JOINT IMPLEMENTATION PROJECT

"Implementation of the energy efficiency measures at SE "Malyshev Plant"

Position of the head of the organization, institution, body, which prepared the document

Director, VEMA S.A. Switzerland (position) (signature) **Fabian Knodel** (name and patronymic, last name)

PS

Position of the economic entity – owner of the source, where the Joint Implementation Project is planned to be carried out

General Director SE "Malyshev Plant" (position) (signature) **Nikolai Belov** (name and patronymic, last name)

PS

Kharkiv 2012

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

CONTENTS

SECTION A. General description of the project

A.1. Title of the project:

"Implementation of the energy efficiency measures at SE "Malyshev Plant"

Sectoral scope:

Category 4 – Manufacturing industries;

Category 9 – Metallurgy.

Project Design Document Version: 04**.**
Date: 16/08/2012.

A.2. Description of the project:

Purposes of the project activity
The main purpose of the Joint Implementation Project (hereinafter – JI project) "Implementation of the energy efficiency measures at SE "Malyshev Plant" is to increase energy efficiency of operations and improve environmental situation in the region due to complex modernization of equipment.

Historical details of SE "Malyshev Plant" development
State Enterprise "Malyshev Plant" is one of the oldest heavy engineering plants in Ukraine and the CIS. The company, having a history of 115 years, is one of Ukraine's largest enterprises.
SE "Malyshev Plant" was created in 1895 as a locomotive-building plant; over the first 15 years, the plant created a wide range of heavy engineering products: locomotives, mills, pumps, compressors, etc. Nowadays, SE "Malyshev Plant" continues to produce large-size military and civil vehicles, parts and components, ship engines, equipment for coal mining, embracing leading positions in the metallurgical sector of the Ukrainian market (pig iron, steel, non-ferrous metals).

Circumstances under which the project will be implemented
The production process at SE "Malyshev Plant" is a complex system with many machines and devices cooperating under the supervision of the servicing staff. Therefore, modernization of the operations requires a complex approach, partial implementation being ineffective, time-consuming and sometimes impossible.
SE "Malyshev Plant" had barely carried out any complex modernization of equipment before the JI project on a lack of financing and the absence of a perspective industry development plan. Therefore, the condition of technological equipment is worsening and its performance rates are on a permanent decline. Most of operating equipment is obsolete and worn-out, which pushes up natural gas and electricity consumption to provide the stable level of electricity and heat supply of the company.
Despite the poor condition of equipment, which is ineffective but still capable of further operation, taking account of the operational experience and economic indicators, it can be concluded that the equipment, which operated before the JI project, can operate for another 15-20 years.

Baseline scenario.
The baseline scenario provides for further operation of the existing equipment with planned repairs and maintenance without considerable investments, which meets the requirements of state standards and the

Ukrainian legislation. Specific consumption of energy resources to supply the company with electricity and heat would have been stable or even growing, which would have caused higher greenhouse gases (GHG) emissions into the atmosphere. The justification of the baseline scenario is provided in Section B.

Project scenario.
The project provides for the complex modernization of manufacturing processes at SE "Malyshev Plant" in the following key areas:

1) installation of effective energy-saving technological equipment to produce:
   a) ferrous and non-ferrous metals;
   b) other products measured in tonnes.
2) implementation of energy-efficient heat generating equipment;
3) replacement of metering devices.

The increase in production efficiency will lead to the reduction of electricity and natural gas consumption in the course of manufacture, which, in turn, will cause lower greenhouse gases (GHG) emissions in the atmosphere.

Measures that will be implemented as part of the project (see Section A.4.2 below), as well as implementation and performance of constant monitoring will help to reduce electricity and natural gas consumption significantly in the course of manufacturing processes at SE "Malyshev Plant", which, in turn, will push down GHG emissions.

SE "Malyshev Plant" has all licenses and permits for the project implementation.
Main contracts for the purchase of raw materials (electricity and diesel fuel) have already been signed and are updated annually. The equipment required for the project is planned to be purchased from leading Ukrainian and European companies on a tender basis.

Historical data of the development of the JI project "Implementation of the energy efficiency measures at SE "Malyshev Plant".

18/04/2006 – the date when implementation of new energy-effective equipment started as part of the project activity (certificate No.1-2006).

13/03/2012 – the date of preparation and submission of the project idea note to support anthropogenic GHG emissions reductions, to the State Environmental Investment Agency of Ukraine.

07/06/2012– the date of obtaining of a Letter of Endorsement from the State Environmental Investment Agency of Ukraine

A.3. Project participants:

Party involved*	Legal entity project participant (as applicable)	Please indicate if the Party involved wishes to be considered as project participant (Yes/No)
Ukraine (host Party)	• SE "Malyshev Plant"	No
Switzerland	• "VEMA S.A."	No
*Please indicate if the Party involved is a host Party.		

A.4. Technical description of the project:

A.4.1. Location of the project:

The location of the project on the map of Ukraine is shown in Figure 1.

Figure 1. Location of SE "Malyshev Plant" on the map of Ukraine

A.4.1.1. Host Party(ies):

The project is located in the territory of Ukraine.
Ukraine is an Eastern European country that ratified the Kyoto Protocol to the UN Framework Convention for Climate Change on Febuary 4, 2004. It is listed in the Annex 1 and meets the requirements of participation in Joint Implementation projects[1].

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

Kharkiv region.

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

Kharkiv city.

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

The project is located in Kharkiv region, Ukraine.
The geographical coordinates of SE "Malyshev Plant" Headquarters are 49°58′20″N 36°17′00″E

[1] http://zakon.rada.gov.ua/cgi-bin/laws/main.cgi?page=1&nreg=995_801

Figure 2. Location of SE "Malyshev Plant" on the map of Kharkiv

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

JI project "Implementation of the energy efficiency measures at SE "Malyshev Plant" provides for the complex modernization of technological production processes by means of implementation of innovative, energy-efficient and energy-saving equipment used for production of pig iron, steel, non-ferrous metals and other products measured in tonnes, as well as heat-generating equipment, taking into account the latest trends in the manufacturing industry, in order to increase the efficiency of electricity and natural gas consumption.

The description of project milestones and technologies is provided below; more details on all the energy-efficiency activities implemented at the plant will be provided at the stage of monitoring of the JI project "Implementation of the energy efficiency measures at SE "Malyshev Plant":

1. Installation of condensing units for reactive power compensation. An overview and specifications are available below as well as on the seller's website[2].

Figure 3. AKU KRM-0.4 condensing unit for reactive power compensation manufactured by "Enersis Ukraine" LLC

[2] http://www.enersys.in.ua/index.php?option=com_content&view=article&id=94&Itemid=70

Reactive power compensators reduce considerably the use of the reactive power component, optimizing electricity consumption. The existence of reactive power causes the necessity to use cables with higher diameters than required for active power; besides, it slices the life of equipment.
Implementation of reactive power compensators increases effective grid power, which provides for:

1. Electricity saving of up to 40% due to lower reactive power in the grid.
2. Increase of potential of power mode control valves by up to 30%.
3. Increase of consumer cable lines throughput by u to 30%.

Table 1. Specifications of reactive power compensators

Parameter	Value
Nominal voltage, kV	0.38
Power, kVA	12.5…1000
Minimal step nominal capacity, kVAr	2.5…40
Number of power control steps	3…11
Operating frequency, Hz	50
Maximum copper cable diameter	3x16…3x150
Protective system	IP21

Installation of reactive power compensators will push down electricity consumption considerably in the course of technological process of manufacture through the increase of potential of power mode control valves and consumer cable lines throughput, which, in turn, will entail lower GHG emissions into the atmosphere.

2. Implementation of the chemical-set core manufacturing technology for non-ferrous metals, pig iron and steel moulding. An overview and specifications are available below as well as on the seller's website[3].

Figure 4. S1Sh3 High-speed single-screw mixer manufactured by "BELNIILIT" OJSC.
Manufacturing of moulding cores from non-ferrous metals, pig iron and steel requires drying them in gas or electrical driers to make the cores hard enough. Gas driers are the most popular ones. This technology requires major energy consumption and additional drying equipment (drying plates, driers, etc.). The implementation of the chemical-set core manufacturing technology enables to exclude heat drying or at least reduces the time for drying considerably, because core hardening occurs during a chemical

[3] http://carbohim.com/?id=322

reaction. In order to meet the chemistry set demand, S1Sh3 High-speed single-screw mixer is used[4], which provides sufficient speed and quality of chemistry set production.

Table 2.Specifications of continuous mixers

Parameter	Mixer model	
	S2Sh1	S1Sh3
Number of screws, pcs	2	1
Steering angle, degrees	90	180
Throughput, t/h	2	3
Screw diameter, mm	140	190
Screw rotation speed, rot/min	109	720
Number of dosing pumps	Adjustable	
Power	5	3
Air pressure, MPa	0.7-0.57	
Dimensions, mm	2 295x510x2 530	1 000x350x1 500
Mixer mass, kg	1 100	270

Refusal from the existing coremaking technology to substitute it with the technology of chemistry-set core manufacturing technology eliminates the necessity to use drying units, i.e. almost fully excludes the use of natural gas and electricity from the manufacturing process, causing lower GHG emissions to the atmosphere.

3. Implementation of a bandsaw machine to cut stamping and forging blanks. An overview and specifications are available below as well as on the seller's website[5].

Figure 5. SGA 300 bandsaw machine

The use of a bandsaw machine for blank cutting instead of cutting by press shears with prior blank heating. The technology of forging and stamping blank cutting at press shears provides for blank heating. Blanks were heated mainly in gas furnaces, which are obsolete and worn-out and thus have poor performance in terms of modern standards and technological process. Besides, the structural characteristics of the old furnaces cause direct emission of combustion products into the atmosphere of operational premises.

Table 3. Specifications of SGA-300 bandsaw machine manufactured by FDB Maschinen

Parameter	Value
Voltage, V	400

[4] http://belniilit.by/catalog.php?pid=3&id=52

[5] http://www.fdb.com.ua/katalog/lentochnyie-pilyi-po-metallu/sga-300-bez-rolgana.html

Power, W	3000
Maximum cutting diameter, mm	300
Maximum feedstock dimensions, mm	300x650
Blade speed, m/min	25/46/80
Blade dimensions, mm	4 240x34x1.1
Mass, kg	1 200
Machine dimensions, mm	2 180x980x1 360

Bandsaw machines are able to cut blanks without prior heating, and this fact will push down natural gas consumption in the course of manufacture, causing lower GHG emissions into the atmosphere.

4. Implementation of a direct-current electric arc furnace for steel alloys. An overview and specifications are available below as well as on the seller's website[6].

Figure 6. DPPTU-6 direct-current electric arc furnace manufactured by "UkrNDIElektroterm" LLC

The substitution of alternate-current furnaces with direct-current electric arc furnaces will reduce electricity consumption for melting and make the melting process more effective. Electric arc furnaces have the following advantages over alternate-current furnaces:

- lower graphite electrode consumption;
- improved wall lining life;
- lower waste of metal and dopants;
- improved environment in the furnace operational site.

The previous steelmaking technology provided for the use of alternate-current electric arc furnaces equipped with a complex and large-sized dusting system. Unstable operation of the dusting system caused heavy concentration of dust and gas contamination of working area. The implementation of a direct-current arc furnace for steel eliminates all the above problems, increases the efficiency of the process and improves the steel quality.

Table 4. Comparison of specifications of DS-6N1 alternate-current furnace and DPPTU-6 direct-current furnace

Parameter	*DS-6N1 furnace*	*DPPTU-6 furnace*
Average electricity consumption per one tonne of steel, kWh	1 200	600

[6] http://www.niiterm.com/index.php?lg=ru&id=4&pid=1&inf=11

Melting cycle, h	3.5-4	1.5
Metal waste, %	6	1.5

Lower electricity consumption by direct-current furnaces with the same operational capacity and shorter melting cycle when compared with alternate-current furnaces ensures a major reduction in electricity consumption, which, in turn, causes lower GHG emissions.

5. Implementation of a direct-current electric arc furnace for bronze and brass alloys. An overview and specifications are available below as well as on the seller's website [7].

Figure 7. DPPTU-0.5AG direct-current electric arc furnace manufactured by "Ekta" research and production company

Substitution of alternate-current electric arc furnaces, which are low-effective, noisy and pollutant, with direct-current electric arc furnaces for bronze and brass alloys enables to slash electricity consumption, increase the efficiency of the process and improve the steel quality

Table 5. Comparison of main working parameters of DMK-0.5 alternate-current furnace and DPPTU-0.5AG direct-current furnace

Parameters	DMK-0.5	DPPTU-0.5AG
Average electricity consumption per tonne of metal, kWh	1 200	600
Melting cycle, h	3.5-4	1.5
Chemical waste, %	10	1.5

Lower electricity consumption by direct-current furnaces with the same operational capacity and shorter melting cycle when compared with alternate-current furnaces ensures a major reduction in electricity consumption, which, in turn, causes lower GHG emissions.

6. Implementation of modern energy-saving gas furnaces with waste-heat exchangers and effective automatic control. An overview and specifications are available below as well as on the seller's website[8].

[7] http://www.stf-ecta.ru/default.asp?page=41&pub=13

[8] http://www.termo.in.ua/index.php?option=com_content&view=category&id=34&Itemid=65

Figure 8. A bell-type furnace manufactured by "Thermoengineering" LLC

Replacement of obsolete and worn-out gas heating furnaces (with charging machines, pusher-type, chamber-type), whose efficiency rate is too low in terms of modern technological process, and which require major expenses to maintain their operable condition, with modern energy-efficient gas furnaces equipped with a double-cable low-pressure burner system with low-conductivity fiber lining, with waste-heat exchangers and gas-feed automatic control will reduce natural gas consumption, utilize exhaust gases heat and reduce repair costs. Implementation of energy-efficient furnaces in the technological manufacturing process will slash natural gas consumption, causing lower GHG emissions to the atmosphere.

7. Implementation of industrial-frequency induction heating of stamping and forging blanks. An overview and specifications are available below as well as on the seller's website[9].

Figure 9. INU-50 industrial-frequency blank heating unit manufactured by "Vnesh-Komplekt" LLC

The previous technology of blank cutting provides for the heating of blanks in obsolete and worn-out gas furnaces, whose efficiency rate is too low in terms of modern technological process, and their structural characteristics cause direct emission of combustion products into the atmosphere of operational premises. Implementation of industrial-frequency induction heating will eliminate the

[9] http://kharkov.prom.ua/p3348395-ustanovka-induktsionnogo-nagreva-shkval.html

necessity to use natural gas and significantly improve the process efficiency due to better automatization of the manufacturing process.

Main advantages of industrial-frequency induction heating against other heating technologies:

- electricity is transferred directly to the heated object, which increases the heating rate;
- there is no need to use various contact devices, which is very handy upon automated routine production with vacuum protective devices used;
- industrial-frequency induction heating is faster and cost-effective than other technologies, which makes it the most efficient technology.

Table 6. Specifications of INU-50 industrial-frequency induction heating unit

Capacity, kW	50
Power consumed from the grid, kW	54
Blank sizes, mm:	
diameter	25-50
length	80-240
Heating rate (up to 500 – 600℃), s	26
Frequency:	
supply network, kHz	50
loop network, kHz	2400
Phaze number:	
supply network, kHz	3
loop network, kHz	1
Nominal voltage:	
supply network, kHz	380
loop network, kHz	800
services network, kHz	220
Weight of the unit, kg	0.45
Area occupied by the unit	3

High-efficiency, energy-saving industrial-frequency induction heating technology will replace the previous heating technology that involved natural gas combustion in furnaces, which caused major waste because of old equipment. Thus, GHG emissions into the atmosphere will decrease.

8. Implementation of SEIATSU automatic moulding line equipped with a system of mixture preparation for iron and steel foundry. An overview and specifications are available below as well as on the seller's website[10].

[10] http://www.lityo.com.ua/hws.html

Figure 10. A SEIATSU mould and SEIATSU automatic moulding process from HWS-Sinto

The existing technology of loam mould production includes the following procedures: mixture preparation, feeding of the mixture to the forming machine using band conveyors, forming, drying of semi-finished moulds in gas driers (for pig iron), installation of cores and stacking for casting.
The implementation of SEIATSU automatic moulding line will:

- increase the production efficiency by up to 5 times;
- reduce specific electricity consumption for loam mould production;
- improve moulding quality;
- reduce the dust concentration in the working area;
- improve the working conditions.

Better efficiency of the process will reduce electricity and natural gas consumption per unit of production which would reduce GHG emissions in the atmosphere.

9. Replacement of meters with lower accuracy class by meters with higher accuracy class. An overview and specifications are available below as well as on the seller's website[11].

Figure 11. NIK2303AP2T high-precision electricity meters
Table 7. Specifications of meters

Rated current	5 – 60 A
Accuracy class	1.0
Number of tariffs	4
Operating temperature	-30 - +50 ^{0}C
Speed of data transfer	9600 baud
Possibility of connection of external power source (12 V) for reading in case of voltage absence	

Application of new meters with higher accuracy class will reduce electricity consumption by meters and improve the monitoring of electricity consumption; this will reduce GHG emissions into the atmosphere.

10. Heating decentralization by building independent heating modules.

[11] http://electrica-shop.com.ua/pi/products_id/2512

Figure 12. Gas boiler for independent heating modules

Decentralized heating pushes down heat loss by reducing the loss in heating mains and providing the possibility to regulate gas supply depending on the outdoor temperature, which considerably reduces natural gas losses.

The replacement of centralized heating by independent heating modules will reduce heat consumption both for technological needs and for heating, which will push down natural gas consumption without a loss in performance, leading to lower GHG emissions into the atmosphere.

Project implementation schedule

Table 8. The schedule of technological equipment implementation within the project at SE "Malyshev Plant"

Implementation within the project framework	Year of implementation					
	2007	2008	2009	2010	2011	2012
Reactive power compensators						
Chemical-set core manufacturing technology						
Bandsaw machines						
Direct-current electric arc furnaces for steel alloys						
Direct-current electric arc furnace for bronze and brass alloys						
Energy-saving gas furnaces						
Industrial-frequency induction heating of stamping and forging blanks						
SEIATSU automatic moulding line equipped with a system of mixture preparation for iron and steel foundry						
Replacement of metering devices						
Heating decentralization, building independent heating modules						

At the beginning of the project, SE "Malyshev Plant" only carried out measures to maintain operable condition of technological equipment used in the production process and operations in general. These activities included repairs to fix breakdowns and replacement of old malfunctioning equipment with similar units due to the low cost of the latter ones. The project provides for implementation of new energy-efficient technological equipment used for production of heat, pig iron, steel, non-ferrous metals and other products measured in tonnes, taking into account the latest trends. The average operating life of equipment installed within the project activity is 16 years if running at nominal rates. Upon due maintenance, no replacement of equipment installed is expected within this period, because the

technologies implemented are in line with the modern global practice. Training of SE "Malyshev Plant" employees will be carried out in accordance with the practice existing prior to the project. Yet, if necessary, i.e. if employees' qualification turns to be insufficient for proper operation of project equipment, the plantmakers will hold trainings and instructions under the equipment purchase contracts.

A.4.3. Brief explanation of how the anthropogenic emissions of greenhouse gases by sources are to be reduced by the proposed JI project, including why the emission reductions would not occur in the absence of the proposed project, taking into account national and/or sectoral policies and circumstances:

The pre-project condition of SE "Malyshev Plant" operations was rather poor. Most of equipment, being installed back in the Soviet times, was worn-out and obsolete, which caused low efficiency and high energy consumption per item of finished products. Taking account of the previous practice, we can say that this equipment is capable of operating for another 20 years on timely repairs. Due to limited financing, the absence of perspective industry development plan, the modernization of technological processes was risky and not economically feasible. On the legislative level, the production process at SE "Malyshev Plant" complied with all the requirements of state standards. Ukraine has not developed a system of incentives and subsidies for the reduction of GHG emissions into the atmosphere, which could have encouraged companies to implement similar project activities. Therefore, without the JI project, the modernization of technological equipment would be unlikely, which would entail high energy losses and GHG emissions to the atmosphere.

The project activity is aimed at the reduction of electricity and natural gas consumption by modernization of technological equipment used for production of heat, pig iron, steel, non-ferrous metals and other products measured in tonnes, by means of implementation of innovative energy efficient and energy saving equipment.

Thanks to the complex modernization of operations under the project "Implementation of the energy efficiency measures at SE "Malyshev Plant", energy resource consumption will drop to the minimum, causing a reduction of GHG emissions to the atmosphere.

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

Table 9. Estimated emission reductions for the period preceding the first commitment period (2007)

	Years
Duration before the crediting period	1
Year	Estimated annual emission reductions in tonnes of CO_2 equivalent
2007	75777
Total estimated emission reductions over the crediting period (tonnes of CO_2 equivalent)	75777
Annual average of estimated emission reductions over the crediting period (tonnes of CO_2 equivalent)	75777

Table 10. Estimated emission reductions over the first commitment period (2008-2012)

	Years
Duration of the crediting period	5
Year	Estimated annual emission reductions in tonnes of

	CO_2 equivalent
2008	70 748
2009	13 505
2010	64 523
2011	40 767
2012	40 767
Total estimated emission reductions over the crediting period (tonnes of CO_2 equivalent)	230 310
Annual average of estimated emission reduction over the crediting period (tonnes of CO_2 equivalent)	46 062

Table 11. Estimated emission reductions for the period following the first commitment period (2013-2022)

	Years
Length of the crediting period	10
Year	Estimate of annual emission reductions in tonnes of CO_2 equivalent
2013	40 767
2014	40 767
2015	40 767
2016	40 767
2017	40 767
2018	40 767
2019	40 767
2020	40 767
2021	40 767
2022	40 767
Total estimated emission reductions over the crediting period (tonnes of CO_2 equivalent)	407 670
Annual average of estimated emission reduction over the crediting period (tonnes of CO_2 equivalent)	40 767

For more details see Supporting Document 1.

Description of formulae used for preliminary calculation of emission reductions see Section D.1.4.

A.5. Project approval by the Parties involved:

Letter of Endorsement No.1463/23/7 dated 07/06/2012 for the JI project "Implementation of the energy efficiency measures at SE "Malyshev Plant" was issued by the State Environmental Investment Agency of Ukraine.
Upon the project analysis, the project design document (PDD) and the Determination Report will be submitted to the State Environmental Investment Agency of Ukraine to obtain a Letter of Approval.

SECTION B. Baseline

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

A baseline is the scenario that reasonably represents the anthropogenic emissions by sources of GHGs that would occur in the absence of the proposed project. The baseline should be established in accordance with the requirements of the "Guidance on criteria for baseline setting and monitoring," Version 03[12]. In line with the "Guidelines for users of the joint implementation project design document form," Version 04[13], a stepwise approach is used for baseline description and justification:

Step 1. Description and justification of the baseline chosen:

None of the existing methodologies can be applied for the proposed project aimed at the reduction of energy consumption at SE "Malyshev Plant". The project participant has chosen a JI-specific approach in accordance with paragraph 9 (a) of the "Guidance on criteria for baseline setting and monitoring", Version 03.

The baseline should be established by selecting the most plausible scenario from the list and description of alternatives based on conservative assumptions.
The following steps were applied to establish the most plausible baseline scenario:
1. Baseline alternatives were identified;
2. Alternatives least plausible in terms of technology and/or economy were excluded on justified basis.

The following factors are taken into account to establish the baseline and further justification of additionality in Section B.2:

- State policy and legislation in the metallurgical sector;
- Economic condition of Ukraine's heavy engineering and forecasted demand for services;
- Technical aspects of management and operation of the company's equipment;
- Availability of capital (including investment barriers);
- Local availability of technology / equipment;
- Prices and availability of fuel.

Besides, the uncertainty of the possibility of ERU generation due to lower activity beyond the project boundary or under force-majeure conditions.

Step 2. Application of the approach chosen
The choice of the plausible baseline alternative is based on estimation of alternative metallurgical production technologies and heavy engineering technologies which could possibly take place.
The following alternatives were analyzed:

Alternative 1.1: Continuation of the current practice, without the JI project implementation.
Alternative 1.2: Project activity without the use of the Joint Implementation mechanism.

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

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

Alternative 1.3: Partial implementation of the project (only some of project activities implemented) without the use of the JI mechanism.
A detailed analysis of each alternative is provided below.

Alternative 1.1
Continuation of the current practice with minimum repairs against general worsening of the technological manufacturing complex.

Current condition of Ukraine's metallurgical and heavy engineering sectors
Ukraine's metallurgical and heavy engineering sectors are in quite a poor condition, facing downward trends.
The technological level in these industries is very low, which pushes down the product quality and competitiveness in the global market; this also causes large consumption of energy resources per unit of output. In 1991-1998, the entire Ukrainian economy suffered a deep crisis. The steelmaking industry, always being one of basic industries, was also hit by these adverse trends. An effective tool to maintain the metallurgy was releasing the tax burden on the sector by the Law of Ukraine «On economic experiment at mining and metallurgical enterprises of Ukraine»[14]. In the following years, the situation somewhat stabilized and the market even saw a slight but steady growth. Starting 2005, the steelmaking industry faced a notable drop in production against the global trend towards overproduction of steel. This trend had a specially intense impact on Ukraine due to its underdevelopment in terms of technology. Sliding demand for domestic metallurgical products makes it rather complicated and indeed even impossible to modernize manufacturing technologies on a lack of money. Metallurgical enterprises, SE "Malyshev Plant" in particular, maintain their profitability by using affordable energy resources, thus cutting the production cost of their products. Taking into account the fact that metallurgical manufacturing in Ukraine is based on high-quality raw materials (coal, natural gas, iron ore, manganese, titanic ore, zirconium ore, non-ferrous ores and precious metal ore), as well as technological underdevelopment of this industry operating with low efficiency and large waste, the stable growth of production that took place since 2006 caused a surge in raw materials and energy consumption, which entailed tougher load on the regional environment. Heavy engineering sees similar trends, lacking technology modernization. The development of this industry influences the development of the other industries.
The situation in the metallurgical and the heavy engineering industries in general had its impact on SE "Malyshev Plant" in particular. Up to 80% of technological equipment currently in operation at the plant is obsolete and worn-out, being over 30 years old. However, long payback period and high cost of equipment make modernization of steelmaking and heavy engineering at SE "Malyshev Plant" unattractive for investments, taking account of the poor financial standing of the company. Despite the low efficiency rate, routine repairs can ensure operation of the existing equipment for another 15-20 years. Ukraine has no legislative basis to encourage modernization of the manufacture, so the company is not interested in energy efficiency measures, production modernization and the reduction of environmental impact. So far, Ukraine has not elaborated a development strategy for the metallurgical industry capable of reforming the sector in relatively short terms. Thus, it is unlikely that any external factors influence the ERU generation at the plant. SE "Malyshev Plant" has implemented measures to prevent force-majeure, which might affect operations, as well as measures to eliminate the possible

[14] http://zakon2.rada.gov.ua/laws/show/934-14

force-majeure consequences. Despite the lack of legislative solutions to encourage steelmakers to modernize production, the sector is still crucial for Ukrainian economy, so it is unlikely that Ukraine will take measures to minimise force majeure impact on the metallurgical sector if such.
This Alternative is the most plausible baseline scenario because:

- it provides the possibility to ensure the necessary production by increasing consumption of relatively affordable energy resources;
- it does not require investments into new technological equipment.

Therefore, *Alternative 1.1* can be considered the most plausible baseline.

Alternative 1.2
Project activity without the use of the Joint Implementation mechanism.
There are two barriers in this case: investment barrier (see Section B.2 for more details), because this scenario requires additional major investments and, having a huge payback period and high risks, is not attractive in terms of investments; and technological barrier, because the use of new modern equipment requires re-training of personnel. Equipment reconstruction to increase energy efficiency at the metallurgical plants is not a popular practice in Ukraine.
This Alternative is the least plausible baseline scenario, because it requires investments into new technological equipment and is characterized with a lack of qualified personnel to service this equipment. Therefore, *Alternative 1.2* cannot be considered the most plausible baseline.

Alternative 1.3
Partial implementation of the project (only some of project activities implemented) without the use of the JI mechanism.
Alternative 1.3 provides for the exclusion of some project implementation measures from the project boundary such as modernization of electricity meters with higher accuracy class devices, etc. Being a complex system, metallurgical manufacturing requires a complex approach to modernization, since partial implementation would not ensure a major decrease in fuel and energy consumption. Besides, *Alternative 1.3* requires investments into new technological equipment and is characterized by a lack of qualified servicing personnel, therefore *Alternative 1.3* cannot be considered a plausible baseline.

The analysis of the above alternatives shows that the most plausible baseline is *Alternative 1.1*, and the least plausible ones are *Alternative 1.2* and *Alternative 1.3*.

An additionality analysis in Section B.2 shows that *Alternative 1.2* and *Alternative 1.3* cannot be considered as the most plausible baselines from the financial viewpoint. These assumptions are supported in Section B.2. The analysis carried out in accordance with the "Tool for the demonstration and assessment of additionality" (Version 06.0.0) in Section B.2 showed that the project scenario is additional.

Baseline scenario

Baseline scenario provides for the continuation of the current practice with minimum repairs against general worsening of the technological manufacturing complex.
The baseline was set using company production data, as well as data on electricity and natural gas consumption during the 2004-2006 historical period. The pre-project efficiency rate was calculated as the average specific electricity and natural gas consumption per unit of manufacture over the three years of the above historical period. The calculation of the pre-project efficiency rate for the three years was used conservatively to exclude peak declines or rises of efficiency on external factors in one individual

year of the historical period. The pre-project efficiency rate helped to calculate GHG emissions in the course of production in each individual monitoring year, which would have taken place of the project were not implemented. Description of formulae to calculate GHG emissions in the baseline scenario is provided below:

$$BE_b^y = N_p^y * BPER, \quad \text{(B1)}$$

BE_b^y - total GHG emissions in the course of production in monitoring period *y* of the baseline scenario, t CO_2eq;

N_p^y - total production in monitoring period *y* of the project scenario, t;

$BPER$ - pre-project production efficiency rate, t CO_2eq/t;

$[y]$ - monitoring period;

$[b]$ - baseline scenario;

$[p]$ - project scenario.

$$BPER = \sum_{n=1}^{3} \frac{BE_b^j / N_b^j}{3}; \quad \text{(B2)}$$

$BPER$ - pre-project production efficiency rate, t CO_2eq/t;

BE_b^j - total GHG emissions in the course of production in historical period *j* of the baseline scenario, t CO_2eq;

N_b^j - total production in historical period *j* of the project scenario, t;

$[j]$ - historical period;

$[b]$ - baseline scenario;

$[3]$ - three years of the baseline scenario;

$$BE_b^j = BE_{b,ELEC}^j + BE_{b,NG}^j, \quad \text{(B3)}$$

BE_b^j - total GHG emissions in the course of production in historical period *j* of the baseline scenario, t CO_2eq); $BE_{b,ELEC}^j$ - GHG emissions from fossil fuel combustion during the generation of electricity consumed in technological production process, in historical period *j* of the baseline scenario, t CO_2eq);

$BE_{b,NG}^j$ - GHG emissions from combustion of natural gas used in the course of production in historical period *j* of the baseline scenario, t CO_2eq;

$[j]$ - historical period;

$[b]$ - baseline scenario;

$[ELEC]$ - electricity;

$[NG]$ - natural gas;

$$BE_{b,ELEC}^j = EC_b^j * EF_{b,CO2,ELEC}^j, \quad \text{(B4)}$$

$BE^{j}_{b,ELEC}$ - GHG emissions from combustion of fossil fuel used in the course of generation of electricity consumed in production in historical period *j* of the baseline scenario, t CO_2eq;

EC^{j}_{b} - total electricity consumption in historical period *j* of the baseline scenario, MWh;

$EF^{j}_{b,CO2,ELEC}$ - carbon dioxide emission factor for electricity consumption by consumers in historical period *j* of the baseline scenario, t CO_2/MWh;

$[j]$ - historical period;

$[b]$ - baseline scenario;

$[ELEC]$ - electricity;

$$BE^{j}_{b,NG} = FC^{j}_{b,NG} * NCV^{j}_{b,NG} * EF^{j}_{b,CO2,NG}, \quad \text{(B5)}$$

$BE^{j}_{b,NG}$ - GHG emissions from combustion of natural gas used in the course of production in historical period *j* of the baseline scenario, t CO_2eq;

$FC^{j}_{b,NG}$ - total natural gas consumption in historical period *j* of the baseline scenario, ths m^3;

$NCV^{j}_{b,NG}$ - net calorific value of natural gas in historical period *j* of the baseline scenario, TJ/ths m^3;

$EF^{j}_{b,CO2,NG}$ - default carbon dioxide emission factor for stationary natural gas combustion in historical period *j* of the baseline scenario, t CO_2 /TJ;

$[j]$ - historical period;

$[b]$ - baseline scenario;

$[NG]$ - natural gas;

$$EF^{j}_{b,CO2,NG} = EF^{j}_{b,C,NG} * OXID^{j}_{b,NG} * 44/12, \quad \text{(B6)}$$

$EF^{j}_{b,CO2,NG}$ - default carbon dioxide emission factor for stationary natural gas combustion in historical period *j* of the baseline scenario, t CO_2 /TJ;

$EF^{j}_{b,C,NG}$ - carbon emission factor for natural gas combustion in historical period *j* of the baseline scenario, t C /TJ;

$OXID^{j}_{b,NG}$ - carbon oxidation factor for natural gas combustion in historical period *j* of the baseline scenario, relative units;

$44/12$ - stoichiometric ratio of carbon dioxide and carbon molecular weight (t CO_2/t C);

$[j]$ - historical period;

$[b]$ - baseline scenario;

$[NG]$ - natural gas;

This scenario is less attractive in terms of future environment (including the first commitment period of 2008-2012), when greenhouse gas emissions stay at the same or even higher level, but from the economic viewpoint, this scenario is more attractive. Therefore, this practice is unable to ensure greenhouse gas emission reduction. Moreover, continued operation of old equipment (most of which was manufactured back in the USSR) would lead to higher natural gas and electricity consumption, which would have a bad impact on the environment due to GHG pollution.

For detailed algorithm of baseline calculation see Section D.1.

The following parameters were used for the baseline setting:

Data / Parameter	N_b^j
Data unit	t
Description	Total production in historical period *j* of the baseline scenario
Time of determination/monitoring	Once at the beginning of the project
Source of data (to be) used	Production rates by each shop are fixed in monthly form No.1-P and submitted to the economic planning department where annual form No.1-P-NPP "Routine report on production (goods and services) by types, tabular" is drawn up
Value of data applied (for ex ante calculations/determinations)	**2004**: 1186.7; **2005**: 1271.9; **2006**: 1211.6
Justification of the choice of data or description of measurement methods and procedures (to be) applied	N/A
QA/QC procedures (to be) applied	Information on production rates is official data of the company stored at the economic planning department for minimum 2 years following the transfer of the last emission reduction units and is annually submitted to the Main Statistics Administration of Kharkiv region.
Any comment	Information on production rates is the basis for greenhouse gas emission calculation, to be archived in paper and electronic form.

Data / Parameter	N_p^y
Data unit	t
Description	Total production in monitoring period *y* of the project scenario
Time of determination/monitoring	Annually
Source of data (to be) used	Production rates by each shop are fixed in monthly form No.1-P and submitted to the economic planning department where annual form No.1-P-NPP "Routine report on production (goods and services) by types, tabular" is drawn up
Value of data applied (for ex ante calculations/determinations)	The value is determined for each monitoring period.
Justification of the choice of data or description of measurement methods and procedures (to be) applied	N/A
QA/QC procedures (to be) applied	Information on production rates is official data of the company stored at the economic planning department for minimum 2 years following the transfer of the last emission reduction units and is annually submitted to the Main Statistics Administration of Kharkiv region.
Any comment	Information on production rates is the basis for greenhouse gas

	emission calculation, to be archived in paper and electronic form.

Data / Parameter	EC_b^j
Data unit	MWh
Description	Electricity consumption in historical period *j* of the baseline scenario
Time of determination/monitoring	Once at the beginning of the project
Source of data (to be) used	Based on monthly reports on electricity consumption by each shop individually, the chief power engineer department draws up periodic (annual or semiannual) forms No.24-enerhetyka and No.11-MTP for the entire plant.
Value of data applied (for ex ante calculations/determinations)	**2004**: 90586.00; **2005**: 82577.00; **2006**: 67476.00
Justification of the choice of data or description of measurement methods and procedures (to be) applied	To determine electricity consumed prior to the project implementation, a historical period of 2004-2006 (period j) was chosen
QA/QC procedures (to be) applied	Measurements were carried out with flow meters which were calibrated and verified on a regular basis in according with quality assurance procedures and Law of Ukraine "On metrology and metrological activity"[15]. Periodical report forms No.24-enerhetyka and No.11-MTP are stored for minimum 2 years after the transfer of the last emission reduction units at the chief power engineer department as well as at the Main Statistics Administration of Kharkiv region. Monthly reports on electricity consumption by the entire plant, verified by the chief power engineer department, are submitted to the energy supplying companies, then certificates of completion are drawn up, which are stored by both parties as an additional guarantee of data storage.
Any comment	Information on electricity consumption is the basis for greenhouse gas emission calculation, to be archived in paper and electronic form.

Data / Parameter	$EF_{b,CO2,ELEC}^j$
Data unit	tCO_2/MWh
Description	Carbon dioxide emission factor for electricity consumption by consumers in historical period *j* of the baseline scenario
Time of determination/monitoring	Once at the beginning of the project
Source of data (to be) used	Carbon dioxide emission factors for 2004-2005 are sourced from the Operational Guidelines for Project Design Documents of Joint Implementation Projects, Volume 1: General guidelines (ERUPT)[16];

[15] http://zakon.rada.gov.ua/cgi-bin/laws/main.cgi?nreg=1765-15

[16] http://ji.unfccc.int/CallForInputs/BaselineSettingMonitoring/ERUPT/index.html

	Carbon dioxide emission factors for 2006 are sourced from "Ukraine - Assessment of new calculation of CEF", approved by TUV SUD on 17/08/2007[17]
Value of data applied (for ex ante calculations/determinations)	2004: 0.916; 2005: 0.896; 2006: 0.896
Justification of the choice of data or description of measurement methods and procedures (to be) applied	N/A
QA/QC procedures (to be) applied	National carbon dioxide emission factors are used in the Joint Implementation project development; in the absence thereof ERUPT factors for 2004-2005 and factors from "Ukraine - Assessment of new calculation of CEF" for 2006 are used.
Any comment	Data allowing of calculation of GHG emissions in the baseline scenario will be archived in paper and electronic format.

Data / Parameter	$FC^{j}_{b,NG}$
Data unit	ths m^3
Description	total natural gas consumption in historical period *j* of the baseline scenario, ths m^3;
Time of determination/monitoring	Once at the beginning of the project
Source of data (to be) used	Based on monthly reports on electricity consumption by each shop individually, the chief power engineer department draws up periodic (annual or semiannual) forms No.11-MTP for the entire plant.
Value of data applied (for ex ante calculations/determinations)	2004: 16747.90; 2005: 18190.40; 2006: 13230.00
Justification of the choice of data or description of measurement methods and procedures (to be) applied	To determine natural gas consumed prior to the project implementation, a historical period of 2004-2006 (period j) was chosen Daily measurements of gas consumption will be held by the chief power engineer department using gas flow meters and then fixed in form No.11-MTП and stored in the chief power engineer department.
QA/QC procedures (to be) applied	Measurements were carried out with flow meters which were calibrated and verified on a regular basis in according with quality assurance procedures and Law of Ukraine "On metrology and metrological activity"[18]. Periodical report form No. 11-MTP is stored for minimum 2 years after the transfer of the last emission reduction units at the chief power engineer department as well as at the Main Statistics Administration of Kharkiv region. Monthly reports on natural gas consumption by the entire plant, verified by the chief power engineer department, are submitted to the energy supplying companies, then certificates of completion are drawn up, which are stored by both parties as an additional guarantee of data

[17] http://ji.unfccc.int/UserManagement/FileStorage/46JW2KL36KM0GEMI0PHDTQF6DVI514

[18] http://zakon1.rada.gov.ua/laws/show/113/98-%D0%B2%D1%80

	storage.
Any comment	Information on natural gas consumption is the basis for greenhouse gas emission calculation, to be archived in paper and electronic form.

Data / Parameter	$NCV^{j}_{b,NG}$
Data unit	TJ/ths m^3
Description	net calorific value of natural gas in historical period *j* of the baseline scenario
Time of determination/monitoring	Once at the beginning of the project
Source of data (to be) used	"National inventory report of anthropogenic emissions by sources and removals by sinks of greenhouse gases in Ukraine for 1990-2010" [19]
Value of data applied (for ex ante calculations/determinations)	**2004**: 33.82; **2005**: 33.82; **2006**: 33.85
Justification of the choice of data or description of measurement methods and procedures (to be) applied	N/A
QA/QC procedures (to be) applied	The National inventory report of anthropogenic emissions by sources and removals by sinks of greenhouse gases in Ukraine is an official report submitted to the Secretariat of the UN Framework Convention on Climate Change (UNFCCC).
Any comment	According to conservative principles minimal calorific value of gas is used. Net calorific value of natural gas combustion is the basis for greenhouse gas emission calculation, to be archived in paper and electronic form.

Data / Parameter	$EF^{j}_{b,C,NG}$
Data unit	t C/TJ
Description	Carbon emission factor for natural gas combustion in historical period *j* of the baseline scenario
Time of determination/monitoring	Once at the beginning of the project
Source of data (to be) used	"National inventory report of anthropogenic emissions by sources and removals by sinks of greenhouse gases in Ukraine for 1990-2010" [20]
Value of data applied	**2004** **2005** **2006**

19 http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/zip/ukr-2012-nir-13apr.zip
20 http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/zip/ukr-2012-nir-13apr.zip

(for ex ante calculations/determinations)	15.3 | 15.3 | 15.3
Justification of the choice of data or description of measurement methods and procedures (to be) applied	N/A
QA/QC procedures (to be) applied	The National inventory report of anthropogenic emissions by sources and removals by sinks of greenhouse gases in Ukraine is an official report submitted to the Secretariat of the UN Framework Convention on Climate Change (UNFCCC).
Any comment	Data allowing of calculation of GHG emissions in the baseline scenario will be archived in paper and electronic format.

Data / Parameter	$OXID_{b,NG}^{j}$
Data unit	Relative units
Description	Carbon oxidation factor for natural gas combustion in historical period *j* of the baseline scenario
Time of determination/monitoring	Once at the beginning of the project
Source of data (to be) used	"National inventory report of anthropogenic emissions by sources and removals by sinks of greenhouse gases in Ukraine for 1990-2010" [21]
Value of data applied (for ex ante calculations/determinations)	**2004** | **2005** | **2006** 0.995 | 0.995 | 0.995
Justification of the choice of data or description of measurement methods and procedures (to be) applied	N/A
QA/QC procedures (to be) applied	The National inventory report of anthropogenic emissions by sources and removals by sinks of greenhouse gases in Ukraine is an official report submitted to the Secretariat of the UN Framework Convention on Climate Change (UNFCCC).
Any comment	Data allowing of calculation of GHG emissions in the baseline scenario will be archived in paper and electronic format.

For more details on baseline emissions see Sections D, E and Annex 2.

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:

Anthropogenic greenhouse gas emissions in the project scenario will decrease due to complex modernization of manufacturing technology by implementation of project activities described above. Implementation of these activities will considerably reduce fuel and energy resources consumption during production, entailing a reduction of greenhouse gas emissions into the atmosphere.

21 http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/zip/ukr-2012-nir-13apr.zip

Additionality of the project

Additionality of the project activity is demonstrated and assessed below using the "Tool for the demonstration and assessment of additionality"[22] (Version 06.0.0). This tool was originally developed for CDM projects but it is also applicable to JI projects.

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

Sub-step 1a. Definition of alternatives to the project activity
There are three alternatives to this project (which have already been discussed in Section B.1 above):
Alternative 1.1: Continuation of the current practice, without the JI project implementation.
Alternative 1.2: Project activity without the use of the Joint Implementation mechanism.
Alternative 1.3: Partial implementation of the project (only some of project activities implemented) without the use of the JI mechanism.

Outcome of Sub-step 1a. One realistic alternative scenario to the project activity was identified.

Sub-step 1b. Consistency of the alternatives with mandatory laws and regulations
All the above alternatives are consistent with the current legislation. All alternatives can be considered realistic and plausible, taking account of the current national and / or sectoral standards as well as the existing circumstances and regime in the host country.
The national policy of Ukraine concerning pollutant emissions is based on the Law of Ukraine No.2556-III "On atmospheric air protection" dated 21/06/2001[23]. The Ministry of Environmental Protection of Ukraine issued Decree No.309 dated 27/06/2006[24] by which it approved standards of maximum allowable pollutant emissions from stationary sources, both operating and those under design, construction or modernization. Standards of maximum allowable pollutant emissions and their total limit the weight concentration of pollutants in organized emissions from stationary combustion (mg/m3) but contain no special requirements towards new technologies. Despite this fact, most steelmaking / heavy engineering companies of Ukraine, as mentioned above, still operate equipment implemented back in Soviet times.
Greenhouse gas emissions by stationary sources are not regulated by the above mentioned Decree of the Ministry of Environment. Standartization of greenhouse gas emissions will be implemented is the Government of Ukraine approves the National GHG Emission Distribution Plan and implementation of the National GHG Emission Trading System, which seems unlikely until 2020.
All the above-mentioned, as well as operational practice of steelmaking companies in Ukraine confirm the baseline consistency of the proposed JI project with national requirements and practice.
Outcome of Sub-step 1b. Under such circumstances, it is believed that all the scenarios are consistent with current laws and regulatory acts.

Therefore, Step 1 is satisfied.

[22] http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-01-v6.0.0.pdf

[23] http://zakon.rada.gov.ua/cgi-bin/laws/main.cgi?nreg=2707-12

[24] http://zakon1.rada.gov.ua/laws/show/z0912-06

According to the "Tool for the demonstration and assessment of additionality"[25] (Version 06.0.0), further justification of additionality shall be performed by means of investment analysis.

Step 2 – Investment analysis.
The main purpose of investment analysis is to determine whether the proposed project:

(a) is the most economically or financially attractive, or
(b) is economically or financially feasible without income from the sale of emission reduction units (ERUs) related to the JI project.

Sub-step 2a - Determination of appropriate analysis method.
There are three methods used for investment analysis:

- a simple cost analysis (Option I);
- an investment comparison analysis (Option II); and
- a benchmark analysis (Option III).

If the project activities and alternatives identified in Step 1 generate no financial or economic benefits other than JI related income, then the simple cost analysis (Option I) is applied. Otherwise, the investment comparison analysis (Option II) or the benchmark analysis (Option III) are used.
Additionality guidelines allow for performance of investment comparison analysis, which compares corresponding financial indicators for the most realistic and plausible investment alternatives (Option II), or the benchmark analysis (Option III). For this project it is appropriate to apply analysis using Option III, according to the instructions of the Tool for the demonstration and assessment of additionality.

Sub-step 2b – Benchmark analysis
The proposed project"Implementation of the energy efficiency measures at SE "Malyshev Plant" will be implemented by a project participant SE "Malyshev Plant". The approach proposed in paragraph 12 of the "Guidelines on the assessment of investment analysis" Version 05[26] provides for using of a discount rate that is determined by considering the weighted average cost of capital (WACC). WACC is calculated as a weighted average cost of own and debt capital. Since details on financing structure are not available, the structure of capital is taken in the form of 50% of own and 50% of debt capital. In accordance with paragraph 18 of the "Guidelines on the assessment of investment analysis"[27] ver. 05, the cost of own capital is calculated as the sum of risk-free rate (3%), the risk premium on investment in own capital (6.5%) and country risk (5.25%)[28], according to the "Default values for the expected return on equity"[29]. Thus, the cost of own capital is 14.75%. The cost of debt capital is estimated at the average cost of credit in foreign currency as of 2006 according to the NBU, which was 11.3%[30]. The nominal discount rate (WACC) equals to 13%. Cash flow is adjusted by inflation index for eurozone (2.4%)[31], since calculation is made in euros.

[25] http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-01-v6.0.0.pdf

[26] http://cdm.unfccc.int/Reference/Guidclarif/reg/reg_guid03.pdf

[27] http://cdm.unfccc.int/Reference/Guidclarif/reg/reg_guid03.pdf

[28] http://pages.stern.nyu.edu/~adamodar/pc/archives/ctryprem06.xls

[29] http://cdm.unfccc.int/Panels/meth/meeting/11/049/mp49_an14.pdf

[30] http://www.bank.gov.ua/doccatalog/document?id=51803

[31] http://www.finfacts.ie/inflation.htm

If the proposed project (not implemented as a JI project) has a less favourable rate, i.e. lower internal rate of return (IRR), than the total limit level, the project may not be considered as financially attractive.

Sub-step 2c – Calculation and comparison of financial indicators.

Financial analysis refers to the time of making investment decisions. The following assumptions were used based on information provided by the company.

The project requires investment of over EUR 9 mln (at the NBU exchange rate)[32];

1. The settlement period is 17 years (2006- 2022) from the starting date of the project to the end of project life;
2. The residual value is calculated as the result of multiplication of unused resource by initial expenses.

Analysis of cash flow takes into account the cash outflow connected with investment and operating costs[33] and cash inflow associated with the receipt of revenues from the sale of products by the enterprise.

The main topics of the interviews are summarized in Table 12.

Table 12. Financial indicators of the project

Revenues without VAT (ths EUR)	Cash flow (ths EUR)	dr (discount rate)	NPV (ths EUR)	IRR (%)	Residual value (ths EUR)
84 881	29 992	13%	-7 427	6.8%	54 889

The source of data on income and expenses of SE "Malyshev Plant" is information provided by the company.

When analysing the cash flow the IRR shows 6.8% that is below the established limit level of IRR which is 13%. As a result, the net present value (NPV) is negative. Therefore the project cannot be considered financially attractive.

Sub-step 2d: Sensitivity analysis

The sensitivity analysis is conducted to confirm whether the conclusions on the financial / economic attractiveness are stable enough for different reasoned variants of the change of baseline conditions.

The account of the following two key factors was taken in the sensitivity analysis: investment expenses as well as prices for products sold. According to the "Guidelines on the assessment of investment analysis" (Paragraph 21) the sensitivity analysis should be made for key indicators in the range of variation ± 10%.

Revenues for products sold

	-10%	0%	+10%
Operational costs	99 771 478.83	99 771 478.83	99 771 479
Investment costs	5 547 705.105	5 547 705.105	5 547 705.105
Company revenues	76 392 511.5	84 880 568.34	93 368 625
NPV (net present value)	-10 582 461.79	-7 427 038.71	-4 271 615.634
IRR (internal rate of return)	4.6%	6.8%	9.2%

[32] http://www.bank.gov.ua/doccatalog/document?id=42881

[33] Supporting Document 2

Investment costs

	-10%	0%	+10%
Operational costs	99 771 478.83	99 771 479	99 771 478.83
Investment costs	6 102 475.615	5 547 705.105	4 992 934.594
Company revenues	84 880 568.34	84 880 568.34	84 880 568.34
NPV (net present value)	-7 477 069.07	-7 427 038.71	-7 377 008.36
IRR (internal rate of return)	6.3%	6.8%	7.2%

Sensitivity analysis was used to assess the sensitivity of the project to changes that may occur during the project implementation and operation of new equipment. Analysis of changes in sales prices for products between -10% and +10% demonstrated that the IRR varies within 4.6% - 9.2%. Analysis of investment costs in the range of -10% and +10% demonstrated that the IRR varies within 6.3% - 7.2%. Expenditures that are considered in the framework of the project are high, and their increase will result in a negative NPV. Even expected price of the investment and the income from the sale of ERUs are unable to make the project viable and it will not bring enough profit to cover the operational and investment costs.

Outcome of Step 2: sensitivity analysis consistently supports (for a realistic range of assumptions) the conclusion that the project is unlikely to be financially / economically attractive.

Step 3: Barrier analysis
According to the Additionality guidelines, the barrier analysis was not conducted.

Step 4: Common practice analysis

Sub-step 4a. Analysis of other activities similar to the proposed project activity
Analysis similar activities demonstrated the absence of similar projects in Ukraine which share the additionality principle without the JI mechanism.
The existing practice of operation of the existing facilities presented in the baseline option chosen for this Project is the common one for Ukraine. There are no state programmes or policies to provide for mandatory modernization of equipment at processing operations. Due to the current practice all the modernization activities through implementation of more efficient production technologies shall be borne by the enterprise, and SE "Malyshev Plant" does not have any incentive to implement new equipment and technologies.

Outcome of Sub-step 4a: Since there are no similar projects in Ukraine, there is no need to conduct the analysis of similar project activity.
According to the "Tool for the demonstration and assessment of additionality"[34] (Version 06.0.0), all steps are satisfied although there are some obstacles.
One of them is additional expenses for the JI project implementation to modernize operations.

The obstacle is associated with the structure of the existing tariffs for products manufactured at SE "Malyshev Plant", which does not consider investment in improvement of metallurgical industry system, manufacturing of a wide range of products by creating appropriate conditions for the reduction of GHG emissions. This causes permanent lack of funding and impossibility to conduct timely overhauls, ensure stable operation of equipment and invest into industry modernization and development.

[34] http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-01-v6.0.0.pdf

We may conclude that the above-mentioned factors might hamper the implementation of the proposed project as well as other alternatives.
However, one of the alternatives is continuation of "business as usual" scenario (continuation of the current practice without the JI project implementation). Since the barriers identified above are directly related to investment in technology upgrade, SE "Malyshev Plant" has no obstacles for further operation of old equipment at the previous level. Therefore, the identified obstacles cannot prevent the introduction of at least one alternative scenario - "business as usual."

Conclusion
Based on the above analysis it can be concluded that the project is additional.

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

While manufacturing a wide range of products, SE "Malyshev Plant" uses the technological complex in its integrity. The complex consists of the following functional components: technological equipment to produce metallurgical and heavy engineering products, which consumes heat and electricity, uses heat generating equipment, flow meters, etc. Thus, the project boundary encompasses the entire technological complex of equipment to produce metallurgical products (pig iron, steel, non-ferrous metals), as well as equipment producing heavy engineering products measured in tonnes, heat generating equipment and flow meters at SE "Malyshev Plant" involved in production.

Table 13 contains an overview of greenhouse gases emission sources within the JI baseline scenario.

Table 13. Emission sources under the baseline scenario

Source	Gas	Included / excluded	Substantiation / Explanation
Baseline emissions			
GHG emissions from electricity consumption for production needs	CO_2	Included	In the course of production of the full range of metallurgical and partially of heavy engineering products, SE "Malyshev Plant" consumes electricity generated by fossil fuel combustion at a conventional power plant, which causes GHG emissions into the atmosphere.
GHG emissions from natural gas consumption for production needs	CO_2	Included	In the course of production of the full range of metallurgical and partially of heavy engineering products, SE "Malyshev Plant" consumes heat generated by natural gas combustion at a conventional power plant, which causes GHG emissions into the atmosphere.

Figure 13 illustrates the baseline boundary (outlined with a black line).

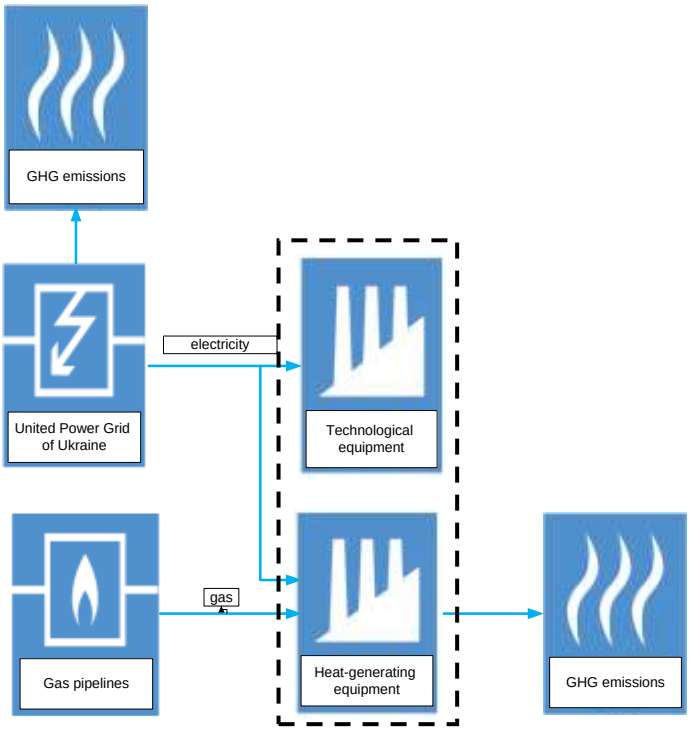

Figure 13. Baseline boundary

Table 14 contains an overview of greenhouse gases emission sources within the JI project scenario.

Table 14. Emission sources under the project scenario

Source	Gas	Included / excluded	Substantiation / Explanation
Project emissions			
GHG emissions from electricity consumption for production needs	CO_2	Included	In the course of production of the full range of metallurgical and partially of heavy engineering products, SE "Malyshev Plant" consumes electricity generated by fossil fuel combustion at a conventional power plant, which causes GHG emissions into the atmosphere.
GHG emissions from natural gas consumption for production needs	CO_2	Included	In the course of production of the full range of metallurgical and partially of heavy engineering products, SE "Malyshev Plant" consumes heat generated by natural gas combustion at a conventional power plant, which causes GHG emissions into the atmosphere.

Figure 14 illustrates the project boundary (enclosed in a black line).

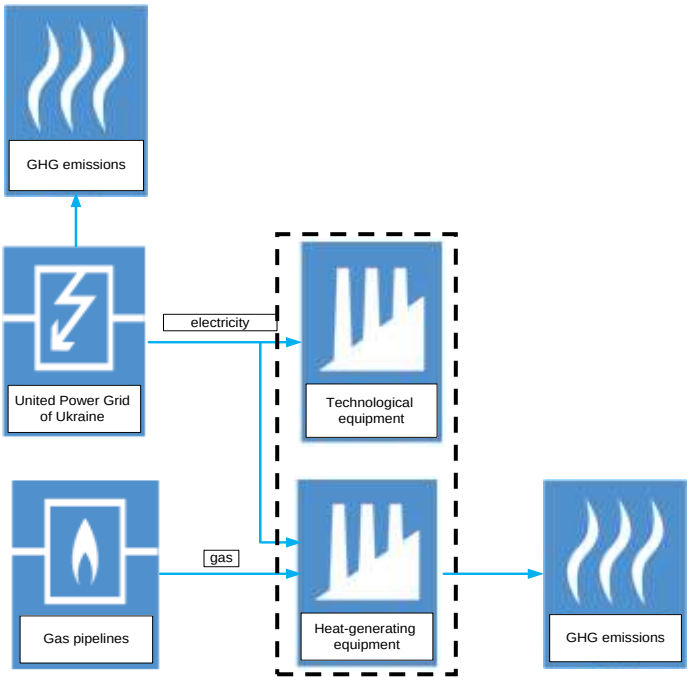

Figure 14. Project boundary

Indirect CO_2, CH_4, N_2O emissions (leakage) from fuel production and transportation are excluded. Leakage is beyond the control of the project developer (leakage cannot be measured) and therefore have been excluded.

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 baseline setting: 28/05/2012.
The baseline is identified by VEMA S.A., project developer and SE "Malyshev Plant"
State Enterprise "Malyshev Plant"
Mykola Bielov
Director General
Phone: +3 (057)759-09-59
Fax: +3 (057) 766-87-33
e-mail: marketing@malyshev.kharkov.ua
State Enterprise "Malyshev Plant" is a project participant (stated in Annex 1).

VEMA S.A.
Geneva, Switzerland
Fabian Knodel
Director:
Phone: +41 (76) 346 11 57
Fax: +41 (76) 346 11 57
e-mail: info@vemacarbon.com
VEMA S.A. is a project participant (stated in Annex 1).

SECTION C. Duration of the project / crediting period

C.1. Starting date of the project:

The starting date of the project is 03/01/2006, which is the date when the Management Board of SE "Malyshev Plant" made a decision to create a Joint Implementation project.

C.2. Expected operational lifetime of the project:

Project participants estimate the average operational life at nominal rates of the equipment implemented under the project at 16 years upon due maintenance.
Project lifetime is from 01/01/2007 to 31/12/2022 (16 years, or 192 months).

C.3. Length of the crediting period:

The duration of the crediting period in years and months is 16 years, or 192 months. The starting date of the crediting period is the date when the first emission reductions are expected to be generated, namely January 1, 2007. 01/01/2008- 31/12/2012 (5 years, or 60 months), prolongation 01/01/2013- 31/12/2022 (10 years, or 120 months)
The starting date of the crediting period is the date when the first emission reductions are expected to be generated, namely January 1, 2007. ERU generation belongs to the first commitment period of 5 years (January 1, 2008 – December 31, 2012). Prolongation of the crediting period beyond 2012 is subject to approval by the Host Party and estimation of emission reductions is presented separately for those until 2012 and those after 2012.
If after the first commitment period the Kyoto Protocol is prolonged, the crediting period under the project will be extended by 10 years/120 months until December 31, 2022.

SECTION D. Monitoring plan

D.1. Description of monitoring plan chosen:

The proposed project uses a JI-specific approach in accordance with p.9 (a) of the "Guidance on criteria for baseline setting and monitoring", Version 03[35].

The monitoring plan is designed for accurate and clear measurement and calculation of greenhouse gas emissions and is implemented according to practices established at SE "Mayshev Plant" for measurement of electricity and natural gas supplied as well as output volumes. Project monitoring does not require any changes in the existing system of data accounting and collection. All relevant data are calculated and recorded and stored within two years after the transfer of the last emission reduction units generated by the project.

The monitoring plan includes measures (measurements, maintenance, registration and calibration), which should be implemented to satisfy the requirements of the monitoring methodology chosen and guarantee verifiability of GHG emission reductions calculations. The main monitoring stages are described below.
Data and parameters not subject to monitoring during the crediting period but identified only once and are available at the PDD development stage:

N_b^j	Total production in historical period *j* of the baseline scenario, t
EC_b^j	Electricity consumption in historical period *j* of the baseline scenario, MWh
$EF_{b,CO2,ELEC}^j$	Carbon dioxide emission factor for electricity consumption by consumers, in historical period *j* of the baseline scenario, tCO_2/MWh
$FC_{b,NG}^j$	Total natural gas consumption in historical period *j* of the baseline scenario, ths m^3
$NCV_{b,NG}^j$	Net calorific value of natural gas in historical period *j* of the baseline scenario, TJ/ths m^3
$EF_{b,C,NG}^j$	Carbon emission factor for natural gas combustion in historical period *j* of the baseline scenario, t C /TJ
$OXID_{b,NG}^j$	Carbon oxidation factor for natural gas combustion in historical period *j* of the baseline scenario, relative units

$[j]$ - historical period;

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

$[b]$ - baseline scenario;

$[ELEC]$ - electricity;

$[NG]$ - natural gas;

Data and parameters not subject to monitoring during the crediting period but identified only once and are not available at the PDD development stage: none.

Data and parameters controlled during the whole crediting period:

N_p^y	Total production in monitoring period *y* of the project scenario, t
EC_p^y	Electricity consumption in monitoring period *y* of the project scenario, MWh
$EF_{p,CO2,ELEC}^y$	Carbon dioxide emission factor for electricity consumption by consumers, in historical period *j* of the baseline scenario, tCO_2/MWh
$FC_{p,NG}^y$	Total natural gas consumption in monitoring period *y* of the project scenario, ths m^3
$NCV_{p,NG}^y$	Net calorific value of natural gas in monitoring period *y* of the project scenario scenario, TJ/ths m^3
$EF_{p,C,NG}^y$	Carbon emission factor for natural gas combustion in monitoring period *y* of the project scenario, t C /TJ
$OXID_{p,NG}^y$	Carbon oxidation factor for natural gas combustion in monitoring period *y* of the project scenario, relative units

$[y]$ - monitoring period;

$[p]$ - project scenario;

$[ELEC]$ - electricity;

$[NG]$ - natural gas;

Tables of parameters for monitoring and verification of ERU calculation are provided in Sections **D.1.1.1** and **D.1.1.3.**

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

D.1.1.1. Data to be collected in order to monitor emissions from the project, and how these data will be archived:

Data / Parameter	EC_p^y
Data unit	MWh
Description	Electricity consumption in monitoring period *y* of the project scenario
Time of determination/monitoring	Daily
Source of data (to be) used	Based on monthly reports on electricity consumption by each shop individually, the chief power engineer department draws up periodic (annual or semiannual) forms No.24-enerhetyka and No.11-MTP for the entire plant.
Value of data applied (for ex ante calculations/determinations)	The value is determined for each monitoring period.
Justification of the choice of data or description of measurement methods and procedures (to be) applied	Daily readings of electricity meters are recorded in current month's logs and fixed in monthly reports on electricity consumption for each individual shop. Based on monthly reports on electricity consumption the chief power engineer department draws up periodic (annual or semiannual) forms No.24-enerhetyka and No.11-MTP submitted to the Main Statistics Administration of Kharkiv region.

QA/QC procedures (to be) applied	Measurements are carried out with flow meters which are calibrated and verified on a regular basis in according with quality assurance procedures and Law of Ukraine "On metrology and metrological activity"[36]. Periodical report forms No.24-enerhetyka and No.11-MTP are stored for minimum 2 years after the transfer of the last emission reduction units at the chief power engineer department as well as at the Main Statistics Administration of Kharkiv region. Monthly reports on electricity consumption by the entire plant, verified by the chief power engineer department, are submitted to the energy supplying companies, then certificates of completion are drawn up, which are stored by both parties as an additional guarantee of data storage.
Any comment	Information on electricity consumption is the basis for greenhouse gas emission calculation, to be archived in paper and electronic form.

Data / Parameter	$EF^{y}_{p,CO2,ELEC}$
Data unit	tCO_2/MWh
Description	Carbon dioxide emission factor for electricity consumption by consumers, in monitoring period *y* of the project scenario
Time of determination/monitoring	Annually

[36] http://zakon.rada.gov.ua/cgi-bin/laws/main.cgi?nreg=1765-15

Source of data (to be) used	Carbon dioxide emission factors for electricity consumption by consumers 2004-2005 are sourced from the Operational Guidelines for Project Design Documents of Joint Implementation Projects, Volume 1: General guidelines (ERUPT)[37]; Carbon dioxide emission factors for 2006-2007 are sourced from "Ukraine - Assessment of new calculation of CEF", approved by TUV SUD on 17/08/2007[38]; Carbon dioxide emission factors for 2008 are sourced from Decree No.62 of the National Agency of Ecological Investments of Ukraine (hereinafter NAEIU) dated 15/04/2011. "On approval of carbon dioxide emission factors for 2008"[39] Carbon dioxide emission factors for 2009 are sourced from NAEIU Decree No.63 dated 15/04/2011. "On approval of carbon dioxide emission factors for 2009"[40] Carbon dioxide emission factors for 2010 are sourced from theNAEIU Decree No.43 dated 28/03/2011 "On approval of carbon dioxide emission factors for 2010"[41] Carbon dioxide emission factors for 2011 are sourced from the NAEIU Decree No.75 dated 12/05/2011. "On approval of carbon dioxide emission factors for 2011"[42] If other carbon dioxide emission factors are adopted for Ukraine, the baseline will be recalculated for any reporting period in accordance with the monitoring plan.

[37] http://ji.unfccc.int/CallForInputs/BaselineSettingMonitoring/ERUPT/index.html

[38] http://ji.unfccc.int/UserManagement/FileStorage/46JW2KL36KM0GEMI0PHDTQF6DVI514

[39] http://www.neia.gov.ua/nature/doccatalog/document?id=127171

[40] http://www.neia.gov.ua/nature/doccatalog/document?id=127172

Value of data applied (for ex ante calculations/determinations)	<table><tr><th>2007</th><th>2008</th><th>2009</th><th>2010</th><th>2011</th></tr><tr><td>0.896</td><td>1.082</td><td>1.096</td><td>1.093</td><td>1.090</td></tr></table>
Justification of the choice of data or description of measurement methods and procedures (to be) applied	Only officially approved factors are used in calculations.
QA/QC procedures (to be) applied	National carbon dioxide emission factors are used in the Joint Implementation project development; in the absence thereof ERUPT factors for 2004-2006, TUV SUD CO2 Emission Factors for 2006-2007 are used.
Any comment	Data allowing of calculation of GHG emissions in the baseline scenario will be archived in paper and electronic format.

Data / Parameter	$FC^{y}_{p,NG}$
Data unit	ths m^3
Description	Total natural gas consumption in monitoring period *y* of the project scenario
Time of determination/monitoring	Daily
Source of data (to be) used	Based on monthly reports on electricity consumption by each shop individually, the chief power engineer department draws up periodic (annual or semi-annual) forms No.11-MTP for the entire plant.
Value of data applied (for ex ante calculations/determinations)	The value is determined for each monitoring period.

[41] http://www.neia.gov.ua/nature/doccatalog/document?id=126006

[42] http://www.neia.gov.ua/nature/doccatalog/document?id=127498

Justification of the choice of data or description of measurement methods and procedures (to be) applied	Daily measurements of gas consumption will be held by the chief power engineer department using gas flow meters and then fixed in form No.11-МТП and stored in the chief power engineer department.
QA/QC procedures (to be) applied	Measurements were carried out with flow meters which were calibrated and verified on a regular basis in accordance with quality assurance procedures and Law of Ukraine "On metrology and metrological activity"[43]. Periodical report form No. 11-MTP is stored for minimum 2 years after the transfer of the last emission reduction units at the chief power engineer department as well as at the Main Statistics Administration of Kharkiv region. Monthly reports on natural gas consumption by the entire plant, verified by the chief power engineer department, are submitted to the energy supplying companies, then certificates of completion are drawn up, which are stored by both parties as an additional guarantee of data storage.
Any comment	Information on natural gas consumption is the basis for greenhouse gas emission calculation, to be archived in paper and electronic form.

Data / Parameter	$NCV^{y}_{p,NG}$
Data unit	TJ/ths m^3
Description	Net calorific value of natural gas in monitoring period *y* of the project scenario
Time of determination/monitoring	Annually

[43] http://zakon.rada.gov.ua/cgi-bin/laws/main.cgi?nreg=1765-15

<table>
<tr><td>Source of data (to be) used</td><td>Net calorific value for natural gas is sourced from the "National inventory report of anthropogenic emissions by sources and removals by sinks of greenhouse gases in Ukraine for 1990-2010"[44]</td></tr>
<tr><td>Value of data applied (for ex ante calculations/determinations)</td><td>
<table>
<tr><th>Year</th><th>Generation of thermal energy and electricity</th><th>Iron and steel industry</th><th>Non-ferrous metallurgy</th><th>Other industries</th></tr>
<tr><td>2007</td><td>33.85</td><td>33.85</td><td>33.85</td><td>33.85</td></tr>
<tr><td>2008</td><td>34</td><td>33.8</td><td>34.1</td><td>34.0</td></tr>
<tr><td>2009</td><td>34.1</td><td>33.7</td><td>34.0</td><td>34.0</td></tr>
<tr><td>2010</td><td>34.1</td><td>33.8</td><td>33.9</td><td>34.0</td></tr>
<tr><td>2011</td><td>34.1</td><td>33.8</td><td>33.9</td><td>34.0</td></tr>
</table>
</td></tr>
<tr><td>Justification of the choice of data or description of measurement methods and procedures (to be) applied</td><td>N/A</td></tr>
<tr><td>QA/QC procedures (to be) applied</td><td>National inventory reports of anthropogenic emissions by sources and removals by sinks of greenhouse gases in Ukraine are official reports submitted to the Secretariat of the UN Framework Convention on Climate Change (UNFCCC).</td></tr>
<tr><td>Any comment</td><td>According to principle of conservatism minimal calorific value of gas is used. Values for 2011 were sourced from the "National inventory report of anthropogenic emissions by sources and removals by sinks of greenhouse gases in Ukraine for 1990-2010"[45]; if new inventory reports come into effect, new values will be set and ERUs will be recalculated for any reporting period in accordance with the monitoring plan. Net calorific value of natural gas combustion is the basis for greenhouse gas emission</td></tr>
</table>

[44] http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/zip/ukr-2012-nir-13apr.zip

[45] http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/zip/ukr-2012-nir-13apr.zip

	calculation, to be archived in paper and electronic form.

Data / Parameter	$EF^{y}_{p,C,NG}$
Data unit	t C/TJ
Description	Carbon emission factor for natural gas combustion in monitoring period *y* of the project scenario
Time of determination/monitoring	Annually
Source of data (to be) used	Carbon emission factor is sourced from the "National inventory report of anthropogenic emissions by sources and removals by sinks of greenhouse gases in Ukraine for 1990-2010"[46]
Value of data applied (for ex ante calculations/determinations)	**2007** 15.3 **2008** 15.17 **2009** 15.2 **2010** 15.17 **2011** 15.17
Justification of the choice of data or description of measurement methods and procedures (to be) applied	N/A
QA/QC procedures (to be) applied	National inventory reports of anthropogenic emissions by sources and removals by sinks of greenhouse gases in Ukraine are official reports submitted to the Secretariat of the UN Framework Convention on Climate Change (UNFCCC).
Any comment	Data allowing of calculation of GHG emissions in the baseline scenario will be archived in paper and electronic format. Values for 2011 were sourced from the "National inventory report of

[46] http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/zip/ukr-2012-nir-13apr.zip

	anthropogenic emissions by sources and removals by sinks of greenhouse gases in Ukraine for 1990-2010"[47]; if new inventory reports come into effect, new values will be set and ERUs will be recalculated for any reporting period in accordance with the monitoring plan.

Data / Parameter	$OXID^{y}_{p,NG}$
Data unit	Relative units
Description	Carbon oxidation factor for natural gas combustion in monitoring period *y* of the project scenario
Time of determination/monitoring	Annually
Source of data (to be) used	Carbon oxidation factor is sourced from the "National inventory report of anthropogenic emissions by sources and removals by sinks of greenhouse gases in Ukraine for 1990-2010"[48]
Value of data applied (for ex ante calculations/determinations)	**2007** 0.995 **2008** 0.995 **2009** 0.995 **2010** 0.995 **2011** 0.995
Justification of the choice of data or description of measurement methods and procedures (to be) applied	N/A
QA/QC procedures (to be) applied	National inventory reports of anthropogenic emissions by sources and removals by sinks of greenhouse gases in Ukraine are official

[47] http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/zip/ukr-2012-nir-13apr.zip

[48] http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/zip/ukr-2012-nir-13apr.zip

	reports submitted to the Secretariat of the UN Framework Convention on Climate Change (UNFCCC).
Any comment	Data allowing of calculation of GHG emissions in the baseline scenario will be archived in paper and electronic format. Values for 2011 were sourced from the "National inventory report of anthropogenic emissions by sources and removals by sinks of greenhouse gases in Ukraine for 1990-2010"[49]; if new inventory reports come into effect, new values will be set and ERUs will be recalculated for any reporting period in accordance with the monitoring plan.

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

$$PE_p^y = PE_{p,ELEC}^y + PE_{p,NG}^y, \quad (1)$$

PE_p^y - total GHG emissions from natural gas combustion and electricity consumption in the course of production in monitoring period *y* of the project scenario, t CO_2eq;

$PE_{p,ELEC}^y$ - GHG emissions from fossil fuel combustion in the course of generation of electricity consumed in the course of production in monitoring period *y* of the project scenario, t CO_2eq;

$PE_{p,NG}^y$ - GHG emissions from combustion of natural gas used in the course of production in monitoring period *y* of the project scenario, t CO_2eq;

$[y]$ - monitoring period;

$[p]$ - project scenario;

$[ELEC]$ - electricity;

$[NG]$ - natural gas;

[49] http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/zip/ukr-2012-nir-13apr.zip

$$PE^{y}_{p,ELEC} = EC^{y} * EF^{y}_{p,CO2,ELEC}, \quad (2)$$

$PE^{y}_{p,ELEC}$ - GHG emissions from fossil fuel combustion in the course of generation of electricity consumed in the course of production in monitoring period *y* of the project scenario, t CO_2eq;

EC^{y}_{p} - electricity consumption in monitoring period *y* of the project scenario, MWh;

$EF^{y}_{p,CO2,ELEC}$ -Carbon dioxide emission factor for electricity consumption by consumers, in monitoring period *y* of the project scenario, tCO2/MWh

$[y]$ - monitoring period;

$[p]$ - project scenario;

$[ELEC]$ - electricity;

$$PE^{y}_{p,NG} = FC^{y}_{p,NG} * NCV^{y}_{p,NG} * EF^{y}_{p,CO2,NG}, \quad (3)$$

$PE^{y}_{p,NG}$ - GHG emissions from combustion of natural gas used in the course of production in monitoring period *y* of the project scenario, t CO_2eq;

$FC^{y}_{p,NG}$ - total natural gas consumption in monitoring period *y* of the project scenario, ths m^3

$NCV^{y}_{p,NG}$ - net calorific value of natural gas in monitoring period *y* of the project scenario scenario, TJ/ths m^3

$EF^{y}_{p,CO2,NG}$ - default carbon dioxide emission factor for stationary natural gas combustion in monitoring period *y* of the project scenario, t CO_2/TJ;

$$EF^{y}_{p,CO2,NG} = EF^{y}_{p,C,NG} * OXID^{y}_{p,NG} * 44/12, \quad (4)$$

$EF^{y}_{p,CO2,NG}$ - default carbon dioxide emission factor for stationary natural gas combustion in monitoring period *y* of the project scenario, t CO_2/TJ;

$EF^{y}_{p,C,NG}$ - carbon emission factor for natural gas combustion in monitoring period *y* of the project scenario, t C /TJ

$OXID^{y}_{p,NG}$ - carbon oxidation factor for natural gas combustion in monitoring period *y* of the project scenario, relative units

$44/12$ - stoichiometric ratio of carbon dioxide and carbon molecular weight (t CO_2/t C);

$[y]$ - monitoring period;

$[p]$ - project scenario;
$[NG]$ - natural gas;

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:

Data / Parameter	N_p^y
Data unit	t
Description	Total production in monitoring period *y* of the project scenario
Time of determination/monitoring	Annually
Source of data (to be) used	Production rates by each shop are fixed in monthly form No.1-P and submitted to the economic planning department where annual form No.1-P-NPP "Routine report on production (goods and services) by types, tabular" is drawn up
Value of data applied (for ex ante calculations/determinations)	The value is determined for each monitoring period.
Justification of the choice of data or description of measurement methods and procedures (to be) applied	N/A
QA/QC procedures (to be) applied	Information on production rates is official data of the company stored at the economic planning department for minimum 2 years following the transfer of the last emission reduction units and is annually submitted to the Main Statistics Administration of Kharkiv region.
Any comment	Information on production rates is the basis for greenhouse gas emission calculation, to be archived in paper and electronic form.

Data / Parameter	N_b^j
Data unit	t
Description	Total production in historical period *j* of the baseline scenario
Time of determination/monitoring	Once at the beginning of the project
Source of data (to be) used	Production rates by each shop are fixed in monthly form No.1-P and submitted to the economic planning department where annual form No.1-P-NPP "Routine report on production (goods and services) by types, tabular" is drawn up
Value of data applied (for ex ante calculations/determinations)	**2004**: 1186.7; **2005**: 1271.9; **2006**: 1211.6
Justification of the choice of data or description of measurement methods and procedures (to be) applied	N/A
QA/QC procedures (to be) applied	Information on production rates is official data of the company stored at the economic planning department for minimum 2 years following the transfer of the last emission reduction units and is annually submitted to the Main Statistics Administration of Kharkiv region.
Any comment	Information on production rates is the basis for greenhouse gas emission calculation, to be archived in paper and electronic form.

Data / Parameter	EC_b^j
Data unit	MWh
Description	Electricity consumption in historical period *j* of the baseline scenario
Time of determination/monitoring	Once at the beginning of the project

Source of data (to be) used	Based on monthly reports on electricity consumption by each shop individually, the chief power engineer department draws up periodic (annual or semiannual) forms No.24-enerhetyka and No.11-MTP for the entire plant.
Value of data applied (for ex ante calculations/determinations)	**2004**: 90586.00; **2005**: 82577.00; **2006**: 67476.00
Justification of the choice of data or description of measurement methods and procedures (to be) applied	To determine electricity consumed prior to the project implementation, a historical period of 2004-2006 (period j) was chosen
QA/QC procedures (to be) applied	Measurements were carried out with flow meters which were calibrated and verified on a regular basis in according with quality assurance procedures and Law of Ukraine "On metrology and metrological activity"[50]. Periodical report forms No.24-enerhetyka and No.11-MTP are stored for minimum 2 years after the transfer of the last emission reduction units at the chief power engineer department as well as at the Main Statistics Administration of Kharkiv region. Monthly reports on electricity consumption by the entire plant, verified by the chief power engineer department, are submitted to the energy supplying companies, then certificates of completion are drawn up, which are stored by both parties as an additional guarantee of data storage.
Any comment	Information on electricity consumption is the basis for greenhouse gas emission calculation, to be archived in paper and electronic form.

Data / Parameter	$EF^{j}_{b,CO2,ELEC}$
Data unit	tCO_2/MWh

[50] http://zakon.rada.gov.ua/cgi-bin/laws/main.cgi?nreg=1765-15

Description	Carbon dioxide emission factor for electricity consumption by consumers in historical period *j* of the baseline scenario
Time of determination/monitoring	Once at the beginning of the project
Source of data (to be) used	Carbon dioxide emission factors for 2004-2005 are sourced from the Operational Guidelines for Project Design Documents of Joint Implementation Projects, Volume 1: General guidelines (ERUPT)[51] Carbon dioxide emission factors for 2006 are sourced from "Ukraine - Assessment of new calculation of CEF", approved by TUV SUD on 17/08/2007[52];
Value of data applied (for ex ante calculations/determinations)	**2004**: 0.916; **2005**: 0.896; **2006**: 0.896
Justification of the choice of data or description of measurement methods and procedures (to be) applied	N/A
QA/QC procedures (to be) applied	National carbon dioxide emission factors are used in the Joint Implementation project development; in the absence thereof ERUPT factors for 2004-2005 and factors from "Ukraine - Assessment of new calculation of CEF" for 2006 are used.
Any comment	Data allowing of calculation of GHG emissions in the baseline scenario will be archived in paper and electronic format.

Data / Parameter	$FC^{j}_{b,NG}$

[51] http://ji.unfccc.int/CallForInputs/BaselineSettingMonitoring/ERUPT/index.html

[52] http://ji.unfccc.int/UserManagement/FileStorage/46JW2KL36KM0GEMI0PHDTQF6DVI514

Data unit	ths m^3
Description	total natural gas consumption in historical period *j* of the baseline scenario, ths m^3;
Time of determination/monitoring	Once at the beginning of the project
Source of data (to be) used	Based on monthly reports on electricity consumption by each shop individually, the chief power engineer department draws up periodic (annual or semiannual) forms No.11-MTP for the entire plant.
Value of data applied (for ex ante calculations/determinations)	**2004**: 16747.90; **2005**: 18190.40; **2006**: 13230.00
Justification of the choice of data or description of measurement methods and procedures (to be) applied	To determine natural gas consumed prior to the project implementation, a historical period of 2004-2006 (period j) was chosen Daily measurements of gas consumption will be held by the chief power engineer department using gas flow meters and then fixed in form No.11-MTП and stored in the chief power engineer department.
QA/QC procedures (to be) applied	Measurements were carried out with flow meters which were calibrated and verified on a regular basis in according with quality assurance procedures and Law of Ukraine "On metrology and metrological activity"[53]. Periodical report form No. 11-MTP is stored for minimum 2 years after the transfer of the last emission reduction units at the chief power engineer department as well as at the Main Statistics Administration of Kharkiv region. Monthly reports on natural gas consumption by the entire plant, verified by the chief power engineer department, are submitted to the energy supplying companies, then certificates of completion are drawn up, which are stored by both parties as an additional guarantee of data storage.

[53] http://zakon1.rada.gov.ua/laws/show/113/98-%D0%B2%D1%80

Any comment	Information on natural gas consumption is the basis for greenhouse gas emission calculation, to be archived in paper and electronic form.

Data / Parameter	$NCV_{b,NG}^{j}$
Data unit	TJ/ths m^3
Description	net calorific value of natural gas in historical period *j* of the baseline scenario
Time of determination/monitoring	Once at the beginning of the project
Source of data (to be) used	"National inventory report of anthropogenic emissions by sources and removals by sinks of greenhouse gases in Ukraine for 1990-2010" [54]
Value of data applied (for ex ante calculations/determinations)	**2004**: 33.82; **2005**: 33.82; **2006**: 33.85
Justification of the choice of data or description of measurement methods and procedures (to be) applied	N/A
QA/QC procedures (to be) applied	The National inventory report of anthropogenic emissions by sources and removals by sinks of greenhouse gases in Ukraine is an official report submitted to the Secretariat of the UN Framework Convention on Climate Change (UNFCCC).
Any comment	According to conservative principles minimal calorific value of gas is used. Net calorific value of natural gas combustion is the basis for greenhouse gas emission calculation, to be archived in paper and electronic form.

54 http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/zip/ukr-2012-nir-13apr.zip

Data / Parameter	$EF^{j}_{b,C,NG}$
Data unit	t C/TJ
Description	Carbon emission factor for natural gas combustion in historical period *j* of the baseline scenario
Time of determination/monitoring	Once at the beginning of the project
Source of data (to be) used	"National inventory report of anthropogenic emissions by sources and removals by sinks of greenhouse gases in Ukraine for 1990-2010" [55]
Value of data applied (for ex ante calculations/determinations)	**2004**: 15.3; **2005**: 15.3; **2006**: 15.3
Justification of the choice of data or description of measurement methods and procedures (to be) applied	N/A
QA/QC procedures (to be) applied	The National inventory report of anthropogenic emissions by sources and removals by sinks of greenhouse gases in Ukraine is an official report submitted to the Secretariat of the UN Framework Convention on Climate Change (UNFCCC).
Any comment	Data allowing of calculation of GHG emissions in the baseline scenario will be archived in paper and electronic format.

Data / Parameter	$OXID^{j}_{b,NG}$
Data unit	Relative units
Description	Carbon oxidation factor for natural gas combustion in historical

55 http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/zip/ukr-2012-nir-13apr.zip

	period *j* of the baseline scenario
Time of determination/monitoring	Once at the beginning of the project
Source of data (to be) used	"National inventory report of anthropogenic emissions by sources and removals by sinks of greenhouse gases in Ukraine for 1990-2010" [56]
Value of data applied (for ex ante calculations/determinations)	**2004**: 0.995; **2005**: 0.995; **2006**: 0.995
Justification of the choice of data or description of measurement methods and procedures (to be) applied	N/A
QA/QC procedures (to be) applied	The National inventory report of anthropogenic emissions by sources and removals by sinks of greenhouse gases in Ukraine is an official report submitted to the Secretariat of the UN Framework Convention on Climate Change (UNFCCC).
Any comment	Data allowing of calculation of GHG emissions in the baseline scenario will be archived in paper and electronic format.

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

$$BE_b^y = N_p^y * BPER, \quad (5)$$

BE_b^y - total GHG emissions in the course of production in monitoring period *y* of the baseline scenario, t CO_2eq;

N_p^y - total production in monitoring period *y* of the project scenario, t;

56 http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/zip/ukr-2012-nir-13apr.zip

$BPER$ - pre-project production efficiency rate, t CO_2eq/t;

$[y]$ - monitoring period;

$[p]$ - project scenario;

$[b]$ - baseline scenario.

$$BPER = \sum_{n=1}^{3} \frac{BE_b^j \ / \ N_b^j}{3}; \quad (6)$$

BE_b^j - total GHG emissions in the course of production in historical period *j* of the baseline scenario, t CO_2eq;

N_b^j - total production in historical period *j* of the project scenario, t;

$[j]$ - historical period;

$[b]$ - baseline scenario;

$[3]$ - three years of the baseline scenario;

$$BE_b^j = BE_{b,ELEC}^j + BE_{b,NG}^j, \quad (7)$$

BE_b^j - total GHG emissions in the course of production in historical period *j* of the baseline scenario, t CO_2eq;

$BE_{b,ELEC}^j$ - GHG emissions from combustion of fossil fuel used in the course of generation of electricity consumed in production in historical period *j* of the baseline scenario, t CO_2eq;

$BE_{b,NG}^j$ - GHG emissions from combustion of natural gas used in the course of production in historical period *j* of the baseline scenario, t CO_2eq;

$[j]$ - historical period;

$[b]$ - baseline scenario;

$[ELEC]$ - electricity;

$[NG]$ - natural gas;

$$BE^{j}_{b,ELEC} = EC^{j}_{b} * EF^{j}_{b,CO2,ELEC}, \quad (8)$$

$BE^{j}_{b,ELEC}$ - GHG emissions from combustion of fossil fuel used in the course of generation of electricity consumed in production in historical period *j* of the baseline scenario, t CO_2eq;

EC^{j}_{b} - total electricity consumption in historical period *j* of the baseline scenario, MWh;

$EF^{j}_{b,CO2,ELEC}$ - carbon dioxide emission factor for electricity consumption by consumers in historical period *j* of the baseline scenario, t CO_2/MWh;

$[j]$ - historical period;

$[b]$ - baseline scenario;

$[ELEC]$ - electricity.

$$BE^{j}_{b,NG} = FC^{j}_{b,NG} * NCV^{j}_{b,NG} * EF^{j}_{b,CO2,NG}, \quad (9)$$

$BE^{j}_{b,NG}$ - GHG emissions from combustion of natural gas used in the course of production in historical period *j* of the baseline scenario, t CO_2eq;

$FC^{j}_{b,NG}$ - total natural gas consumption in historical period *j* of the baseline scenario, ths m^3;

$NCV^{j}_{b,NG}$ - net calorific value of natural gas in historical period *j* of the baseline scenario, TJ/ths m^3;

$EF^{j}_{b,CO2,NG}$ - default carbon dioxide emission factor for stationary natural gas combustion in historical period *j* of the baseline scenario, t CO_2 /TJ;

$[j]$ - historical period;

$[b]$ - baseline scenario;

$[NG]$ - natural gas;

$$EF^{j}_{b,CO2,NG} = EF^{j}_{b,C,NG} * OXID^{j}_{b,NG} * 44/12, \quad (10)$$

$EF^{j}_{b,CO2,NG}$ - default carbon dioxide emission factor for stationary natural gas combustion in historical period *j* of the baseline scenario, t CO_2 /TJ;

$EF^{j}_{b,C,NG}$ - carbon emission factor for natural gas combustion in historical period *j* of the baseline scenario, t C /TJ;

$OXID_{b,NG}^{j}$ - carbon oxidation factor for natural gas combustion in historical period *j* of the baseline scenario, relative units;

$44/12$ - stoichiometric ratio of carbon dioxide and carbon molecular weight (t CO_2/t C);

$[j]$ - historical period;

$[b]$ - baseline scenario;

$[NG]$ - natural gas;

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

D.1.2.1. Data to be collected in order to monitor emission reductions from the project, and how these data will be archived:								
ID number *(Please use numbers to ease cross-referencing to D.2.)*	Data variable	Source of data	Data unit	Measured (m), calculated (c), estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment

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:

GHG emissions from leakage within and beyond the project boundary, which may result from the project activity, are not expected to increase. The company conducts permanent control over natural gas consumption and pollution of operational premises, which ensures that leakage from technological equipment are absent. Gas pipelines - source of natural gas leaks - are not owned by project participants and cannot be included into the project boundary.

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):

N/A

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):

Emission reductions in the project scenario are calculated under the JI-specific approach:

$$ER^y = BE_b^y - PE_p^y \quad (11)$$

ER^y – emission reductions due to the project activity in monitoring period *y* of the project scenario, t CO_2eq;

BE_b^y - total GHG emissions from natural gas combustion and electricity consumption in the course of production in monitoring period *y* of the baseline scenario, t CO_2eq;

PE_p^y - total GHG emissions from natural gas combustion and electricity consumption in the course of production in monitoring period *y* of the project scenario, t CO_2eq;

$[y]$ - monitoring period;

$[p]$ - project scenario;

$[b]$ - baseline scenario.

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:

The company conducts systematic control over environmental emissions in accordance with the current legislation of Ukraine:

- Law of Ukraine No.1264-XII "On environmental protection"[57] dated 25/06/1991;
- Law of Ukraine No.2707-XII "On atmospheric air protection"[58] dated 16/10/1992;
- Current rules for emission restriction: "Standards of maximum permissible emissions of pollutants from stationary sources" approved by the Ministry of Environmental Protection of Ukraine dated 27/06/2006, No.309 and registered in the Ministry of Justice of Ukraine dated 01/09/2006, No.912/12786[59].

According to the above-mentioned laws, authorized entities carried out the Environmental Impact Assessment (EIA) at SE "Malyshev Plant" in 1997. Calculations showed that maximum concentration of near-earth pollutants is lower than the highest permissible concentrations. Emergency and breakaway releases are absent. Pollution of soil, soil waters, ground waters and water ponds is absent. In 2001, the "Draft standards of maximum permissible emissions of pollutants from stationary sources" were developed, which characterized the company as a source of atmospheric pollution. In accordance with this document, the company fills in report forms No.2-TP (air), No.2-TP (water facilities), No.1-ekolohichni vytraty (rivers).

Information on the environmental impact of the project is collected as part of the company's operations and stored for the entire project lifetime and two years after the transfer of the last emission reduction units generated by the project.

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.
N^y	Low	Information on output volumes is official data of the company submitted to and stored at the Main Statistics Administration of Kharkiv region.

[57] http://zakon2.rada.gov.ua/laws/show/1264-12

[58] http://zakon1.rada.gov.ua/laws/show/2707-12

[59] http://search.ligazakon.ua/l_doc2.nsf/link1/RE12786.html

EC^{y}	Low	Measurements are carried out with flow meters calibrated and verified on a regular basis in according with quality assurance procedures and Law of Ukraine "On metrology and metrological activity"[60]. Final results are fixed in official reports, submitted to state regulation entities for additional verification.
$EF^{y}_{CO2,ELEC}$	Low	National carbon dioxide emission factors are used in the Joint Implementation project development; in the absence thereof ERUPT factors for 2004-2006, TUV SUD CO2 Emission Factors for 2006-2007 are used.
FC^{y}_{NG}	Low	Measurements are carried out with flow meters calibrated and verified on a regular basis in according with quality assurance procedures and Law of Ukraine "On metrology and metrological activity"[61]. Final results are fixed in official reports, submitted to state regulation entities for additional verification.
NCV^{y}_{NG}	Low	National inventory reports of anthropogenic emissions by sources and removals by sinks of greenhouse gases in Ukraine are official reports submitted to the Secretariat of the UN Framework Convention on Climate Change (UNFCCC).
$EF^{y}_{C,NG}$	Low	National inventory reports of anthropogenic emissions by sources and removals by sinks of greenhouse gases in Ukraine are official reports submitted to the Secretariat of the UN Framework Convention on Climate Change (UNFCCC).

*for parameter definitions see Section D.1.

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

Since the monitoring plan is designed for accurate and clear measurement and calculation of greenhouse gas emissions, data necessary to calculate GHG emission reductions generated by the project are collected in accordance with the practice established at SE "Malyshev Plant".
The operational structure of the company envisages data collection, compilation and cross-verification, as part of monitoring plan preparation, as demonstrated in a figure below:

[60] http://zakon.rada.gov.ua/cgi-bin/laws/main.cgi?nreg=1765-15

[61] http://zakon.rada.gov.ua/cgi-bin/laws/main.cgi?nreg=1765-15

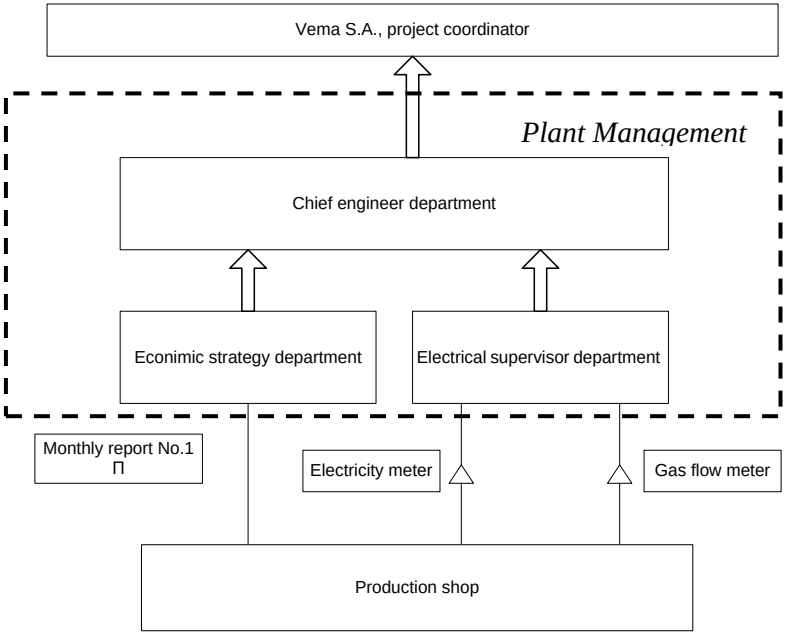

Figure 15. The structure of data collection and processing under the monitoring plan

Natural gas consumption by shops is measured by gas flow meters and fixed by the chief power engineer department employees in daily reports on natural gas consumption which afterwards constitute the basis of monthly reports. On the basis of the monthly reports, settlements with natural gas suppliers are made, upon which certificates of completion are drawn up to be stored in the economic planning department. Information reflected in monthly reports on natural gas consumption is fixed in periodical report form No.11-MTP and is submitted annually (or semi-annually) to the Statistics Administration of Kharkiv region.
Electricity consumption is measured by electricity meters and fixed by the chief power engineer department employees in daily reports on electricity consumption which afterwards constitute the basis of monthly reports. On the basis of the monthly reports, settlements with electricity suppliers are made, upon which certificates of completion are drawn up to be stored in the economic planning department. Information reflected in monthly reports on electricity consumption is fixed in periodical report form No.24-enerhetyka and is submitted annually (or semi-annually) to the Statistics Administration of Kharkiv region.
Every unit/tonne of production is duly registered in receipt and transfer invoices. Each shop of the company draws up a monthly report on output and submits it to the economic planning department where monthly production reports are drawn up for the whole plant. Based on monthly production reports for the entire plant, periodic form No.1-P-NPP is prepared and submitted to the Statistics Administration of Kharkiv region.

Data to be monitored and required for determination will be kept for two years after the last transfer of ERUs for the project.

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

The monitoring plan is identified by VEMA S.A., project developer and SE "Malyshev Plant", project owner.

State Enterprise "Malyshev Plant"
Mykola Bielov
Director General
Phone: +3 (057)759-09-59
Fax: +3 (057) 766-87-33
e-mail: marketing@malyshev.kharkov.ua
State Enterprise "Malyshev Plant" is a project participant (stated in Annex 1).

VEMA S.A.
Geneva, Switzerland
Fabian Knodel
Director:
Phone: +41 (76) 346 11 57
Fax: +41 (76) 346 11 57
e-mail: info@vemacarbon.com
VEMA S.A. is a project participant (stated in Annex 1).

SECTION E. Estimation of greenhouse gas emission reductions

E.1. Estimated project emissions:

Project emissions were estimated in accordance with the formulae given in Section D.1.1.2.
Results of the calculations are provided in the tables below. The calculations are stated in Supporting Document 1 annexed to the PDD.
For the period of 2007-2011, ex-post data on company output are used, while for the period of 2012-2022, ex-ante data are used taken from the company's development plan.

Table 15. Estimated project emissions for the period of January 1, 2007 – December 31, 2007

Year	Project emissions (t CO_2 equivalent)
2007	62 348
Total project emissions in 2007 (t CO_2 equivalent)	**62 348**

Table 16. Estimated project emissions for the period of January 1, 2008 – December 31, 2012

Year	Project emissions (t CO_2 equivalent)
2008	78 578
2009	69 214
2010	81 355
2011	69 736
2012	69 736
Total project emissions in 2008-2012 (t CO_2 equivalent)	**368 619**

Table 17. Estimated project emissions for the period of January 1, 2013 - December 31, 2022

Year	Project emissions (t CO_2 equivalent)
2013	69 736
2014	69 736
2015	69 736
2016	69 736
2017	69 736
2018	69 736
2019	69 736
2020	69 736
2021	69 736
2022	69 736
Total project emissions in 2013-2022 (t CO_2 equivalent)	**697 360**

E.2. Estimated leakage:

No leakage is expected. Natural gas leaks from technological equipment during the manufacturing process are absent. Gas pipelines fuelling the company as the source of natural gas leaks are not owned by project participants and cannot be included into the project boundary.

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

Since no leakage is expected, the sum of estimated project emissions and estimated leakage equals project emissions; the results are provided in tables below.

Table 18. Table containing the sum of estimated project emissions and estimated leakage prior to the first commitment period.

Year	Estimated project emissions (t CO_2 equivalent)	Estimated leakage (t CO_2 equivalent)	The sum of estimated project emissions and estimated leakage (t CO2 equivalent)
2007	62 348	0	62 348
Total (t CO_2 equivalent)	**62 348**	0	**62 348**

Table 19. Table containing the sum of estimated project emissions and estimated leakage during the first commitment period.

Year	Estimated project emissions (t CO_2 equivalent)	Estimated leakage (t CO_2 equivalent)	The sum of estimated project emissions and estimated leakage (t CO2 equivalent)
2008	78 578	0	78 578
2009	69 214	0	69 214
2010	81 355	0	81 355
2011	69 736	0	69 736
2012	69 736	0	69 736
Total (t CO_2 equivalent)	**368 619**	0	**368 619**

Table 20. Table containing the sum of estimated project emissions and estimated leakage after the first commitment period.

Year	Estimated project emissions (t CO_2 equivalent)	Estimated leakage (t CO_2 equivalent)	The sum of estimated project emissions and estimated leakage (t CO2 equivalent)
2013	69 736	0	69 736
2014	69 736	0	69 736
2015	69 736	0	69 736
2016	69 736	0	69 736
2017	69 736	0	69 736
2018	69 736	0	69 736
2019	69 736	0	69 736
2020	69 736	0	69 736
2021	69 736	0	69 736
2022	69 736	0	69 736
Total (t CO_2 equivalent)	**697 360**	0	**697 360**

E.4. Estimated baseline emissions:

Baseline emissions were estimated in accordance with the formulae given in Section D.1.1.4.
Results of the calculations are provided in the tables below. The calculations are stated in Supporting Document 1 annexed to the PDD.

For the period of 2007-2011, ex-post data on company output are used, while for the period of 2012-2022, ex-ante data are used taken from the company´s development plan as well as the strategic plan for metallurgy and heavy engineering industries.

Table 21. Estimated baseline emissions for the period of January 1, 2007– December 31, 2007

Year	Estimated baseline emissions (t CO_2 equivalent)
2007	138 125
Total baseline emissions in 2007 (t CO_2 equivalent)	**138 125**

Table 22. Estimated baseline emissions for the period of January 1, 2008 – December 31, 2012

Year	Estimated baseline emissions (t CO_2 equivalent)
2008	149 326
2009	82 719
2010	145 878
2011	110 503
2012	110 503
Total baseline emissions in 2008-2012 (t CO_2 equivalent)	**598 929**

Table 23. Estimated baseline emissions for the period January 1, 2013 – December 31, 2022

Year	Estimated baseline emissions (t CO_2 equivalent)
2013	110 503
2014	110 503
2015	110 503
2016	110 503
2017	110 503
2018	110 503
2019	110 503
2020	110 503
2021	110 503
2022	110 503
Total baseline emissions in 2013-2022 (t CO_2 equivalent)	**1 105 030**

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

Emission reductions are calculated according to formula (15) given in section D.1.4.
Results are provided in the tables below. The calculations are provided in the Supporting Document 1, attached to the PDD.

Table 24. Estimated emission reductions for the period of January 1, 2007– December 31, 2007

Year	Estimated emission reductions (t CO_2 equivalent)
2007	75 777
Total estimated emission reductions in 2007 (t CO_2 equivalent)	**75 777**

Table 25. Estimated emission reductions for the period of January 1, 2008 – December 31, 2012

Year	Estimated emission reductions (t CO_2 equivalent)
2008	70 748
2009	13 505
2010	64 523
2011	40 767
2012	40 767
Total estimated emission reductions in 2008-2012 (t CO_2 equivalent)	**230 310**

Table 26. Estimated emission reductions for the period of January 1, 2013 - December 31, 2022

Year	Estimated emission reductions (t CO_2 equivalent)
2013	40 767
2014	40 767
2015	40 767
2016	40 767
2017	40 767
2018	40 767
2019	40 767
2020	40 767
2021	40 767
2022	40 767
Total estimated emission reductions in 2013-2022 (t CO_2 equivalent)	**407 670**

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

Table 27. Table containing results of estimation of emission reductions for the period from January 1, 2007 to December 31, 2007

Year	Estimated project emissions (t CO_2 equivalent)	Estimated leakage (t CO_2 equivalent)	Estimated baseline emissions (t CO_2 equivalent)	Estimated emission reduction (t CO_2 equivalent)
2007	62 348	0	138 125	75 777
Total estimated emission reductions (t CO_2 equivalent)	**62 348**	0	**138 125**	**75 777**

Table 28. Table containing results of estimation of emission reductions for the period from January 1, 2008 to December 31, 2012

Year	Estimated project emissions (t CO_2 equivalent)	Estimated leakage (t CO_2 equivalent)	Estimated baseline emissions (t CO_2 equivalent)	Estimated emission reduction (t CO_2 equivalent)
2008	78 578	0	149 326	70 748
2009	69 214	0	82 719	13 505
2010	81 355	0	145 878	64 523
2011	69 736	0	110 503	40 767

2012	69 736	0	110 503	40 767
Total estimated emission reductions (t CO_2 equivalent)	**368 619**	0	**598 929**	**230 310**

Table 29. Table containing results of estimation of emission reductions for the period from January 1, 2013 to December 31, 2022

Year	Estimated project emissions (t CO_2 equivalent)	Estimated leakage (t CO_2 equivalent)	Estimated baseline emissions (t CO_2 equivalent)	Estimated emission reduction (t CO_2 equivalent)
2013	69 736	0	110 503	40 767
2014	69 736	0	110 503	40 767
2015	69 736	0	110 503	40 767
2016	69 736	0	110 503	40 767
2017	69 736	0	110 503	40 767
2018	69 736	0	110 503	40 767
2019	69 736	0	110 503	40 767
2020	69 736	0	110 503	40 767
2021	69 736	0	110 503	40 767
2022	69 736	0	110 503	40 767
Total estimated emission reductions (t CO_2 equivalent)	**697 360**	0	**1 105 030**	**407 670**

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:

All the required documents for the environmental impact assessment is as follows:

- Law of Ukraine No.1264-XII "On environmental protection"[62] dated 25/06/1991;
- Law of Ukraine No.2707-XII "On atmospheric air protection"[63] dated 16/10/1992;
- Current rules for emission restriction: "Standards of maximum permissible emissions of pollutants from stationary sources" approved by the Ministry of Environmental Protection of Ukraine dated 27/06/2006, No.309 and registered in the Ministry of Justice of Ukraine dated 01/09/2006, No.912/12786[64].

Implementation of this project will increase the efficiency of the production process at SE "Malyshev Plant". The experience of SE "Malyshev Plant" employees and compliance with labour protection standards will minimize the possibility of emergencies during the project implementation.

Transboundary impacts from the project activity, according to their definition in the text of "Convention on long-range transboundary pollution" ratified by Ukraine, will not take place.

No negative impact is expected as a result of the project implementation.
SE "Malyshev Plant has all necessary permits and licences for its activities. Main contracts for the purchase of raw materials and electricity have been signed and revised on the annual basis, according to the current practice.

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:

According to the law of Ukraine "On Environmental Protection" and DBN A.2.2-1-2003 "Composition and content of the materials of environment impact assessment (EIA) for design and construction of plants, buildings and structures"[65], SE "Malyshev Plant" is not obliged to carry out the EIA development for this type of project, because it has no negative impact on the environment.

[62] http://zakon2.rada.gov.ua/laws/show/1264-12

[63] http://zakon2.rada.gov.ua/laws/show/2707-12

[64] http://www.budinfo.org.ua/doc/1815297.jsp

[65] http://www.proxima.com.ua/dbn/articles.php?clause=6

SECTION G. Stakeholders' comments

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

Since the project activity does not provide for any negative environmental or social impact, there was no necessity to hold special public discussions. Stakeholders were consulted with by local authorities at their meetings.

The programme for better efficiency of fuel and energy resources is spotlighted regularly in mass media[66]:
Numerous publications of company's employees in specialized national periodicals took place.

[66] http://profsoyuz.kh.ua/Zavod_imeni_Malisheva_budut_modernizirovat__gendirektor_zavoda
http://infa.kharkov.ua/zavod-im-malysheva-budet-reorganizovan/
http://news.kompass.ua/news/2009-03-19-9263
http://www.ukrrudprom.ua/digest/dtyghhhg250907.html
http://www.energoshop.in.ua/news/35.html

Annex 1

CONTACT INFORMATION ON PROJECT PARTICIPANTS

State Enterprise "Malyshev Plant", project owner

Organisation:	State Enterprise "Malyshev Plant"
Street/P.O.Box:	Plekhanivska
Building:	126
City:	Kharkiv
State/Region:	Kharkiv region
Postal code:	61037
Country:	Ukraine
Phone:	(057) 759-09-59
Fax:	(057) 766-87-33
E-mail:	marketing@malyshev.kharkov.ua
URL:	www.malyshevplant.com
Represented by:	
Title:	Director General
Salutation:	Mister
Last name:	Bielov
Middle name:	
First name:	Mykola
Department:	
Phone (direct):	
Fax (direct):	(057) 739-31-01
Mobile:	
Personal e-mail:	sekr@malyshev.kharkov.ua

VEMA S.A., project developer, ERU buyer

Organisation:	VEMA S.A.
Street/P.O.Box:	Route de Thonon
Building:	45
City:	Geneva
State/Region:	
Postal code:	Case postale 170 CH-1222 Vésenaz
Country:	Switzerland
Phone:	+41 (76) 346 11 57
Fax:	+41 (76) 346 11 57
E-mail:	info@vemacarbon.com
URL:	www.vemacarbon.com
Represented by:	
Title:	Director
Salutation:	Mister
Last name:	Knodel
Middle name:	
First name:	Fabian
Department:	
Phone (direct):	+41 (76) 346 11 57
Fax (direct):	+41 (76) 346 11 57

Mobile:	
Personal e-mail:	

Annex 2

BASELINE INFORMATION

A **baseline** is the scenario that reasonably represents the anthropogenic emissions by sources of GHGs that would occur in the absence of the proposed project. The baseline should be established in accordance with the requirements of the "Guidance on criteria for baseline setting and monitoring," Version 03 [67]. In line with the "Guidelines for users of the joint implementation project design document form," Version 04[68], a stepwise approach is used for baseline description and justification:

None of the existing methodologies can be applied for the proposed project aimed at the reduction of energy consumption at SE "Malyshev Plant". The project participant has chosen a JI-specific approach in accordance with paragraph 9 (a) of the "Guidance on criteria for baseline setting and monitoring", Version 03.

The following parameters were used for the baseline setting:

Data / Parameter	N_b^j
Data unit	t
Description	Total production in historical period *j* of the baseline scenario
Time of determination/monitoring	Once at the beginning of the project
Source of data (to be) used	Production rates by each shop are fixed in monthly form No.1-P and submitted to the economic planning department where annual form No.1-P-NPP "Routine report on production (goods and services) by types, tabular" is drawn up
Value of data applied (for ex ante calculations/determinations)	**2004**: 1186.7; **2005**: 1271.9; **2006**: 1211.6
Justification of the choice of data or description of measurement methods and procedures (to be) applied	N/A
QA/QC procedures (to be) applied	Information on production rates is official data of the company stored at the economic planning department for minimum 2 years following the transfer of the last emission reduction units and is annually submitted to the Main Statistics Administration of Kharkiv region.
Any comment	Information on production rates is the basis for greenhouse gas emission calculation, to be archived in paper and electronic form.

Data / Parameter	N_p^y
Data unit	t
Description	Total production in monitoring period *y* of the project scenario
Time of	Annually

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

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

determination/monitoring	
Source of data (to be) used	Production rates by each shop are fixed in monthly form No.1-P and submitted to the economic planning department where annual form No.1-P-NPP "Routine report on production (goods and services) by types, tabular" is drawn up
Value of data applied (for ex ante calculations/determinations)	The value is determined for each monitoring period.
Justification of the choice of data or description of measurement methods and procedures (to be) applied	N/A
QA/QC procedures (to be) applied	Information on production rates is official data of the company stored at the economic planning department for minimum 2 years following the transfer of the last emission reduction units and is annually submitted to the Main Statistics Administration of Kharkiv region.
Any comment	Information on production rates is the basis for greenhouse gas emission calculation, to be archived in paper and electronic form.

Data / Parameter	EC_b^j
Data unit	MWh
Description	Electricity consumption in historical period *j* of the baseline scenario
Time of determination/monitoring	Once at the beginning of the project
Source of data (to be) used	Based on monthly reports on electricity consumption by each shop individually, the chief power engineer department draws up periodic (annual or semiannual) forms No.24-enerhetyka and No.11-MTP for the entire plant.
Value of data applied (for ex ante calculations/determinations)	**2004**: 90586.00; **2005**: 82577.00; **2006**: 67476.00
Justification of the choice of data or description of measurement methods and procedures (to be) applied	To determine electricity consumed prior to the project implementation, a historical period of 2004-2006 (period j) was chosen
QA/QC procedures (to be) applied	Measurements were carried out with flow meters which were calibrated and verified on a regular basis in according with quality assurance procedures and Law of Ukraine "On metrology and metrological activity"[69]. Periodical report forms No.24-enerhetyka and No.11-MTP are stored for minimum 2 years after the transfer of the last emission reduction units at the chief power engineer department as well as at the Main Statistics Administration of Kharkiv region. Monthly reports on electricity consumption by the entire plant, verified by the chief power engineer department, are submitted to the energy supplying companies, then certificates of completion are drawn up, which are stored by both parties as an

[69] http://zakon.rada.gov.ua/cgi-bin/laws/main.cgi?nreg=1765-15

	additional guarantee of data storage.
Any comment	Information on electricity consumption is the basis for greenhouse gas emission calculation, to be archived in paper and electronic form.

Data / Parameter	$EF^{j}_{b,CO2,ELEC}$
Data unit	tCO_2/MWh
Description	Carbon dioxide emission factor for electricity consumption by consumers in historical period *j* of the baseline scenario
Time of determination/monitoring	Once at the beginning of the project
Source of data (to be) used	Carbon dioxide emission factors for 2004-2005 are sourced from the Operational Guidelines for Project Design Documents of Joint Implementation Projects, Volume 1: General guidelines (ERUPT)[70]; Carbon dioxide emission factors for 2006 are sourced from "Ukraine - Assessment of new calculation of CEF", approved by TUV SUD on 17/08/2007[71]
Value of data applied (for ex ante calculations/determinations)	**2004**: 0.916; **2005**: 0.896; **2006**: 0.896
Justification of the choice of data or description of measurement methods and procedures (to be) applied	N/A
QA/QC procedures (to be) applied	National carbon dioxide emission factors are used in the Joint Implementation project development; in the absence thereof ERUPT factors for 2004-2005 and factors from "Ukraine - Assessment of new calculation of CEF" for 2006 are used.
Any comment	Data allowing of calculation of GHG emissions in the baseline scenario will be archived in paper and electronic format.

Data / Parameter	$FC^{j}_{b,NG}$
Data unit	ths m^3
Description	total natural gas consumption in historical period *j* of the baseline scenario, ths m^3;
Time of determination/monitoring	Once at the beginning of the project
Source of data (to be) used	Based on monthly reports on electricity consumption by each shop individually, the chief power engineer department draws up periodic (annual or semiannual) forms No.11-MTP for the entire plant.
Value of data applied	**2004** | **2005** | **2006**

[70] http://ji.unfccc.int/CallForInputs/BaselineSettingMonitoring/ERUPT/index.html

[71] http://ji.unfccc.int/UserManagement/FileStorage/46JW2KL36KM0GEMI0PHDTQF6DVI514

(for ex ante calculations/determinations)	16747.90 | 18190.40 | 13230.00
Justification of the choice of data or description of measurement methods and procedures (to be) applied	To determine natural gas consumed prior to the project implementation, a historical period of 2004-2006 (period j) was chosen Daily measurements of gas consumption will be held by the chief power engineer department using gas flow meters and then fixed in form No.11-МТП and stored in the chief power engineer department.
QA/QC procedures (to be) applied	Measurements were carried out with flow meters which were calibrated and verified on a regular basis in according with quality assurance procedures and Law of Ukraine "On metrology and metrological activity"[72]. Periodical report form No. 11-MTP is stored for minimum 2 years after the transfer of the last emission reduction units at the chief power engineer department as well as at the Main Statistics Administration of Kharkiv region. Monthly reports on natural gas consumption by the entire plant, verified by the chief power engineer department, are submitted to the energy supplying companies, then certificates of completion are drawn up, which are stored by both parties as an additional guarantee of data storage.
Any comment	Information on natural gas consumption is the basis for greenhouse gas emission calculation, to be archived in paper and electronic form.

Data / Parameter	$NCV_{b,NG}^{j}$
Data unit	TJ/ths m^3
Description	net calorific value of natural gas in historical period *j* of the baseline scenario
Time of determination/monitoring	Once at the beginning of the project
Source of data (to be) used	"National inventory report of anthropogenic emissions by sources and removals by sinks of greenhouse gases in Ukraine for 1990-2010" [73]
Value of data applied (for ex ante calculations/determinations)	**2004** | **2005** | **2006** 33.82 | 33.82 | 33.85
Justification of the choice of data or description of measurement methods and procedures (to be) applied	N/A
QA/QC procedures (to be) applied	The National inventory report of anthropogenic emissions by sources and removals by sinks of greenhouse gases in Ukraine is an official report submitted to the Secretariat of the UN Framework Convention on Climate Change (UNFCCC).
Any comment	According to conservative principles minimal calorific value of gas is used. Net calorific value of natural gas combustion is the basis

[72] http://zakon1.rada.gov.ua/laws/show/113/98-%D0%B2%D1%80
73http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/zip/ukr-2012-nir-13apr.zip

	for greenhouse gas emission calculation, to be archived in paper and electronic form.

Data / Parameter	$EF^{j}_{b,C,NG}$
Data unit	t C/TJ
Description	Carbon emission factor for natural gas combustion in historical period *j* of the baseline scenario
Time of determination/monitoring	Once at the beginning of the project
Source of data (to be) used	"National inventory report of anthropogenic emissions by sources and removals by sinks of greenhouse gases in Ukraine for 1990-2010" [74]
Value of data applied (for ex ante calculations/determinations)	**2004**: 15.3; **2005**: 15.3; **2006**: 15.3
Justification of the choice of data or description of measurement methods and procedures (to be) applied	N/A
QA/QC procedures (to be) applied	The National inventory report of anthropogenic emissions by sources and removals by sinks of greenhouse gases in Ukraine is an official report submitted to the Secretariat of the UN Framework Convention on Climate Change (UNFCCC).
Any comment	Data allowing of calculation of GHG emissions in the baseline scenario will be archived in paper and electronic format.

Data / Parameter	$OXID^{j}_{b,NG}$
Data unit	Relative units
Description	Carbon oxidation factor for natural gas combustion in historical period *j* of the baseline scenario
Time of determination/monitoring	Once at the beginning of the project
Source of data (to be) used	"National inventory report of anthropogenic emissions by sources and removals by sinks of greenhouse gases in Ukraine for 1990-2010" [75]
Value of data applied (for ex ante calculations/determinations)	**2004**: 0.995; **2005**: 0.995; **2006**: 0.995
Justification of the choice of data or description of measurement methods and procedures (to be)	N/A

74 http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/zip/ukr-2012-nir-13apr.zip

75 http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/zip/ukr-2012-nir-13apr.zip

applied	
QA/QC procedures (to be) applied	The National inventory report of anthropogenic emissions by sources and removals by sinks of greenhouse gases in Ukraine is an official report submitted to the Secretariat of the UN Framework Convention on Climate Change (UNFCCC).
Any comment	Data allowing of calculation of GHG emissions in the baseline scenario will be archived in paper and electronic format.

Annex 3

MONITORING PLAN

The proposed project uses a JI-specific approach in accordance with paragraph 9 (a) of the "Guidance on criteria for baseline setting and monitoring", Version 03[76].

The monitoring plan is designed for accurate and clear measurement and calculation of greenhouse gas emissions and is implemented according to practices established at SE "Mayshev Plant" for measurement of electricity and natural gas consumed. Monitoring under the project does not require changes in existing data accounting and collection system. All relevant data are calculated and recorded and stored within two years after the transfer of the last emission reduction units generated by the project.

The monitoring plan includes measures (measurements, maintenance, registration and calibration), which should be implemented to satisfy the requirements of the monitoring methodology chosen and guarantee verifiability of GHG emission reductions calculations. The main monitoring stages are described below.

The monitoring plan provides for the following measures:
1. Identification of all potential sources of emissions within the project boundary.
2. Collection of information on greenhouse gas emissions within the project during the crediting period.
3. Assessment of the project implementation schedule.
4. Collection of the information on measurement equipment, its calibration.
5. Collection and archiving information on the impact of project activities on the environment.
6. Data archiving.
7. Determination of the structure of responsibility for project monitoring.
8. Analysis of organization of personnel training.

Data and parameters controlled during the monitoring period:

Data / Parameter	N_p^y
Data unit	t
Description	Total production in monitoring period *y* of the project scenario
Time of determination/monitoring	Annually
Source of data (to be) used	Production rates by each shop are fixed in monthly form No.1-P and submitted to the economic planning department where annual form No.1-P-NPP "Routine report on production (goods and services) by types, tabular" is drawn up
Value of data applied (for ex ante calculations/determinations)	The value is determined for each monitoring period.
Justification of the choice of data or description of measurement methods and procedures (to be) applied	N/A

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

QA/QC procedures (to be) applied	Information on production rates is official data of the company stored at the economic planning department for minimum 2 years following the transfer of the last emission reduction units and is annually submitted to the Main Statistics Administration of Kharkiv region.
Any comment	Information on production rates is the basis for greenhouse gas emission calculation, to be archived in paper and electronic form.

Data / Parameter	EC_p^y
Data unit	MWh
Description	Electricity consumption in monitoring period *y* of the project scenario
Time of determination/monitoring	Daily
Source of data (to be) used	Based on monthly reports on electricity consumption by each shop individually, the chief power engineer department draws up periodic (annual or semiannual) forms No.24-enerhetyka and No.11-MTP for the entire plant.
Value of data applied (for ex ante calculations/determinations)	The value is determined for each monitoring period.
Justification of the choice of data or description of measurement methods and procedures (to be) applied	Daily readings of electricity meters are recorded in current month's logs and fixed in monthly reports on electricity consumption for each individual shop. Based on monthly reports on electricity consumption the chief power engineer department draws up periodic (annual or semiannual) forms No.24-enerhetyka and No.11-MTP submitted to the Main Statistics Administration of Kharkiv region.
QA/QC procedures (to be) applied	Measurements are carried out with flow meters which are calibrated and verified on a regular basis in according with quality assurance procedures and Law of Ukraine "On metrology and metrological activity"[77]. Periodical report forms No.24-enerhetyka and No.11-MTP are stored for minimum 2 years after the transfer of the last emission reduction units at the chief power engineer department as well as at the Main Statistics Administration of Kharkiv region. Monthly reports on electricity consumption by the entire plant, verified by the chief power engineer department, are submitted to the energy supplying companies, then certificates of completion are drawn up, which are stored by both parties as an additional guarantee of data storage.
Any comment	Information on electricity consumption is the basis for greenhouse gas emission calculation, to be archived in paper and electronic form.

Data / Parameter	$EF_{p,CO2,ELEC}^y$
Data unit	tCO_2/MWh

[77] http://zakon.rada.gov.ua/cgi-bin/laws/main.cgi?nreg=1765-15

Description	Carbon dioxide emission factor for electricity consumption by consumers, in monitoring period *y* of the project scenario
Time of determination/monitoring	Annually
Source of data (to be) used	Carbon dioxide emission factors for electricity consumption by consumers 2004-2005 are sourced from the Operational Guidelines for Project Design Documents of Joint Implementation Projects, Volume 1: General guidelines (ERUPT)[78]; Carbon dioxide emission factors for 2006-2007 are sourced from "Ukraine - Assessment of new calculation of CEF", approved by TUV SUD on 17/08/2007[79]; Carbon dioxide emission factors for 2008 are sourced from Decree No.62 of the National Agency of Ecological Investments of Ukraine (hereinafter NAEIU) dated 15/04/2011. "On approval of carbon dioxide emission factors for 2008"[80] Carbon dioxide emission factors for 2009 are sourced from NAEIU Decree No.63 dated 15/04/2011. "On approval of carbon dioxide emission factors for 2009"[81] Carbon dioxide emission factors for 2010 are sourced from theNAEIU Decree No.43 dated 28/03/2011 "On approval of carbon dioxide emission factors for 2010"[82] Carbon dioxide emission factors for 2011 are sourced from the NAEIU Decree No.75 dated 12/05/2011. "On approval of carbon dioxide emission factors for 2011"[83] If other carbon dioxide emission factors are adopted for Ukraine, the baseline will be recalculated for any reporting period in accordance with the monitoring plan.
Value of data applied (for ex ante calculations/determinations)	**2007**: 0.896; **2008**: 1.082; **2009**: 1.096; **2010**: 1.093; **2011**: 1.090
Justification of the choice of data or description of measurement methods and procedures (to be) applied	Only officially approved factors are used in calculations.
QA/QC procedures (to be) applied	National carbon dioxide emission factors are used in the Joint Implementation project development; in the absence thereof ERUPT factors for 2004-2006, TUV SUD CO2 Emission Factors for 2006-2007 are used.
Any comment	Data allowing of calculation of GHG emissions in the baseline

[78] http://ji.unfccc.int/CallForInputs/BaselineSettingMonitoring/ERUPT/index.html

[79] http://ji.unfccc.int/UserManagement/FileStorage/46JW2KL36KM0GEMI0PHDTQF6DVI514

[80] http://www.neia.gov.ua/nature/doccatalog/document?id=127171

[81] http://www.neia.gov.ua/nature/doccatalog/document?id=127172

[82] http://www.neia.gov.ua/nature/doccatalog/document?id=126006

[83] http://www.neia.gov.ua/nature/doccatalog/document?id=127498

	scenario will be archived in paper and electronic format.

Data / Parameter	$FC^{y}_{p,NG}$
Data unit	ths m^3
Description	Total natural gas consumption in monitoring period *y* of the project scenario
Time of determination/monitoring	Daily
Source of data (to be) used	Based on monthly reports on electricity consumption by each shop individually, the chief power engineer department draws up periodic (annual or semi-annual) forms No.11-MTP for the entire plant.
Value of data applied (for ex ante calculations/determinations)	The value is determined for each monitoring period.
Justification of the choice of data or description of measurement methods and procedures (to be) applied	Daily measurements of gas consumption will be held by the chief power engineer department using gas flow meters and then fixed in form No.11-МТП and stored in the chief power engineer department.
QA/QC procedures (to be) applied	Measurements were carried out with flow meters which were calibrated and verified on a regular basis in accordance with quality assurance procedures and Law of Ukraine "On metrology and metrological activity"[84]. Periodical report form No. 11-MTP is stored for minimum 2 years after the transfer of the last emission reduction units at the chief power engineer department as well as at the Main Statistics Administration of Kharkiv region. Monthly reports on natural gas consumption by the entire plant, verified by the chief power engineer department, are submitted to the energy supplying companies, then certificates of completion are drawn up, which are stored by both parties as an additional guarantee of data storage.
Any comment	Information on natural gas consumption is the basis for greenhouse gas emission calculation, to be archived in paper and electronic form.

Data / Parameter	$NCV^{y}_{p,NG}$
Data unit	TJ/ths m^3
Description	Net calorific value of natural gas in monitoring period *y* of the project scenario
Time of determination/monitoring	Annually

[84] http://zakon.rada.gov.ua/cgi-bin/laws/main.cgi?nreg=1765-15

Source of data (to be) used	Net calorific value for natural gas is sourced from the "National inventory report of anthropogenic emissions by sources and removals by sinks of greenhouse gases in Ukraine for 1990-2010"[85]
Value of data applied (for ex ante calculations/determinations)	

Year	Generation of thermal energy and electricity	Iron and steel industry	Non-ferrous metallurgy	Other industries
2007	33.85	33.85	33.85	33.85
2008	34	33.8	34.1	34.0
2009	34.1	33.7	34.0	34.0
2010	34.1	33.8	33.9	34.0
2011	34.1	33.8	33.9	34.0

Justification of the choice of data or description of measurement methods and procedures (to be) applied	N/A
QA/QC procedures (to be) applied	National inventory reports of anthropogenic emissions by sources and removals by sinks of greenhouse gases in Ukraine are official reports submitted to the Secretariat of the UN Framework Convention on Climate Change (UNFCCC).
Any comment	According to principle of conservatism minimal calorific value of gas is used. Values for 2011 were sourced from the "National inventory report of anthropogenic emissions by sources and removals by sinks of greenhouse gases in Ukraine for 1990-2010"[86]; if new inventory reports come into effect, new values will be set and ERUs will be recalculated for any reporting period in accordance with the monitoring plan. Net calorific value of natural gas combustion is the basis for greenhouse gas emission calculation, to be archived in paper and electronic form.

Data / Parameter	$EF^{y}_{p,C,NG}$
Data unit	t C/TJ
Description	Carbon emission factor for natural gas combustion in monitoring period *y* of the project scenario
Time of determination/monitoring	Annually
Source of data (to be) used	Carbon emission factor is sourced from the "National inventory report of anthropogenic emissions by sources and removals by sinks of greenhouse gases in Ukraine for 1990-2010"[87]

85 http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/zip/ukr-2012-nir-13apr.zip

86 http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/zip/ukr-2012-nir-13apr.zip

87 hthttp://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/zip/ukr-2012-nir-13apr.zip

Value of data applied (for ex ante calculations/determinations)		**2007**	15.3	
		2008	15.17	
		2009	15.2	
		2010	15.17	
		2011	15.17	
Justification of the choice of data or description of measurement methods and procedures (to be) applied	N/A			
QA/QC procedures (to be) applied	National inventory reports of anthropogenic emissions by sources and removals by sinks of greenhouse gases in Ukraine are official reports submitted to the Secretariat of the UN Framework Convention on Climate Change (UNFCCC).			
Any comment	Data allowing of calculation of GHG emissions in the baseline scenario will be archived in paper and electronic format. Values for 2011 were sourced from the "National inventory report of anthropogenic emissions by sources and removals by sinks of greenhouse gases in Ukraine for 1990-2010"[88]; if new inventory reports come into effect, new values will be set and ERUs will be recalculated for any reporting period in accordance with the monitoring plan.			

Data / Parameter	$OXID^{y}_{p,NG}$		
Data unit	Relative units		
Description	Carbon oxidation factor for natural gas combustion in monitoring period *y* of the project scenario		
Time of determination/monitoring	Annually		
Source of data (to be) used	Carbon oxidation factor is sourced from the "National inventory report of anthropogenic emissions by sources and removals by sinks of greenhouse gases in Ukraine for 1990-2010"[89]		
Value of data applied (for ex ante calculations/determinations)		**2007**	0.995
		2008	0.995
		2009	0.995
		2010	0.995
		2011	0.995
Justification of the choice of data or description of measurement methods and procedures (to be) applied	N/A		

88 hhttp://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/zip/ukr-2012-nir-13apr.zip

89 http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/zip/ukr-2012-nir-13apr.zip

QA/QC procedures (to be) applied	National inventory reports of anthropogenic emissions by sources and removals by sinks of greenhouse gases in Ukraine are official reports submitted to the Secretariat of the UN Framework Convention on Climate Change (UNFCCC).
Any comment	Data allowing of calculation of GHG emissions in the baseline scenario will be archived in paper and electronic format. Values for 2011 were sourced from the "National inventory report of anthropogenic emissions by sources and removals by sinks of greenhouse gases in Ukraine for 1990-2010"[90]; if new inventory reports come into effect, new values will be set and ERUs will be recalculated for any reporting period in accordance with the monitoring plan.

90 http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/zip/ukr-2012-nir-13apr.zip