation and fuel properties was obtained from the individual power plants.[d] The local NCV values of individual power plants for natural gas and coal were used. For heavy oil, the IPCC[e] default NCV was used. Local CO_2 emission factors for all types of fuels were taken for the purpose of the calculations and Ukrainian oxidation factors were used.

The Simple OM is applicable to the JI project that delivers additional amount of electricity to the grid, "generation JI project". However, the project that reduces on-site consumption of electricity, referred to as "reducing project", reduces losses in the grid. Losses in the Ukrainian grid are classified as technical losses and non-technical losses that include no-payment and other losses of unknown reasons. For the purpose to determine emission factor of the Ukrainian grid for "reducing project", only technical losses were considered. Statistical data on the losses are indicated in Table Ann.2.A.4.[d]

Table Ann.2.A.4 Grid losses in Ukraine.

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

Though technical losses decrease over years and are expected to reach 22% in 2012, technical losses of ten (10) percent are applied for the period during 2006 through 2012 as a conservative assumption.

As conclusions, emission factors for "generation JI projects" and "reducing JI projects" in Ukraine are summarized as follows,

$$EF_{grid,produced,y} = EF_{OM,y} \tag{A.3}$$

and

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

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

$$EF_{grid,reduced,y} = \frac{EF_{gid,produced,y}}{1 - loss_{grid}} \qquad (A.4)$$

Where,
$EF_{grid,produced,y}$ is the emission factor for JI projects supplying additional electricity to the grid (tCO2e/MWh);
$EF_{grid,reduced,y}$ is the emission factor for JI projects reducing electricity consumption from the grid (tCO2e/MWh);
$EF_{OM,y}$ is the simple OM of the Ukrainian grid (tCO2e/MWh);
$Loss_{grid}$ is the technical losses in the grid (%).

Basic data employed for the assessment of carbon emission factor of the Ukrainian grid are summarized in Table Ann.2.A.5.

Table Ann.2. A.5 Key data for OM factor calculation of the Ukrainian grid.

	Generation (MWh)	CO_2 emissions (tCO_2)	Technical losses (%)	for producing project, $EF_{grid,produced}$ (tCO_2/MWh)	for reducing project, $EF_{grid,reduced}$ (tCO_2/MWh)
2003	98,214,112	80,846	14.2		
2004	94,330,765	74,518	13.4		
2005	96,526,887	78,203	13.1		
total	**289,071,764**	**233,567**	**10**	**0.807**	**0.896**

The results of the calculation are summarized as indicated in Table Ann.2.A.6.

Table Ann.2. A.6 Emission factors for the Ukrainian grid for 2006-2012.

Type of JI project	parameter	EF (tCO_2e/MWh)
Producing projects	$EF_{grid,produced,y}$	0.807
Reducing projects	$EF_{grid,reduced,y}$	0.896

Summary of key baseline elements

ID number	Data variable	Source of data	Data unit	Measured (m), calculated (c), estimated (e)	Definition/Summary
B-1	f_{wcm}	N/A	N/A	c	Fraction of total electricity generated by the project activity using waste energy.
B-2	$EG_{PJ,y}$	Alchevskkoks	MWh	m	Total amount of electricity generated in the project activity.
B-3	$EC_{CDQ,y}$	Alchevskkoks	MWh	m	Amount of electricity self-consumed by CDQ.
B-4	$EG_{hist,BL}$	Alchevskkoks	MWh	c	Average amount of electricity generated in the most recent three years prior to the project activity.
B-5	$h_{PJ,y}$	Alchevskkoks	hours per year	m	CDQ system operation hours.
B-6	$h_{hist,BL}$	Alchevskkoks	hours per year	c	Average operating hours of existing captive power generators in the most recent three years prior to the project activity.
B-7	$EF_{elec,gr}$	Annex 2 of “Ukraine – Assessment of new calculation of CEF”	tCO_2/MWh	e	The CO_2 emission factor for the electricity source, national electric grid, displaced due to the project activity, during the project activity.
B-8	$Q_{OE,BL}$	Manufacturer’s Specification	tonnes per year	e	Output/intermediate energy that can be theoretically produced (in appropriate unit), to be determined on the basis of maximum recoverable energy from the WECM, which would have been released (or WECM would have been flared or energy content of WECM would have been wasted) in the absence of project activity.
B-9	$SG_{PJ,CDQ,y}$	Alchevskkoks	tonnes per year	m	Amount of steam generated in CDQ boiler in the project activity.
B-10	$H_{steam,CDQ,y}$	Alchevskkoks	kcal/kg ~~TJ~~	m	Specific enthalpy of steam generated in CDQ boiler in the project activity.
B-11	$H_{water,CDQ,y}$	Alchevskkoks	kcal/kg ~~TJ~~	m	Specific enthalpy of feed water in CDQ boiler in the project activity.
B-12	$EF_{CO2,NG}$	IPCC2006	tCO_2/TJ	e	The CO2 emission factor per unit of energy of natural gas in the baseline used in the existing boiler used by Alchevskkoks in absence of the project activity.
B-13	$\eta_{Ex\text{-}Boiler}$	N/A	%	e	Efficiency of the existing boiler that would have supplied heat to Alchevskkoks in the absence of the project activity.
B-14	$ws_{Ex\text{-}Boiler}$	N/A	N/A	c	Fraction of total heat that is used by Alchevskkoks in the project that in absence of the project activity would have been supplied by the existing boiler.
B-15	$F_{pigiron}$	Alchevskkoks	N/A	c	Increased pig iron production due to dry coke input in a blast furnace (faction).
B-16	F_{coke}	Alchevskkoks	N/A	c	Decreased coke consumption due to dry coke input in a blast furnace (faction).
B-17	$M_{25,BL}$	Alchevskkoks	%	e	Index for coke hardness of wet coke produced in the baseline activity.
B-18	$M_{10,BL}$	Alchevskkoks	%	e	Index for reduced wet coke abrasion for coke produced in the baseline activity.

B-19	$M_{80,BL}$	Alchevskkoks	%	e	Index for reduced wet coke faction content over 80mm for coke produced the baseline activity.
P-2	$M_{25,PJ}$	Alchevskkoks	%	m	Index for coke hardness of produced dry coke by CDQ.
P-3	$M_{10,PJ}$	Alchevskkoks	%	m	Index for reduced coke abrasion for produced dry coke by CDQ.
P-4	$M_{80,PJ}$	Alchevskkoks	%	m	Index for reduced coke faction content over 80mm for produced dry coke by CDQ.

B. Emission Reduction

Formulae to be used for calculation of emission calculation are listed in the table below with the equation numbers and the calculation order to calculate the emissions.

Table Ann. 2.B.1 Equations used for the reduction calculation

Calculation order	Equation No.	Equation
14	(3)	$ER_y = BE_y - PE_y$
13	(4)	$PE_y = PE_{coke,,y} = Q_{coke,PJ,y} * 3.1$
12	(1)	$BE_y = BE_{En,y} + BE_{coke,y}$
11	(1a)	$BE_{En,y} = BE_{Elec,y} + BE_{Ther,y}$
4	(1a-1)	$BE_{Elec,y} = f_{cap} * f_{wcm} * (EG_y * EF_{elec,gr})$
3	(1a-1-1)	$EG_y = EG_{PJ,y} – EC_{CDQ,y} – EG_{hist,BL*} h_{PJ,y} / h_{hist,BL}$
2	(1h)	$f_{cap} = Q_{OE,BL} / Q_{OE,y}$
1	(1h-1)	$Q_{OE,y} = SG_{PJ,CDQI,y}$
7	(1a-2)	$BE_{Ther,y} = f_{cap} * f_{wcm} * HG_{CDQ,y} * EF_{heat,CDQ}$
6	(1a-22)	$EF_{heat,CDQ} = ws_{Ex-Boiler} * EF_{CO2,NG} / \eta_{ExBoiler}$
5	(1a-2-1)	$HG_{CDQ,y} = SG_{PJ,CDQI,y} * (H_{steam,CDQ,y} - H_{water,CDQ,y}) * 41.87 * 10^{-6}$
10	(5)	$BE_{coke,y} = Q_{coke,PJ,y} * (1 + F_{pigiron}) / (1 - F_{coke}) * 3.1$
8	(5a)	$F_{pigiron} = [(M_{25,PJ} – M_{25,BL}) * 0.6 + (M_{10,PJ} – M_{10,BL}) * -2.8 + (M_{80,PJ} – M_{80,BL}) * -0.2]/100$
9	(5b)	$F_{coke} = [(M_{25,PJ} – M_{25,BL}) * 0.6 + (M_{10,PJ} – M_{10,BL}) * -2.8 + (M_{80,PJ} – M_{80,BL}) * -0.2]/100$

The table below shows the figures used for the calculation of the baseline emissions during crediting period together with the source or the equation numbers by which the data or parameters are calculated, the calculation order, and the intermediate results of the calculation.
Note that the figures in ( ) in the column of the "Calculation order" show the steps in which the data or parameters are used.

Table Ann. 2.B.2 The Figures used for the reduction calculations and the results

Calculation order	Data and Parameters	Applicable equation, reference or ID number in monitoring table	Unit	Year				
				2008	2009	2010	2011	2012
14	ER_y	Per Eq. (3)	tCO_2/y	134,5906	208,051	253,735	253,735	253,735
13	$PE_{coke,,y}$	Per Eq (4)	tCO_2/y	2,068,189	2,176,741	2,821,000	2,821,000	2,821,000
12	BE_y	Per Eq. (1)	tCO_2/y	2,202,779	2,384,792	3,074,735	3,074,735	3,074,735
11	$BE_{En,y}$	Per Eq (1a)	tCO_2/y	44,338	51,156	130,631	130,631	130,631
4	$BE_{Elec,y}$	Per Eq (1a-1)	tCO_2/y	-16,637	-11,520	42,577	42,577	42,577
2, (4, 7)	f_{cap}	Per Eq (1h)	Fraction	1	1	1	1	1
(4, 7)	f_{wcm}	Refer to (B-1)	Fraction	1	1	1	1	1
3, (4)	EG_y	Per Eq (1a-1-1)	MWh/y	-18,568	-12,857	47,519	47,519	47,519
(4)	$EF_{elec,gr}$	Refer to (B7)	tCO_2/MWh	0.896	0.896	0.896	0.896	0.896
(3)	$EG_{PJ,y}$	Monitor (B2)	MWh/y	13,501	18,942	84,840	84,840	84,840
(3)	$EC_{CDQ,y}$	Monitor (B3)	MWh/y	16,748	16,478	22,000	22,000	22,000
(3)	$EG_{hist,BL}$	Refer to (B4)	MWh/y	15,321	15,321	15,321	15,321	15,321
(3)	$h_{PJ,y}$	Refer to (B5)	hours	8640	8640	8640	8640	8640
(3)	$h_{hist,BL}$	Per Eq (B6)	hours	8640	8640	8640	8640	8640
(2)	$Q_{OE,BL}$	Refer to (B8)	t/y	907,200	907,200	907,200	907,200	907,200
(1)	$Q_{OE,y}$	Per Eq (1h-1)	t/y	392,525	381,127	480,000	480,000	480,000
(1), (5)	$SG_{PJ,CDQI,y}$	Monitor (B9a)	t/y	392,525	381,127	480,000	480,000	480,000
7	$BE_{Ther,y}$	Per Eq (1a-2)	tCO_2/y	60,975	69,886	88,054	88,054	88,054
5	$HG_{CDQ,y}$	Per Eq (1a-2-1)	TG/y	956	1,096	1,381	1,381	1,381
(5)	$H_{steam,CDQ,y}$	Monitor (B10)	kcal/kg	685	790	790	790	790
(5)	$H_{water,CDQ,y}$	Monitor (B11)	kcal/kg	103	103	103	103	103
6	$EF_{heat,CDQ}$	Per Eq (1a-22)	tCO_2/TJ	63.75	63.75	63.75	63.75	63.75

(6)	$ws_{Ex\text{-}Boiler}$	Refer to (B-14)	Fraction	1	1	1	1	1
(6)	$EF_{CO2,NG}$	Refer to (B12)	tCO_2/TJ	56.1	56.1	56.1	56.1	56.1
(6)	$\eta_{ExBoiler}$	Refer to (B13)	No dimension	0.88	0. 88	0. 88	0. 88	0. 88
10	$BE_{coke,y}$	Per Eq (5)	tCO_2/y	2,158,441	2,326,426	2,944,1042	2,944,104	2,944,104
(10)	$Q_{coke,PJ,y}$	Monitor (P1)	t/y	667,158	702,175	910,000	910,000	910,000
8, (10)	$F_{pigiron}$	Per Eq (5a)	%	1.82	1.82	1.82	1.82	1.82
9, (10)	F_{coke}	Per Eq (5b)	%	1.82	1.82	1.82	1.82	1.82
(8) (9)	$M_{25,PJ}$	Monitor (P1)	%	89.1	89.1	89.1	89.1	89.1
(8) (9)	$M_{10,PJ}$	Monitor (P1)	%	5.6	5.6	5.6	5.6	5.6
(8) (9)	$M_{80,PJ}$	Monitor (P1)	%	4.3	4.3	4.3	4.3	4.3
(8) (9)	$M_{25,BL}$	Monitor (B17)	%	88.1	88.1	88.1	88.1	88.1
(8) (9)	$M_{10,BL}$	Monitor (B18)	%	6	6	6	6	6
(8) (9)	$M_{80,BL}$	Monitor (B19)	%	5.4	5.4	5.4	5.4	5.4

Annex 3

MONITORING PLAN

The monitoring at Alchevskkoks and AISW will be conducted on monthly basis according to monitoring plan described below. Two operational managers at each plants will be in charge for monitoring of GHG emissions and ERUs and preparation of annual monitoring reports.

The data required to monitor the project will be routinely collected within the normal operation of the Companies and therefore monitoring will be also an integral part of routine monitoring. All data will be collected into electronic database of the Companies. Data will be complied in day-to-day records, monthly records and annual records. All records are finally stored in Commercial Units of the Plants. The appropriate data for GHG monitoring will be fed into the Monitoring Database.

The Project Developers will also supervise the implementation of the Monitoring Plan for the project at regular intervals.

All the monitoring equipment are on the ДСТУ ISO 9001:2001 and national standards of Ukraine. Specifications of all the meters are in compliance with the national standard of Ukraine and their verification (calibration) will also be conducted on the basis of the standard to ensure their level of necessary accuracies.

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