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

A.1. Title of the project:

"Energy Efficiency Improvement in Revamping of Steel Production at Severstal JSC, Cherepovets, Russia. Iron production expanding".

Sectoral scope 9: Metal production.

Project design document (PDD) version 1.6

10 June 2011.

A.2. Description of the project:

Enterprise description

Severstal is an international steel and mining company listed on the Russian Trading System (RTS) and on the London Stock Exchange (LSE). The company focuses on high added value products and unique niche products. It has a successful track record of acquiring and operating high-quality assets in North America and Europe. Severstal also owns mining enterprises in Russia and the USA, supplying them with raw materials. The company also has a gold mining segment, managing important assets in Russia and Kazakhstan. Severstal is Russia's largest steel producer and includes the following segments: steel, pipe, metalware, trade and distribution and services as well as scrap procurement operations.

Project purpose

The goal of the proposed Joint Implementation (JI) project is to reduce impact of the ironmaking process on the climate by modernization of the existing production process by application of more energy efficient technology. Emissions of GHG were reduced significantly as a result of the project implementation. In order to achieve the goal of the project, Severstal constructed Coke Furnace Battery (CFB) #3 from scratch and constructed the Blast Furnace (BF) #4. Also new energy efficient auxiliary equipment was introduced (a top-pressure recovery turbine and coke dry-quenching plant).

Before project

The coke furnace battery #3 was constructed in 1957. It was moved out from service due to full depreciation in 1994. The blast furnace #4 was constructed in 1969. Rehabilitation was made from 29/07/1984 to 19/09/1984. It served all working period and was moved out from service in 1995.

Project scenario and status

The project consists of two subprojects:
1. Construction of coke oven battery #3;
2. Construction of blast furnace #4.

The coke furnace battery #3 was constructed in 2007. It also includes a coke dry-quenching plant and heat-recovery boilers. Annual production capacity of the renovated coke furnace battery is approximately 460 000 tonnes of coke. Also about 256,000 Gcal of steam or about 100 000 MWh per year may be generated due to utilizing of the thermal energy of red-hot in the steam turbines located in an energy generation facility of the plant.

The blast furnace #4 was constructed in 2006. Construction of the blast furnace #4 included installation of the top-pressure recovery turbine which generates additional energy using waste gas pressure (about 43 000 MWh per year). Annual capacity of the blast furnace #4 is approximately 2.3 million tonnes of iron.

Baseline scenario

In the baseline scenario it is assumed that the level of coke and iron production will be equal to the project scenario level. But, since the old equipment could not operate further or was unworkable, in the absence of the project the products (coke, iron) required by different consumers would have been produced and supplied by other plants. Therefore third party producers would have produced the displacing part.
CO_2 emissions for the subprojects are associated with displacing capacity. Emissions associated with displacing capacity are calculated based on CO_2 emission level from the other producers. Additional steam will be generated by a new boiler or the existing boiler at Severstal. Electricity is generated by Regional Energy System.

Project background and description

A plan of technical and economic development was introduced in 2004. Its primary task was to increase production capacity and provide the plant with own material for steel production using new modern energy efficient equipment and constructing new equipment. To achieve this purpose Severstal decided to begin modernization of its iron and coke production. A plan of technical and economic development was approved in December 2004. The plant had taken into account GHGs reduction and additional revenues earning due to project implementation as JI. It will improve economic indicators of the projects and minimize project risks. Design documents for these projects were developed by LLC Severstal-proekt. Glavgosexpertiza of Russian Federation approved the design documents for the coke furnace battery and the blast furnace in November-December 2006. BF and COB were commissioned in 2006 and 2007 corresponding. Project implementation schedule is presented in Section A.4.2 below.

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)
Party A -The Russian Federation (host Party)	JSC Severstal	No
Party B - The Netherlands	Global Carbon BV	No

Role of the project participants:

- JSC Severstal is the largest steelmaker in the Russian Federation. Severstal will implement the JI project. It invests in the JI project implementation and will own ERUs generated. Severstal is a project participant;
- Global Carbon BV is a leading expert on environmental consultancy and financial brokerage services in the international greenhouse emissions trading market under the Kyoto Protocol. Global Carbon

has developed the first JI project that has been registered at the United Nations Framework Convention on Climate Change (UNFCCC). The first verification under JI mechanism was also completed for Global Carbon B.V project. The company focuses on Joint Implementation (JI) project development in Bulgaria, Ukraine, Russia. Global Carbon BV is responsible for the preparation of the investment project as a JI project including PDD preparation, obtaining Party approvals, monitoring and transfer of ERUs. Global Carbon BV is a project participant.

A.4. Technical description of the project:

A.4.1. Location of the project:

Severstal is located in Cherepovets city, north-west of Russia, in the Vologda region, on the bank of the Sheksna river in its flowing into the Rybinskoye pool (see Figure A.4.1.2). Geographical location of Vologda region and Cherepovets are presented in Figure A.4.1.1 and Figure A.4.1.2 below.

Figure A.4.1.1: Map of Russia with location of Vologda region (selected by red colour)

Source: http://en.wikipedia.org/wiki/File:Map_of_Russia_-_Vologda_Oblast_(2008-03).svg

Figure A.4.1.2: Map of Vologda region with the project location

Source: *http://maps.yahoo.com/#mvt=h&lat=59.15448&lon=37.85606&zoom=11&q1=cherepovets*

A.4.1.1. Host Party(ies):

The Russian Federation

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

Vologda Region is one of the largest regions of Russian Federation and makes 1% of its territory (145.7 thousands square kilometres); the area stretches 385 km north-south and 650 km east-west. Population of the Territory is about 1 million 227 thousands 800 people.

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

Cherepovets is the biggest city in Vologda Oblast, Russia, located on the bank of the Rybinsk Reservoir of the Volga River. Population: 311,869 (2002 Census); 310,463 (1989 Census). The big plants like JSC Severstal (one of the biggest metallurgical plants), JSC Ammophos, JSC Cherepovetskiy Azot, Agro-Cherepovets (producing phosphorous and nitric fertilisers), JSC Severstal-Metiz made the region one of the highly developed industrial centres of Russia. Those are the enterprises which laid a basis of economic potential of Cherepovets. Cherepovets region has all characteristics to consider it as an industrially developed one.

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

The Severstal production site is located at the north outskirts of Cherepovets (see Figure A.4.1.4.1). The project site coordinates are: longitude 37.58' E, latitude 59.15' N (by the program Google Earth).

Figure A.4.1.4.1: Satellite image of Cherepovets town with Severstal plant

Source: http://maps.google.com/maps?hl=en&tab=wl

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

The proposed JI project aims at enhancement of pig iron and coke production and increase of iron production using modern energy-efficient technology. In order to ensure increase of own iron production, Severstal modernized iron and coke production since they are interconnected as raw material and product. Severstal uses pig iron as metal stock for arc-furnace process. Coke is important raw material for iron production. Severstal increases raw material production to support their steel production independently from other coke and iron producer.

The project consists of two subprojects:

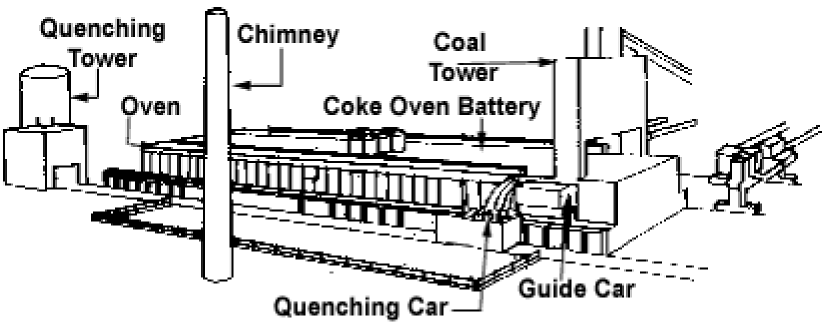
1. Construction of the coke furnace battery #3 and the coke dry-quenching plant for additional energy generation;
2. Construction of blast furnace #4 and installation of the top-pressure recovery turbine for additional energy generation.

Proposed project covers the following stages of pig iron production process: coke oven battery – blast furnace. These stages are described below. Main technical data of the equipments are presented in Tables A.4.2.1 and A.4.2.2 below.

Coke making (coke oven battery)
Coking coals are the coals which when heated in the absence of air, first melt, go in the plastic state, swell and re-solidify to produce a solid coherent mass called coke. When coking coal is heated in absence of air, a series of physical and chemical changes take place with the evolution of gases and vapours, and the solid residue left behind is called coke.

Conventional cokemaking is done in a coke oven battery of ovens sandwiched between heating walls. They are carbonized at a temperature around 1000-1100 °C up to a certain degree of devolatization to produce metallurgical coke of desired mechanical and thermo-chemical properties. A schematic diagram of Coke Oven Battery is given in Figure A4.2.1 below.

Figure A.4.2.1: Schematic Diagram of Coke Oven Battery



Source: http://www.sail.co.in/learning_cemter.php?tag=learning_center_coke_ovens

During carbonization, coking coals undergo transformation into plastic state at around 350º-400º C swell and then resolidify at around 500-550 °C to give semi-coke and then coke. In coke ovens, after coal is charged inside the oven, plastic layers are formed adjacent to the heating walls, and with the progress of time, the plastic layers move towards the centre of oven from either side and ultimately meet each other at the centre. During coke making, two opposite reactions take place, viz. condensation and pyrolysis.

Dry Coke Quenching

Introduction of Dry Coke Quenching in the coke making which has improved coke quality and allow generate additional energy. Dry quenching of coke is a major technology for the post-carbonisation treatment which has come up in a big way. Here the red-hot coke is cooled by inert gases, instead of conventional water quenching. It not only effectively utilises the thermal energy of red-hot coke (80% of the sensible heat of coke can be recovered & made use of for production of steam) but also results in improvement of the coke quality. The steam is used in steam turbine for electricity generation and other needs. Dry Coke Quenching technology was developed by GIPROKOKS in sixties (a patent was gotten). This technology has been introduced about 24%[1] from total coke production in Russia. Wet-quenched and Dry Coke Quenching technologies are used together at Severstal. Japan bought the patent for Dry Coke Quenching equipment introduction from GIPROKOKS.

[1] "GIPROKOKS", http://giprokoks.com/en/page/5/3 and LLC "Korporatsiya proizvoditeley chernih metalov"

Table A.4.2.1: Main technical data of the coke oven battery.

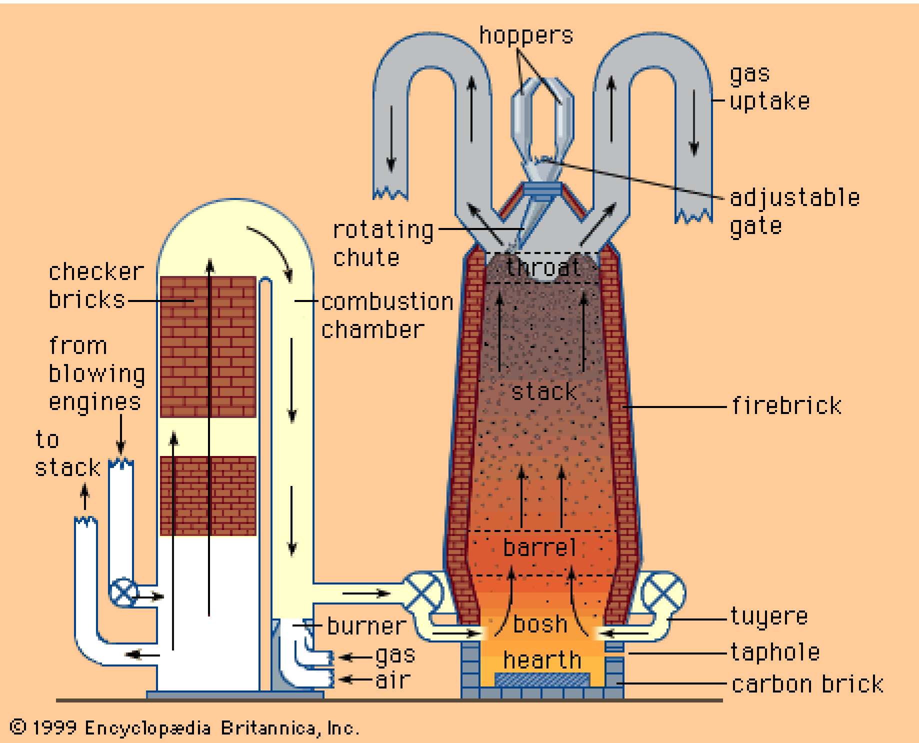
Indicator	Unit	
Furnace capacity	t/year	460,000
Number of furnaces		61
Type of fuel		coke oven gas and blast furnace gas
Coke quenching		dry
Steam generation (max) by coke quenching	t/hour	100

Source: Severstal

Ironmaking (blast furnace)

Coke is used in Blast Furnace (BF) both as a reductant and as a source of thermal energy. The Blast furnace iron making process basically consists of the conversion of iron oxide to iron in liquid form. This requires reductant for reduction of iron oxide and heat for the above reduction reaction to take place and for melting the products of smelting. The primary source to fulfill both these requirements is carbon (in the form of coke), which shares major portion of cost of hot metal production. A schematic diagram of a blast furnace is given in Figure A4.2.2 below.

Figure A.4.2.2: Schematic Diagram of a Blast Furnace



Source: http://www.britannica.com/EBchecked/topic-art/69019/1535/Schematic-diagram-of-modern-blast-furnace-and-hot-blast-stove

Iron making blast furnaces consist of several zones: a crucible-shaped hearth at the bottom of the furnace; an intermediate zone called a bosh between the hearth and the stack; a vertical shaft (the stack) that

extends from the bosh to the top of the furnace; and the furnace top, which contains a mechanism for charging the furnace. The furnace charge, or burden, consisting of iron-bearing materials (*e.g.,* iron-ore pellets and sinter), coke and flux (*e.g.,* limestone) descends through the shaft, where it is preheated and reacts with ascending reducing gases to produce liquid iron and slag which are accumulated in the hearth. Air that has been preheated to temperatures from 900° to 1,250° C (1,650° and 2,300° F) is blown into the furnace through multiple tuyeres (nozzles) located around the circumference of the furnace in the upper part of the hearth; these nozzles may number from 12 to as many as 40 on large furnaces. The preheated air is, in turn, supplied from a bustle pipe, a large-diameter pipe encircling the furnace. The preheated air reacts vigorously with the preheated coke, resulting in both the formation of the reducing gas (carbon monoxide) that rises through the furnace, and a very high temperature of about 1,650° C (3,000° F) that produces the liquid iron and slag.
The main chemical reaction producing the molten iron is:

$$Fe_2O_3 + 3CO \rightarrow 2Fe + 3CO_2$$

Preheated blast air blown into the furnace reacts with the carbon in the form of coke to produce carbon monoxide and heat. The carbon monoxide then reacts with the iron oxide to produce molten iron and carbon dioxide. Hot carbon dioxide, unreacted carbon monoxide, and nitrogen from the air pass up through the furnace as fresh feed material travels down into the reaction zone. As the material travels downward, the counter-current gases both preheat the feed charge, decompose the limestone to calcium oxide and carbon dioxide, and begin to reduce the iron oxides in the solid state. The main reaction controlling the gas atmosphere in the furnace is called the Boudouard reaction:

$$C + O_2 \rightarrow CO_2$$
$$CO_2 + C \rightarrow 2CO$$

The decomposition of limestone in the middle zones of the furnace proceeds according to the following reaction:

$$CaCO_3 \rightarrow CaO + CO_2$$

The calcium oxide formed by decomposition reacts with various acidic impurities in the iron (notably silica), to form a fayalitic slag which is essentially calcium silicate, CaSiO3:

$$SiO_2 + CaO \rightarrow CaSiO_3$$

The "pig iron" produced by the blast furnace has a relatively high carbon content of around 4–5%, making it very brittle, and of limited immediate commercial use. Some pig iron is used to make cast iron. The majority of pig iron produced by blast furnaces undergoes further processing to reduce the carbon content and produce various grades of steel used for tools and construction materials.

Top-pressure recovery turbine (TRT)

The blast furnace gas produced during iron smelting process can be utilized to generate electricity by going through the TRT. The pressure of the BF gas generated in a blast furnace is 2-3kg/cm^2 at the furnace top in high-pressure operation. Without TRT power generation system, the blast furnace gas will be treated by various processes to decrease its pressure and temperature. A top-pressure recovery turbine (TRT) utilizes this pressure and temperature, and recovers them as electricity by a gas turbine. This technology was developed in the end of sixties in Soviet Union[2]. But this technology does not widely used in iron industry (see *common practice analysis* in Section B.2).

Table A.4.2.2: Main technical data of the blast furnace and TRT.

Indicator	Unit	
Capacity	tonne/day	6,400
Capacity	tonne/year	2,300,000
Coke specific consumption	kg/tonne	400
Volume	m^3	2,700
Pressure of blast-furnace gas	bar	2.5
Temperature of blast-furnace gas	ºC	140
Top-pressure recovery turbine capacity (max)	kW	13,500

Source: Severstal

The project implementation schedule is presented in Table A.4.2.3 below.

After installation of equipment, Training program was developed. Operation and maintenance trainings were provided by the equipment supplier in accordance with the agreement. Trainings were made with the help of personnel who had operational experience on such equipment. All the operational and monitoring personnel is regularly trained and certified in accordance with approved training courses and certification grades. Training and exams schedule is developed and approved annually. Staffs are regularly passes extensive training courses. The new plant staffs are trained permanently in the metallurgical college of Cherepovets. The college training covers the main subject areas (several specialities) such as:

• cokemaking;
• blast-furnace metallurgist.

Table A.4.2.3: Project implementation schedule

N	Title	2004				2005				2006				2007				2008			
		I q	II q	III q	IV q	I q	II q	III q	IV q	I q	II q	III q	IV q	I q	II q	III q	IV q	I q	II q	III q	IV q
1	Construction of coke furnace battery #3																				
2	Construction of blast furnace #4																				
3	Construction the Dry Coke Quenching																				
4	Construction the top-pressure recovery turbine																				

[2] http://www.esco-ecosys.ru/2005_12/art69.htm and http://utz.ru/

Source: Severstal

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:

Steel industry is connected with significant CO_2 emission. It is associated with significant coke and fuel consumption. Proposed project allows reducing CO_2 emission at Severstal by the modernization of coke and iron production. Construction of coke oven battery allows coke producing with lower fuels (coke oven gas, blast furnace gas) consumption. Also additional electricity is generated due to utilizing the thermal energy of red-hot coke by a steam turbine. The main benefit of BF Reconstruction with application of TRT is that it reduces carbon consumption during iron production and generates additional electricity due to pressure utilising of blast furnace gas. The usage of coke at the BF causes more than 90% of the total CO_2 emission. Coke production is connected with CO_2 emission too (0.56[3] tonne CO_2/tonne coke). Due to the project implementation the GHG emission factor of coke production will be reduced.

Also information on baseline setting and additionality are presented in Section B. Total estimated amount of emission reductions due to project implementation is 2,183,811 tonnes of CO_2 equivalent as determined in Section E.

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

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

[3] IPCC Guidelines for National Greenhouse Gas Inventories (2006), Volume 3, Chapter 4, page 25.

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

	Years
Length of the crediting period	5
Year	Estimate of annual emission reductions in tonnes of CO_2 equivalent
2008	268,147
2009	372,625
2010	513,009
2011	515,015
2012	515,015
Total estimated emission reductions over the crediting period (tonnes of CO_2 equivalent)	2,183,811
Annual average of estimated emission reductions over the crediting period (tonnes of CO_2 equivalent)	436,762

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

	Years
Period after 2012, for which emission reductions are estimated	8
Year	Estimate of annual emission reductions in tonnes of CO_2 equivalent
2013	515,015
2014	515,015
2015	515,015
2016	515,015
2017	515,015
2018	515,015
2019	515,015
2020	515,015
Total estimated emission reductions over the period indicated (tonnes of CO_2 equivalent)	4,120,121
Annual average of estimated emission reductions over the period indicated (tonnes of CO_2 equivalent)	515,015

A.5. Project approval by the Parties involved:

The project was approved by the Parties involved:

Russia (Host party) – the Letter of approval from the Ministry of Economic Development decision dated 12 March 2012 No 112.

The Netherlands (Investor) – the Letter of approval from NL Agency, Ministry of Economic Affairs dated 01 March 2011 No 2011JI07.

SECTION B. Baseline

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

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

Description and justification of the baseline chosen is provided below in accordance with the "Guidelines for users of the Joint Implementation Project Design Document Form", version 04[6], using the following step-wise approach:

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

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

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

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

The baseline for this project shall be established in accordance with appendix B of the JI guidelines. Furthermore, the baseline shall be identified by listing and describing plausible future scenarios on the basis of conservative assumptions and selecting the most plausible one.

Key factors that affect the baseline are taken into account:

a) **Sectoral reform policies and legislation.** The main development goal of the metallurgical industry is meeting domestic metal demand.[7] JSC Severstal does not have any obligations for construction of new production capacity;

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

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

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

[7] http://www.minpromtorg.gov.ru/ministry/strategic/sectoral/2

b) **Economic situation/growth and socio-demographic factors in the relevant sector as well as resulting predicted demand. Suppressed and/or increasing demand that will be met by the project can be considered in the baseline as appropriate (e.g. by assuming that the same level of service as in the project scenario would be offered in the baseline scenario)**. It is assumed that the level of steel production and demand are not influenced by the project. The steel industry is a transparent market where standardized types of products (steel, iron and coke) exist. Within a certain region or country their products can be transported from the producer to the consumer without constrains. If the facility in question cannot provide the amount of products that is needed third party producer would have produced the displacing part. In case of the project absence and increased market demand, other producer can produce displacing part of requested products (iron, steel, coke) by increasing the number of run-days, decreasing duration of stops or new capacities installation. The incremental capacity emissions are determined in line with the methodological approach as described in Annex 2**;**

c) **Availability of capital (including investment barriers).** Capital was available but high bank rate (according to the Russian Central bank, the minimum short term loan in Russia in June 2004 was 11,6%, long term loan rate is higher) and high country investment risk made unprofitable of new equipment introduction in Russia;

d) **Local availability of technologies/techniques, skills and know-how and availability of best available technologies/techniques in the future.** Pig iron production process by a blast furnace is better-known and applied in Russia;

e) **Fuel prices and availability.** Electricity, natural gas and coke are widely used and available in Russia. All of them are produced inland. Fuel prices in Russia are less than world market price.

The baseline is established in a transparent manner with regard to the choice of approaches, assumptions, methodologies, parameters, data sources and key factors. Most information is taken from the international publicly available sources and is referenced. Uncertainties are taken into account and conservative assumptions are used. ERUs cannot be earned for decreases in activity levels outside the project activity or due to force majeure as emission factors based on specific production are used (e.g. tCO_2/t steel).

The baseline for this project will be the most plausible future scenario on the basis of conservative assumptions and key factors described above. The basic principle applied is that the demand for products (steel, iron, coke) is not influenced by the project and is identical in the project and the baseline scenario. This means that, depending on the actual production in the project scenario, there is an option in the baseline scenario where this amount of products (steel, iron, coke) is produced by other producers in Russia.

Step 2. Application of the approach chosen

JSC Severstal produces pig iron in a blast furnace. Usually pig iron is used as part of metal stock during steelmaking process. Arc-furnace steel allows using up to 100 % metal scrap during steel production. Lately scrap usage drives out pig iron during steelmaking process. But pig iron cannot be eliminated fully as a result of increasing of steel demand and steel corrosion. Thus additional pig iron volume is required for additional steel production.
Proposed project aims to construct new production (including iron and coke production as production of required raw materials for steelmaking process) using recent achievements in this field. There were coke oven battery #3 and blast furnace #4 which could not operate any more at Severstal. This means that actual production in the project scenario depends on production of other producers in Russia in the baseline scenario.

The baseline assumptions are based on the current situation in the region and industry while investment analysis is to be implemented as at the moment of taking the decision on the project (i.e. 2004).

The coke furnace battery #3 was moved out from service by reason of full deprecation at Severstal in 1994. The blast furnace #4 was moved out from service for similar reasons in 1995.

At JSC Severstal several options for the production are technically feasible and are discussed below.

Production capacity:

1. Coke capacity:

a. Other coke producers will satisfy coke demand;
b. Construction of coke oven battery #3 implemented not as JI project.

2. Pig iron capacity:

a. Other pig iron producers (blast furnaces) will satisfy the iron demand of Severstal;
b. Construction of Blast Furnace #4 using recent achievements in this field implemented not as JI project.

Combination of these options results in possible future scenarios that may allow reaching annual project pig iron and coke capacity at Severstal. The subproject (construction of coke oven battery) is connected with reaching 2,300,000 tonnes of pig iron production per year, as coke is raw material for pig iron production. Severstal has coke deficiency, because of this about 10-15% of coke is bought from other coke producers.

Scenario 1: Other pig iron and coke producers will produce the project volume of pig iron and coke ;
Scenario 2: The coke oven battery #3 construction along with the blast furnace #4 (Project activity not implemented as JI);
Scenario 3: Only the coke oven battery #3 construction;
Scenario 4: Only the blast furnace #4 construction.

These scenarios are described below in more detail.

1) Other pig iron and coke producers will produce the project volume of pig iron and coke

The production of about 2.3 million tonnes of pig iron per year will be covered by other (new and/or existing) pig iron producers (blast furnaces). Increase in production will be possible due to increase of existing plants load. Reconstruction/construction is not being implemented under this scenario. There are no legal or other requirements that enforce other pig iron producers to stop ironmaking or steelmaking. It is the continuation of the situation without project. Thus, scenario 1 is feasible.

2) The coke oven battery #3 construction along with the blast furnace #4 (Project activity not implemented as JI)

In this scenario, expected total annual production of the Blast Furnace will be approximately 2.3 million tonnes of pig iron. Production of pig iron will depend on its demand. There is coke deficit at Severstal. About 10-15 % of coke (total consumption by Severstal) is bought from other coke producers. Capacity of coke oven battery #3 can cover only about 50 % from required coke for additional pig iron production by BF#4. Other required coke will be purchased. Implementation of this scenario without JI requires significant investments and not financially feasible. Thus this scenario cannot be considered as a baseline scenario (see investment analysis Section B.2).

3) Only the coke oven battery #3 construction

In this scenario, expected total annual production of *the coke oven battery* will be approximately 0.4 million tonnes of coke. The annual pig iron production volume of approximately 2.3 million tonnes will be produced by other pig iron producer. Part of the produced coke will be consumed at own pig iron production. Coke surplus will be sold. In this scenario there is a risk of coke demand absence since final product has more demand than a raw material (Severstal will depend on other coke consumers). Also, a coke oven battery cannot be stopped but put only in hot reserve that will lead to fuel consumption without coke production. Thus this scenario cannot be accepted as a reasonable scenario.

4) Only the blast furnace #4 construction

Production of pig iron will depend on its demand. Severstal will consume significant amount of coke produced by the other coke producers. Pig iron production will depend on the other coke producers.
This scenario represents the situation when only blast furnace is build/ that means no coke oven battery will be build. Severstal will consume significant amount of coke produced by the other coke producers because coke compulsory material for pig production. As Severstal does not have any other available facility for coke production, the plant will buy coke from other producers. First of all it is economically unprofitable. Primary cost of coke is less than price of already produced coke by other producers.
Secondly there is also a risk of no delivery just in time. In terms of plant size and obligations it is not profitable to construct blast furnace without coke oven battery. More over it is world common practice to construct blast furnace and coke oven together.
Thirdly part of coke will lose during transportation also it leads to the coke dust originating. Thus it is economically unprofitable. Besides coke dust usage for sinter production is not environmentally friendly due to GHG emission.
Thus scenario 4 cannot be accepted as a favourable scenario.

Conclusions

Scenario 1 is the only remaining plausible scenario and is therefore identified as the baseline.

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

The key data used to establish the baseline in tabular form is presented below.

Data/Parameter	PP_y^{BF4}
Data unit	Tonnes
Description	Displacing steelmaking iron production in the baseline scenario in year *y*
Time of determination/monitoring	*Ex-post*. During the crediting period
Source of data (to be) used	Plant records
Value of data applied (for *ex-ante* calculations/determinations)	2,440,000
Justification of the choice of data or description of measurement methods and procedures (to be) applied	In the baseline scenario displacing iron production is equal to iron production of reconstructed BF #4 in the project scenario in year *y*. The weighting method is used to identify the amount of iron. The weighting equipment is being calibrated and checked by the plant staff.
OA/QC procedures (to be) applied	The company has a special Department of Control and Measuring devices. This department is in charge of supervision

	of measuring devices operation and performance. It checks and replaces devices (adjusted and calibrated) from the reserve if necessary. The company has approved regulations for measurements, registration and archiving data and the annual schedule for calibration and replacement of devices.
Any comment	This parameter is being used for emissions calculations for displacing production (by other plants).

Data/Parameter	BEF_y^{iron}
Data unit	tCO_2/tonne of steelmaking pig iron
Description	Baseline emission factor for displacing steelmaking pig iron production in year *y*
Time of determination/monitoring	*Ex-ante*
Source of data (to be) used	Calculated according to LLC “Korporatsiya proizvoditeley chernih metalov” annual statistical report “Russian Chermet information“, Russia in 2007, chapter 1, operation of blast furnaces and coke oven batteries . This report contains the data of annual steel and iron production and annual fuel and electricity consumption at Russian steel plants.
Value of data applied (for *ex-ante* calculations/determinations)	1.721 (2007)
Justification of the choice of data or description of measurement methods and procedures (to be) applied	The approach of “Tool to calculate the emission factor for an electricity system” is used. IPCC default values are used for CO_2 emission factor of fossil fuels. The default grid emission factors for the regional power systems of Russia are used. Please see Annex 2 for more detail information.
OA/QC procedures (to be) applied	-
Any comment	If data required to calculate the baseline emission factors for the year y is usually available six months later after the end of the year y, alternatively emission factors of the previous year (y-1) may be used. If data is available latter than 18 months after the end of year y, emission factors of the year preceding the previous year (y-2) may be used. The same data vintage (y, y-1 or y-2) should be used throughout the crediting period. After the data for the last three years is available, emission factor may be fixed *ex-ante* as three-year average. Pig iron is usually separated into two major groups of grades according to their composition and further use: foundry and steelmaking. Specific fuel consumption for these grades differs. Therefore their production emission factors are calculated individually.

Data/Parameter	$Fuel_y^i$

Data unit	tonnes or m^3
Description	Fuel *i* (gas, coal, coke) consumption in year *y*
Time of determination/monitoring	*Ex-post*. During the crediting period
Source of data (to be) used	Calculated according to LLC "Korporatsiya proizvoditeley chernih metalov" annual statistical report "Russian Chermet information". This report contains the data of annual steel and iron production and annual fuel and electricity consumption at Russian steel plants.
Value of data applied (for *ex-ante* calculations/determinations)	According to the annual report made by LLC "Korporatsiya proizvoditeley chernih metalov" for every pig iron producer in Russia.
Justification of the choice of data or description of measurement methods and procedures (to be) applied	-
OA/QC procedures (to be) applied	-
Any comment	-

Data/Parameter	SER_y^k
Data unit	1000 m^3
Description	Secondary energy resource *k* (blast furnace, coke oven gases) output in year *y*
Time of determination/monitoring	*Ex-post*. During the crediting period
Source of data (to be) used	Calculated according to LLC "Korporatsiya proizvoditeley chernih metalov" annual statistical report "Russian Chermet information". This report contains the data of annual steel and iron production and annual fuel and electricity consumption at Russian steel plants.
Value of data applied (for *ex-ante* calculations/determinations)	According to the annual report made by LLC "Korporatsiya proizvoditeley chernih metalov" for every pig iron producer in Russia.
Justification of the choice of data or description of measurement methods and procedures (to be) applied	-
OA/QC procedures (to be) applied	-
Any comment	Usual, part of blast furnace gas is used outside of the blast furnace plant as fuel for other equipment.

Data/Parameter	Coke_y , Sin_y , Oxy_y , Pel_y
Data unit	tonnes or $1000m^3$
Description	Coke, sinter, oxygen and pellet consumption in year *y*
Time of determination/monitoring	*Ex-post*. During the crediting period
Source of data (to be) used	Calculated according to LLC "Korporatsiya proizvoditeley chernih metalov" annual statistical report "Russian Chermet information". This report contains the data of annual steel and iron production and annual fuel and electricity consumption at

	Russian steel plants.
Value of data applied (for *ex-ante* calculations/determinations)	According to the annual report made by LLC "Korporatsiya proizvoditeley chernih metalov" for every pig iron producer in Russia.
Justification of the choice of data or description of measurement methods and procedures (to be) applied	-
OA/QC procedures (to be) applied	-
Any comment	-

Data/Parameter	CO_y^k
Data unit	fraction
Description	Carbon monoxide content in *k* (blast furnace, coke oven gases) in year *y*
Time of determination/monitoring	*Ex-post*. During the crediting period
Source of data (to be) used	Calculated according to LLC "Korporatsiya proizvoditeley chernih metalov" annual statistical report "Russian Chermet information". This report contains the data of annual steel and iron production and annual fuel and electricity consumption at Russian steel plants.
Value of data applied (for *ex-ante* calculations/determinations)	According to the annual report made by LLC "Korporatsiya proizvoditeley chernih metalov" for every pig iron producer in Russia.
Justification of the choice of data or description of measurement methods and procedures (to be) applied	If the plant provides them separately to LLC "Korporatsiya proizvoditeley chernih metalov", then these parameters are taken separately for steelmaking pig iron and separately for foundry pig iron. If the plant provides consolidated data for steelmaking pig iron and foundry pig iron together, as one figure, than this figure can be used for calculation of BEF_y^{iron}, because it is connected with steelmaking and foundry pig iron production by the same blast furnace.

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

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

Step 1. Indication and description of the approach applied

As suggested by Paragraph 2 (c) of the Annex 1 of the Guidance the most recent version of the "Tool for the demonstration and assessment of additionality" approved by the CDM Executive Board is used to demonstrate additionality. At the time of this document completion the most recent version of the "Tool for the demonstration and assessment of additionality" approved by the CDM Executive Board is version 05.2[8] and it is used to demonstrate additionality of the project activity.

Step 2. Application of the approach chosen

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

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

We will define realistic and credible alternatives to the project activity through the following Sub-steps:

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

The following alternatives to the proposed project were identified:

Alternative 1: Other pig iron and coke producers will produce the project volume of pig iron and coke. In the absence of project the pig iron would have been supplied from other (new and/or existing) Russian metallurgical plants. Other metallurgical plants can increase their production in case of demand increase. Annual displacing iron production will be about 2,300 thousand tonnes.

Alternative 2: The proposed project activity undertaken without being registered as a JI project activity. The coke oven battery #3 construction along with the blast furnace #4. Coke oven battery #3 will be constructed in view to provide additional coke for pig iron production. Expected total annual pig iron and coke production will be approximately 2.3 and 0.4 million tonnes according. The coke oven battery constructions along with the blast furnace #4 reduce primary cost of pig iron and allow reducing of investment payback time.

Alternative 3: Only the coke oven battery #3 construction. Only COB construction means investment in a development resource for other iron producers (surplus of coke will be sold) it does not make sense. Also in this alternative there is a risk of coke demand absence. Thus this alternative cannot be considered as a reasonable alternative.

Alternative 4: Only the blast furnace #4 construction. In this alternative only BF#4 will be constructed. The process will not be supplied with own coke in this case. Pig iron production at Severstal will depend on the third-party coke producers. Thus this alternative cannot be considered as a reasonable alternative.

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

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

Sub-step 1b: Consistency with mandatory laws and regulations

All of the alternatives identified above are consistent with mandatory laws and regulations of the Russian Federation.

Outcome of Step 1b: We have identified realistic and credible alternative scenarios to the project activities that are in compliance with mandatory legislation and regulations taking into account the enforcement in the Russian Federation.

Step 2. Investment Analysis

The purpose of the investment analysis in the context of additionality is to determine whether the proposed project activity is not:

a) The most economically or financially attractive; or
b) Economically or financially feasible, without the revenue from the sale of emission reductions.

Sub-step 2a: Determine appropriate analysis method

In principle, there are three methods applicable for an investment analysis: simple cost analysis, investment comparison analysis and benchmark analysis.

A simple cost analysis (Option I) shall be applied if the proposed JI project and the alternatives identified in step 1 generate no financial or economic benefits other than JI related income. The proposed JI project results in sales revenues due to the new steel production capacity installed and modernised. Thus, this analysis method is not applicable.

An investment comparison analysis (Option II) compares suitable financial indicators for realistic and credible investment alternatives. As only plausible alternative represents the continuation of existing situation, a benchmark analysis (Option III) is applied.

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

The proposed project (construction of blast furnace #4 and coke oven battery #3) shall be implemented by JSC Severstal. Severstal has no internal IRR benchmark for its investment decision making. IRR benchmark analysis is calculated according to the Table B.2.1. If the proposed project (not being implemented as a JI project) has less favourable indicator, i.e. a lower IRR, than this benchmark, then the project cannot be considered as financially attractive.

Table B.2.1. Financial indicators used to set benchmark

#	Factor	Rate	Description	Source
1	Risk-free rate	4.31%	German long-term interest rate in euro as a secondary market yields of government bonds with remaining maturity close to ten years, June 2004. This rate is taken as Germany is the largest Euro economy.	European Central Bank[9]
2	Russian interest rate	7.5%	Weighted average interest rate of Russian federal bonds and short-dated bond.	Eurobond [10]
3	Country risk premium	**3.19%**	Non-specific risk associated with investments in Russia. Equals to Russian interest rate less Risk-free rate.	-
4	Euro inflation	2.0%	Inflation in euro zone	Eurostat[11]
5	Real risk-free rate	**2.26%**	*Real interest rate=(1+Nominal Interest Rate)/(1+Inflation)-1*	-
6	Project risk premium	**8%**	This type of projects has the medium risk factor of 8-10%. Thus the lowest range is applied to be conservative.	Methodological recommendations on evaluation of investment projects efficiency. Approved by Ministry of Economy of the RF, Ministry of Finance of the RF, State Committee of the RF on Construction, Architecture and Housing Policy of the RF 21.06.1999 N BK 477.
	Total expected return	**13.45%**	This rate takes into account real (inflation adjusted) risk-free rate increased by a general expected market return, country risk and specific project risk.	Investment Valuation: Tools and Techniques for Determining the Value of Any Asset, Second Edition, A. Damodaran, 992 pages Publisher: Wiley; 2nd edition (January 18, 2002), page 218.

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

The financial analysis refers to the time of investment decision-making.

The following assumptions have been used based on the information provided by the enterprise:

1. Investment decision: 20 July 2004, commissioning date: January 2006;

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[9] The calculation at constant prices as of the time of decision-making provides an objective view of the long-term future. It allows to perform a “pure” sensitivity analysis not impacted by expert estimations of inflation levels, prices etc., and to identify the most important factors actually impacting the project’s financial performance.

[10] http://www.cbonds.info/ru/rus/emissions/emission.phtml/params/id/242

[11] Eurostat statistic annual report http://epp.eurostat.ec.europa.eu/tgm/table.do?tab=table&language=en&pcode=tsieb060&tableSelection=1&footnotes=yes&labeling=labels&plugin=1

2. The project investment cost accounts for approximately EUR 176 million[12] during four years;
3. The calculations are made at constant prices as of June 2004[13];
4. The exchange rate (EUR/RUR) 1/ 36.1936 [14];
5. The project lifetime is around 20 years[15] (lifetime of the main equipment);
6. Raw material consumption and electricity for BF is taken into account in line with the technical specifications;
7. Coke and iron bearing material consumptions are the biggest cost component constituting more than 80 % of total operational cost.
8. Annual pig iron production in steelmaking pig iron equivalent is 2,300,000[16] tonnes of pig iron per year.
9. Annual coke production by the coke oven battery is 432[17] thousand tonnes, commissioning date: January 2007;
10. Left additional coke (for operation BF#4) is bought from other coke producers.

The project cash flow is formed by revenue flows generated by sales of pig iron. Production of slag and blast furnace gas are taken into account during calculation primary cost.
The project's financial indicator is presented in the Table B.2.2 below.

Table B.2.2. Financial indicators of the project

Scenario	IRR (%)
Base case	4.84

Cash flow analysis shows IRR of 4.84 %. It is well below the benchmark determined as 13.45 %. Hence, the project cannot be considered as a financially attractive course of action.

Sub-step 2d: Sensitivity analysis

A sensitivity analysis should be made to show whether the conclusion regarding the financial/economic attractiveness is robust to reasonable variations in the critical assumptions, as it can be seen by application of the Methodological Tool "Tool for the demonstration and assessment of additionality" (Version 05.2).

The following three key indicators were considered in the sensitivity analysis: investment cost, steel prices, metal stock. The other cost components account for less than 20 % of total or operation cost and therefore are not considered in the sensitivity analysis. In line with the Additionality Tool the sensitivity analysis should be undertaken within the corridor of ±10 % for the key indicators.

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[12] According to Severstal's summary expenditure for BF#4, COB#3 and TRT construction.
[13] The calculation at constant prices as of the time of decision-making provides an objective view of the long-term future. It allows to perform a "pure" sensitivity analysis not impacted by expert estimations of inflation levels, prices etc., and to identify the most important factors really impacting the project's financial performance.
[14] http://www.cbr.ru/eng/currency_base/daily.aspx?C_month=07&C_year=2004&date_req=20.07.2004
[15] Government of the Russian Federation's enactment #1 from 01.01.2002, Classification of fixed capital and amortization groups, http://base.consultant.ru/cons/cgi/online.cgi?req=doc;base=LAW;n=64119
[16] Design parameter, Detail project JSC Severstal Construction of Coke Oven Battery #3, 2003.
[17] Design parameter, Detail project JSC Severstal Construction of Blast Furnace #4, 2004.

It is unlikely that pig iron, coke and iron bearing materials price will go up or down independently one from another because these parameters are considered together. Coke and pellet cost occupies fixed part in iron cost of a pig iron producer. They are the biggest cost component constituting about 80 % of total operation cost. Thus they are depended from each other.

Scenario 1 considers 10% investment cost growth. Scenario 1 shows that this assumption worsened the cash flow performance due to significant cost increase. IRR is equal 3.98%.

Scenario 2 is based on the assumption of 10% investment cost decrease that improves cash flow and performance indicators making IRR the higher on 5.81%.

Scenario 3 implies 10% growth of coke and iron bearing materials cost and pig iron price. It leads that IRR climbing up to 5.55%. Pig iron prices are the most revenue driving indicator. But despite increase in pig iron price proposed scenario is robust.

Scenario 4 implies 10% reduction of coke and iron bearing materials cost and pig iron price. As plant revenues are one of the main components reducing worsens the cash flow performance indicators. But despite reduce in pig iron price proposed scenario is robust. IRR is equal 4.07%.

A summary of the results is presented in the Table B.2.3 below.

Table B.2.3: Sensitivity analysis (summary)

Scenario	IRR (%)
Scenario 1	3.98
Scenario 2	5.81
Scenario 3	5.55
Scenario 4	4.07

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

Outcome of Step 2: After the sensitivity analysis it is concluded that the proposed JI project activity is unlikely to be financially/economically attractive.

Step 3: Barrier analysis
In line with the Additionality Tool no barrier analysis is needed when investment analysis is applied.

Step 4: Common practice analysis

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

Construction of the BF #4 includes introduction of the top-pressure recovery turbine (GUBT). GUBT allows returning about 40% of spent energy for blast-furnace air and used to generate additional electricity due to utilising off-gas positive pressure. Twenty-two GUBTSs were installed by OJSC Turbomotorniy zavod (see below). Only seven of them were installed in Russia. Considering that forty-nine blast furnaces were operating in Russia in 2007, this amount cannot be considered significant.

Table B.2.4: GUBT installation

Works	Country	Year	Installed equipment (amount)
Cherepovecky MK	Russia	1968-1989, 2005[18]	GUBT-8 (1), GUBT-12 (3)
MMK	Russia	1969	GUBT-6 (1)
NTMK	Russia	1983	GUBT-12 (1)
Uralsteel	Russia	1981	GUBT-8 (1)
Krivorog MZ	Ukraine	1974-1980	GUBT-12 (4)
Dneprovskiy MK	Ukraine	1980	GUBT-8 (1)
Karagandinskiy MK	Kazakhstan	1984-1985	GUBT-12 (2)
Alchevskiy MK	Ukraine	1981	GUBT-12 (1)
Nippon Steel	Japan	1975 (1998 reconstruction)	GUBT-12 (1)
Kawasaki Steel	Japan	1978	GUBT-12 (1)
Sumitomo shoji	Japan	1978 (1998 reconstruction)	GUBT-12 (1)
Nippon Kokan	Japan	1979	GUBT-12 (1)
Italsider	Italy	1981	GUBT-12 (1)
Vizakhapatnam	India	1984-1987	GUBT-12 (2)

Source: http://www.esco-ecosys.ru/2005_12/art69.htm and http://utz.ru/view_news2/id/145

GUBT life time is about 16-20 year (it depends on dust content in blast furnace gas). Taking into account information above the following can be concluded:

- most GUBTs installed in the Russian Federation were installed in the Soviet time under totally different conditions, incl. regulatory framework, investment climate, access to financing;
- the only GUBT installed lately is at Cherepovecky MK and is a JI project activity. Therefore according to the Additionality Tool the project should be excluded from the analysis.

Therefore, GUBT installation is not a common practice at Russian ironmaking plants.

Construction of coke oven battery includes dry-quenching plant installation. It has made possible to generate additional electricity due to utilising of coke thermal power. Usually water quenching is usage by Russian coke producers. Because it requires less investment and allows increasing bulk-coke yield but it leads to insignificant quality reducing. GIPROKOKS developed this technology and received patent. Technology usage is shown in Table B.2.5. GIPROKOKS's technology has been implemented less than 22% from total dry-quenching units in Russia. Dry-quenching usage in Russia is about 30 % from total coke production. Also other dry-quenching technologies (no GIPROKOKS) have been implemented in Russia.

Table B.2.5: Dry-quenching usage

Facility	Usage percentage of Dry-quenching in Russia in 2010[19]	Implementation of GIPROKOKS's technology (quantity of Dry-quenching units)[20]
	%	item
Total Russia	30	14 (about 24%)

[18] It is a JI project published on UNFCCC web-page for global stakeholder consultation ().
[19] "LLC "Korporatsiya proizvoditeley chernih metalov" annual statistical report 2010
[20] "GIPROKOKS", http://giprokoks.com/en/page/5/3

OJSC "MMK"	15.1	1 (1986)
OJSC "NTMK"	67.1	1 (1986)
OJSC "NKMK"	-	-
OJSC "Uralsteel"	23.0	1 (1968)
OJSC "Cherepovecky MK"	59.0	3 (1965, 1972, 1978)
OJSC "NLMK"	62.2	2 (1969, 1979)
OJSC "ZSMK"	23.0	3 (1969, 1971, 1975)
OJSC "Mechel Coks"	-	-
OJSC "Altay koks"	27.8	2 (1984, 1985)
OJSC "Kemerovskiy KXZ"	28.2	1 (1979)
OJSC "Gubahinskiy koks"	-	-
OJSC "Moscow KGZ"	-	-

COB life time is about 30 years in Russia. Thus the proposed JI project does not reflect a widely observed and commonly carried out activity.

Sub-step 4b: Discuss any similar Options that are occurring:
It is required to follow Sub-step 4b according to the Tool when this project is widely observed and commonly carried out. The proposed JI project does not represent a widely observed practice in the area considered (see Sub-step 4a). So, this sub-step is not applied.

Sub-steps 4a and 4b are satisfied, i.e. similar activities cannot be widely observed. Thus proposed project activity is not a common practice.

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

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

There are three different sources of GHG emissions during the coke and iron production:
- Emission from the raw materials (coke, lime, limestone, sinter, pellet etc.);
- Fuel (gas) combustion;
- Steam consumption (steam generation);
- GHG emissions from the Russian electricity grid.

An overview of all emission sources in the coke and iron production of each proposed subproject are given in Table B.3.1-B.3.2 below. The emission sources within the subproject boundary are shown in Figure B.3.1-B.3.2 below. The project boundary shall encompass all anthropogenic emissions by sources of GHGs which are:

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

Leakages
The potential leakages are associated with:

- Fugitive CH_4 emissions associated with fuel extraction, processing, transportation and distribution of natural gas;
- Technical transmission and distribution losses of electricity.

Subproject 1
This subproject does not consume natural gas from outside. Own blast furnace gas and oven gas are used. Annual electricity consumption in project scenario is approximately 6,353 MWh. In Russian Federation the electricity losses are 11-13%[21]. The emission factor for electricity consumption is 0.511 tCO_2/MWh (please see Annex 2 of the PDD). And volume of emission is 0.511×6,353×11/100 = 357 tCO_2. Also all Coke oven batteries have similar leakages and it contributes to less than 1 % of the total emissions (CO_2 equivalent). Therefore omitting these leakages for a coke making process is conservative.

Subproject 2
For subproject 2, most part of leakages in project scenario is associated with fugitive CH_4 emission (for natural gas consumption) and losses of electricity.
During calculation baseline emission factor for pig iron production, electricity is not taking into account. Project emission includes project electricity consumption (for conservative reasons). Also annual natural gas consumption in project is less than by other pig iron producers. Therefore omitting these leakages for the project ironmaking process is conservative.

Thus the leakages in project scenario are less than in baseline scenario for both subprojects 1 and 2 and these emissions have not been taken into account for simplicity and conservatism.

Table B.3.1: Sources of emissions during coke production

№	Source	Gas	Included/ excluded	Justification/Explanation
1	Total electricity consumption during a coal charge and coke production	CO_2	Included	• All coke producers have comparable emissions from these sources; • Emissions are calculated using standardized regional electricity factors for Russia.
2	Fuel consumption (coke oven gas, blast furnace gas).	CO_2	Included	• All coke producers have comparable emissions from these sources; • Emissions are calculated using IPCC emission factor for a coke oven gas and own emission factors for a blast furnace gas.
3	Coke oven gas combustion in flaring system	CO_2	Included	• All iron producers have comparable emissions from these sources; • Emissions are calculated using IPCC emission factor.
4	Methane origination during fuels burning	CH_4	Excluded	The gas was excluded from the consideration due to their small volume of emissions (see the description in section D.1).
5	Nitrous oxide origination during fuels burning	N_2O	Excluded	The gas was excluded from the consideration due to their small volume of emissions (see the description in section D.1).

[21] http://www.abok.ru/for_spec/articles/14/2833/tb.htm

Figure B.3.1: Sources of emissions and subproject boundary for coke production

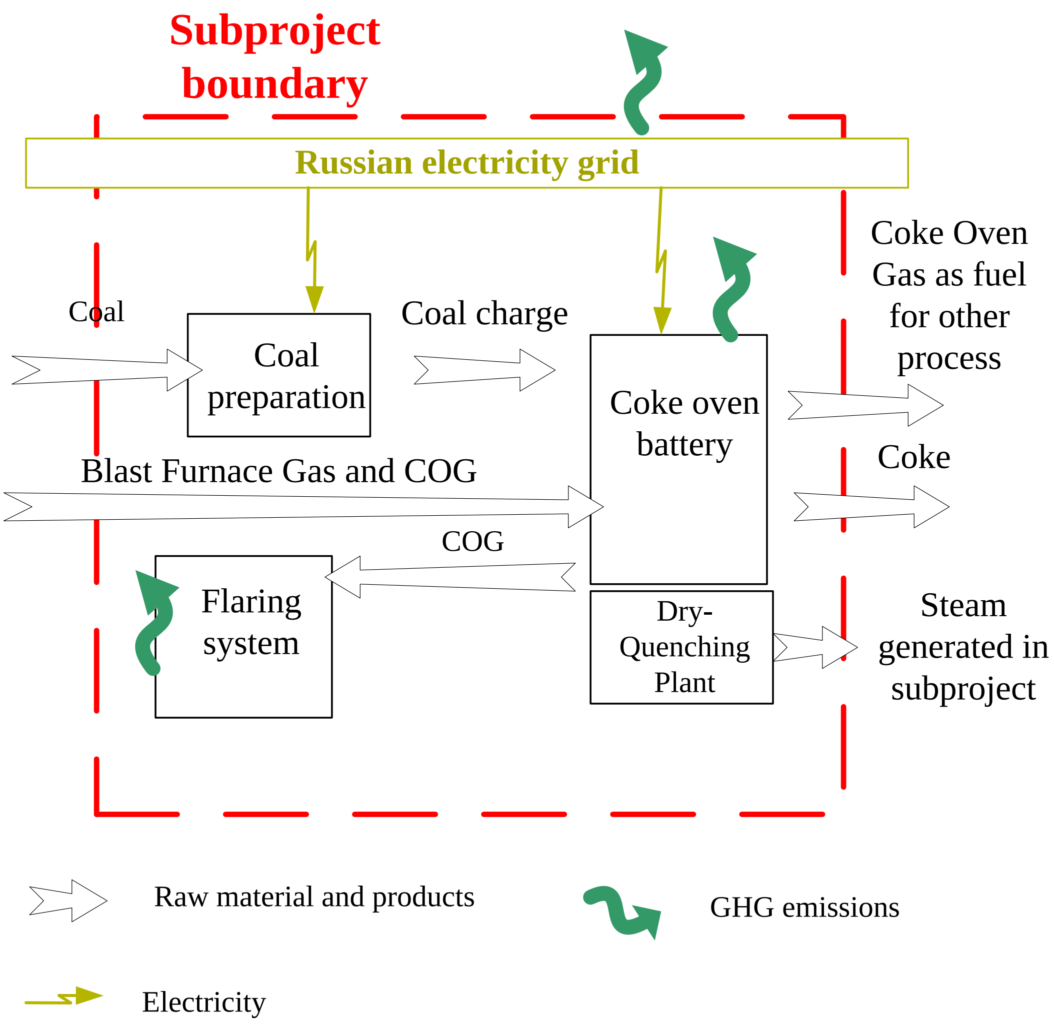
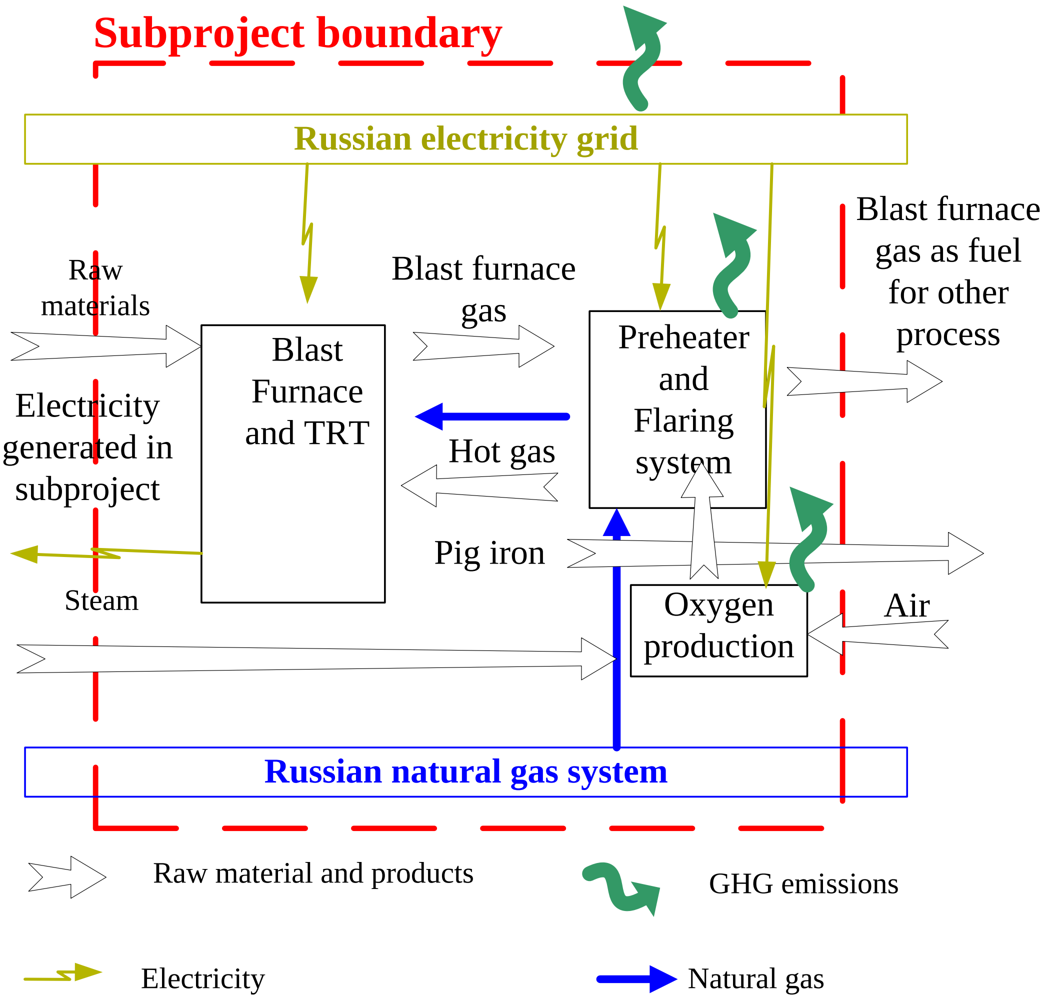


Table B.3.2: Sources of emissions from the ironmaking process

№	Source	Gas	Included/ excluded	Justification/Explanation
	Electricity and steam consumption during the oxygen production	CO_2	Included	• All steel producers have comparable emissions from these sources, thus including these sources is conservative; • Emissions associated with nitrogen and argon production are not calculated separately, these emissions are included in emissions associated with oxygen production because they are by-products of oxygen production; • Emissions (from electricity) are calculated using standardized regional electricity factors for Russia; • Emissions (from steam) are calculated using own emission factors for steam production.

№	Source	Gas	Included/ excluded	Justification/Explanation
2	Total electricity consumption during an iron production and compressed air production.	CO_2	Included	• All iron producers have comparable emissions from these sources, thus including of these sources is conservative; • Emissions are calculated using standardized regional electricity factors for Russia.
3	Natural gas consumption	CO_2	Included	• All iron producers have comparable emissions from these sources, thus including of these sources is conservative; • Emissions are calculated using standardized IPCC emission factor for natural gas.
4	Coke, pellet and sinter production	CO_2	Included	• All iron producers have comparable emissions from these sources; • Emissions are calculated using IPCC and calculated own emission factors (for coke).
5	Limestone and Dolomite (slag-forming materials)	CO_2	Included	The emission of this source is minor because usual slag-forming components are included as part of pellet and sinter. Additive of limestone and dolomite directly to a blast furnace is only as correction, thus including of these sources is conservative.
6	Blast furnace gas post-combustion in preheater and flaring system.	CO_2	Excluded	Blast furnace gas consists of carbon monoxide, carbon dioxide and hydrogen gas. It is underfired exhaust gas which is determined by blast furnace process. During emission calculation from raw material (coke) and fuel (natural gas) IPCC emission factor is used. Thus it means full combustion in a blast furnace without case of underfiring. Therefore blast furnace gas post-combustion is not included in the emission calculation (for the avoidance of double accounting).
7	Blast furnace gas combustion outside the plant site	CO_2	Excluded	Part of blast furnace gas is used in boiler (outside of the plant site for preparation of hot water). Blast furnace gas consists of carbon monoxide, carbon dioxide and hydrogen gas. Only carbon monoxide and hydrogen gas can be used as fuel. Therefore carbon dioxide generated from carbon monoxide in boiler has to be excluded from total emissions. Because blast furnace gas (carbon monoxide) is combusted not for the project.
8	Methane origination during fuels burning	CH4	Excluded	The gas was excluded from the consideration due to their small volume of emissions (see the description in section D.1).
9	Nitrous oxide origination during fuels burning	N2O	Excluded	The gas was excluded from the consideration due to their small volume of emissions (see the description in section D.1).

Figure B.3.2: Sources of emissions and subproject boundary for ironmaking process



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

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

Date of completion of the baseline study: 09/09/ 2010

Name of person/entity setting the baseline:
Mikhail Butyaykin
Global Carbon BV
Phone: +31 30 850 6724
Fax: +31 70 891 0791
E-mail: butyaykin@global-carbon.com
Global Carbon BV is a project participant.

SECTION C. Duration of the project / crediting period

C.1. Starting date of the project:

According to GLOSSARY OF JOINT IMPLEMENTATION TERMS, Starting date of JI project is the date when construction, implementation or real action takes place for the project. This project consists of two subprojects. Construction of the blast furnace is connected with the coke oven battery construction because coke is main raw material for pig iron production. Coke oven battery financing was approved by JSC Severstal on the 20 July, 2004. Blast furnace financing was approved by JSC Severstal on the 23 December, 2004[22]. After approved financing, equipment purchase taken place.

Thus project start date is taken 20 July 2004JSC.

C.2. Expected operational lifetime of the project:

The operational lifetime of the project is 20 years or 240 months. This corresponds to expected operational lifetime of BF and COB – the biggest investment cost item.

C.3. Length of the crediting period:

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

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

[22] Document - Approved financing of blast furnace # 4 construction by Severstal, 23.12.2004

SECTION D. Monitoring plan

D.1. Description of monitoring plan chosen:

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

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

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

The following assumptions for calculation of both baseline and project emissions were used (for conservative reasons):

- The pig iron and coke production are the same in the project and baseline scenario (ER calculations could not be made due to steel production reduction);
- The type of fuel combusted and raw material consumed is not influenced by the project (In case fuel change it will allow to calculate ER correct);
- The emissions from electricity consumption/generation are established using the relevant regional Russian standardized grid emission factor, as described in Annex 2 (This Russian standardized grid emission factor was calculated according to CDM tool and was determined by Bureau Veritas).

The project emissions are established in the following way (for conservative reasons):

- The project emission is the emission from blast furnace #4;
- The emission from coke oven battery #3are included as coke production emission factor in calculation BF project emission (for double calculation excluding);
- Greenhouse emissions for 2008-2009 are determined using actual production data for these years(for calculation actual ER in this period);
- Greenhouse emissions during 2010-2012 are determined using performance data of 2009 (for calculation ER on the ground of achieved data).

The baseline emissions are established in the following way (for conservative reasons):

- The baseline emissions of the pig iron production are established using the approach as given in Annex 2;
- The baseline emissions of the coke production are established using the IPCC emission factor for coke production;

- The baseline emissions of the grid are established using the Russian standardized grid factor as described in Annex 2 (This Russian standardized grid emission factor was calculated according to CDM tool and was determined by Bureau Veritas);
- Baseline emission factor of the displacing production may be fixed ex-ante for three years.

General remarks:

- Social indicators, such as number of people employed, safety records, training records etc., will be available to a verifier, if required;
- Only CO_2 emissions are taken into account. Major source of other GHGs such as CH_4 and N_2O at a blast furnace process is the burning of fuel (coke). Given fuel specific consumption in ordinary blast furnace process in Russia, CH_4 emission is 127 g/tonne of pig iron and N_2O emissions is 19 g/tonne of pig iron compared with about 1700 kg of CO_2 per tonne of pig iron (2006 IPCC Guidelines for National Greenhouse Gas Inventories, Chapter 2, STATIONARY COMBUSTION). Also emissions may be less because blast furnace gas is burnt up in boiler and preheater. Omitting these two pollutants for a ironmaking process is conservative, because they contribute to less than 0.52 % of the total emissions (CO_2 equivalent), far below the confidence level for the CO_2 emission calculation. The CH_4 and N_2O emission reductions will not be claimed. This is conservative.

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

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

ID number *(Please use numbers to ease cross-referencing to D.2.)*	Data variable	Source of data	Data unit	Measured (m), calculated (c), estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment
P1	PE_y	Annual plant calculations	tCO_2	C	Annually	100%	Electronic and paper	-
P2	PE_y^{BF4}	Annual plant calculations	tCO_2	C	Annually	100%	Electronic and paper	-
P3	$PE_{raw,y}^{BF4}$	Annual plant calculations	tCO_2	C	Annually	100%	Electronic and paper	-
P4	$PE_{gas,y}^{BF4}$	Annual plant calculations	tCO_2	C	Annually	100%	Electronic and paper	-
P5	$PE_{oxy,y}^{BF4}$	Annual plant calculations	tCO_2	C	Annually	100%	Electronic and paper	-

P6	$PE_{coke,y}^{BF4}$	Annual plant calculations	tCO_2	C	Annually	100%	Electronic and paper	-
P7	$PE_{el,y}^{BF4}$	Annual plant calculations	tCO_2	C	Annually	100%	Electronic and paper	-
P8	$PE_{other,y}^{CO\rightarrow CO2}$	Annual plant calculations	tCO_2	C	Annually	100%	Electronic and paper	-
P9	PE_{y}^{COB3}	Annual plant calculations	tCO_2	C	Annually	100%	Electronic and paper	-
P10	$PR_{i,y}^{BF4}$	Annual technical report, measuring instrumentation	tonnes	M/C	Annually	100%	Electronic and paper	-
P11	EF_i	IPCC	tCO_2/tonne	C	Fixed *ex-ante*	100 %	Electronic and paper	Default values (IPCC 2006)
P12	$PR_{coke,y}^{BF4}$	Annual technical report, measuring instrumentation	tonnes	M/C	Annually	100%	Electronic and paper	-
P13	$PR_{coke,y}^{COB3}$	Annual technical report, measuring instrumentation	tonnes	M/C	Annually	100%	Electronic and paper	-
P14	EF_{coke}	IPCC	tCO_2/tonne	C	Fixed *ex-ante*	100 %	Electronic and paper	Default values (IPCC 2006)
P15	$EF_{coke,y}^{COB3}$	Annual plant calculations	tCO_2/tonne	C	Annually	100%	Electronic and paper	-
P16	$PG_{gas,y}^{BF4}$	Annual technical report, measuring instrumentation	$1000Nm^3$	M/C	Annually	100%	Electronic and paper	-
P17	$NCV_{gas,y}$	Annual technical report or IPCC	GJ/ m^3	C	Annually or Fixed *ex-ante*	100 %	Electronic and paper	Default values (IPCC 2006)
P18	EF_{gas}	IPCC	tCO_2/GJ	C	Fixed *ex-ante*	100 %	Electronic and paper	Default values (IPCC 2006)

P19	$PO_{oxy,y}^{BF4}$	Annual technical report, measuring instrumentation	1000 Nm^3	M/C	Annually	100%	Electronic and paper	-
P20	EF_{oxy}	Plant calculations	t CO_2/nm^3	C	Fixed *ex-ante*	100 %	Electronic and paper	See Annex 2
P21	EF_{coke}	IPCC	tCO_2/GJ	C	Fixed *ex-ante*	100 %	Electronic and paper	Default values (IPCC 2006)
P22	NCV_{coke}	Annual technical report or IPCC	GJ/ m^3or tonne	M/C	Annually or Fixed *ex-ante*	100 %	Electronic and paper	Default values (IPCC 2006)
P23	EF_{el}	See Annex 2	tCO_2/MWh	C	Fixed *ex-ante*	100 %	Electronic and paper	Electricity grid GHG emission factor for JI projects in Russian Regional Energy System “Center”. See Annex 2.
P24	$PEL_{el,y}^{BF4}$	Annual technical report, measuring instrumentation	MWh	M/C	Annually	100 %	Electronic and paper	-
P25	PBG_y^{BF4}	Annual plant calculations	$1000Nm^3$	C	Annually	100%	Electronic and paper	-
P26	CO_y	Annual technical report, measuring instrumentation	fraction	M/C	Annually	100 %	Electronic and paper	-
P27	$PBG_y^{BF4total}$	Annual technical report, measuring instrumentation	$1000Nm^3$	M/C	Annually	100%	Electronic and paper	-
P28	$PBG_y^{BF4preheater}$	Annual technical report,	$1000Nm^3$	M/C	Annually	100%	Electronic and paper	-

		measuring instrumentation						
P29	$PBG_y^{severstaltotal}$	Annual technical report, measuring instrumentation	$1000Nm^3$	M/C	Annually	100%	Electronic and paper	-
P30	$PBG_y^{severstal\ flaring}$	Annual technical report, measuring instrumentation	$1000Nm^3$	M/C	Annually	100%	Electronic and paper	-
P31	$PE_{COG,y}^{COB3}$	Annual plant calculations	tCO_2	C	Annually	100%	Electronic and paper	-
P32	$PE_{BFG,y}^{COB3}$	Annual plant calculations	tCO_2	C	Annually	100%	Electronic and paper	-
P33	$PE_{el,y}^{COB3}$	Annual plant calculations	tCO_2	C	Annually	100%	Electronic and paper	-
P34	$PG_{COG,y}^{COB3+4\ process}$	Annual technical report, measuring instrumentation	$1000Nm^3$	M/C	Annually	100%	Electronic and paper	-
P35	$PR_{coke,y}^{COB3+4}$	Annual technical report, measuring instrumentation	tonnes	M/C	Annually	100%	Electronic and paper	-
P36	$PP_{coke,y}^{severstal}$	Annual technical report, measuring instrumentation	tonnes	M/C	Annually	100%	Electronic and paper	-
P37	$PG_{COG,y}^{Severstalflaring}$	Annual technical report, measuring instrumentation	$1000Nm^3$	M/C	Annually	100%	Electronic and paper	-
P38	$NCV_{COG,y}$	Annual technical report or IPCC	GJ/Nm^3	M/C	Annually or Fixed *ex-ante*	100 %	Electronic and paper	Default values (IPCC 2006)
P39	EF_{COG}	IPCC	tCO_2/GJ	C	Fixed *ex-ante*	100 %	Electronic and	Default values

							paper	(IPCC 2006)
P41	PBG_y^{COB3}	Annual technical report, measuring instrumentation	1000Nm^3	M/C	Annually	100%	Electronic and paper	-
P42	$PEL_{el,y}^{COB3+4batteries+coke\,quenching}$	Annual technical report, measuring instrumentation	MWh	M/C	Annually	100 %	Electronic and paper	-
P43	$PEL_{el,y}^{severstal\,coal\,preparation}$	Annual technical report, measuring instrumentation	MWh	M/C	Annually	100 %	Electronic and paper	-

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

Project emission is determined according to the following formula:

$$PE_y = PE_y^{BF4} \quad (1)$$

Where:

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

PE_y^{BF4} Project emissions from BF#4 in year *y* (tCO_2).

Subproject emissions (BF4)

Subproject emission is determined according to the following formula:

$$PE_{y}^{BF4} = PE_{raw,y}^{BF4} + PE_{coke,y}^{BF4} + PE_{gas,y}^{BF4} + PE_{oxy,y}^{BF4} + PE_{el,y}^{BF4} - PE_{other,y}^{CO \to CO2} \qquad (2)$$

Where:

PE_{y}^{BF4}	Subproject emissions from BF#4 in year y (tCO_2);
$PE_{raw,y}^{BF4}$	Subproject emissions due to raw material production (coke, pellets and sinter) in year y (tCO_2);
$PE_{gas,y}^{BF4}$	Subproject emissions due to natural gas combustion in year y (tCO_2);
$PE_{oxy,y}^{BF4}$	Subproject emissions due to oxygen production in year y (tCO_2);
$PE_{coke,y}^{BF4}$	Subproject emissions due to coke combustion in year y (tCO_2);
$PE_{el,y}^{BF4}$	Subproject emissions due to electricity consumption in year y (tCO_2);
$PE_{other,y}^{CO \to CO2}$	Emissions that are not connected with subproject (burning of blast furnace gas (only CO) in other equipment) in year y (tCO_2).

Subproject emissions due to raw material production (BF4)

$$PE_{raw,y}^{BF4} = (PR_{i,y}^{BF4} \times EF_{i}) + ((PR_{coke,y}^{BF4} - PR_{coke,y}^{COB3}) \times EF_{coke}) + (PR_{coke,y}^{COB3} \times EF_{coke,y}^{COB3}) \qquad (3)$$

Where:

$PE_{raw,y}^{BF4}$	Subproject emissions due to raw material production (pellets and sinter) in year y (tCO_2);
$PR_{i,y}^{BF4}$	Raw material i consumption for BF#4 in year y (tonnes);
EF_{i}	Default emission factor of i production[23] (tCO_2/tonne of i).
$PR_{coke,y}^{BF4}$	Total coke consumption for BF#4 in year y (tonnes);

[23] IPCC Guidelines for National Greenhouse Gas Inventories (2006), Volume 3, Chapter 4, page 25, table 4.1.

$PR_{coke,y}^{COB3}$ Coke production by COB #3 in year *y* (tonnes);

EF_{coke} Default emission factor of coke production[24] (tCO_2/tonne of coke);

$EF_{coke,y}^{COB3}$ Emission factor of coke production by COB#3 in year *y* (tCO_2/tonne of coke).

Subproject emissions due to natural gas combustion (BF4)

$$PE_{gas,y}^{BF4} = PG_{gas,y}^{BF4} \times EF_{gas} \times NCV_{gas,y} \qquad (4)$$

Where:

$PE_{gas,y}^{BF4}$ Subproject emissions due to natural gas combustion in year *y* (tCO_2);

$PG_{gas,y}^{BF4}$ Total consumption of natural gas in the blast furnace #4 in year *y* (Nm^3);

$NCV_{gas,y}$ Net calorific value of natural gas in year *y* (GJ/Nm^3);

EF_{gas} Emission factor of natural gas (tCO_2/GJ)[25].

Subproject emissions associated with oxygen production are calculated according to the following formula (BF4)

$$PE_{oxy,y}^{BF4} = PO_{oxy,y}^{BF4} \times EF_{oxy} \qquad (5)$$

Where:

$PE_{oxy,y}^{BF4}$ Subproject emissions due to oxygen production in year *y* (tCO_2);

$PO_{oxy,y}^{BF4}$ Oxygen consumption in year *y* (nm^3);

EF_{oxy} Specific emission factor for oxygen production (t CO_2/Nm^3)[26].

[24] IPCC Guidelines for National Greenhouse Gas Inventories (2006), Volume 3, Chapter 4, page 25, table 4.1.

[25] IPCC Guidelines for National Greenhouse Gas Inventories (2006), Volume 2, Chapter 2, table 2.3.

[26] This parameter is fixed ex-ante (average for 2006-2008 years).

Subproject emissions due to coke combustion (BF4)

$$PE_{coke,y}^{BF4} = EF_{coke} \times PR_{coke,y}^{BF4} \times NCV_{coke} \qquad (6)$$

Where:

$PE_{coke,y}^{BF4}$ Project emissions due to coke combustion in year y (tCO_2);

EF_{coke} Emission factor of coke (tCO_2/GJ) [27];

$PR_{coke,y}^{BF4}$ Total consumption of coke in the blast furnace #4 in year y (tonnes);

NCV_{coke} Net calorific value of coke (GJ/ t) [28];

Subproject emissions due to electricity consumption (BF4)

Emissions that are due to electricity consumption are estimated/calculated as follows:

$$PE_{el,y}^{BF4} = EF_{el} \times PEL_{el,y}^{BF4} \qquad (7)$$

Where:

$PE_{el,y}^{BF4}$ Subproject emissions due to electricity consumption in year y (tCO_2);

EF_{el} Standardized CO_2 emission factor of the relevant regional electricity grid in year y (tCO_2/MWh), fixed ex-ante (see Annex 2);

$PEL_{el,y}^{BF4}$ Electricity consumption during iron production by constructed BF#4 in year y (MWh).

[27] IPCC Guidelines for National Greenhouse Gas Inventories (2006), Volume 2, Chapter 2, table 2.3.

[28] 2006 IPCC Guidelines on National GHG Inventories, http://www.ipcc-nggip.iges.or.jp/public/2006gl/vol2.html Volume 2, table 1.2.

Emissions that are not connected with subproject (BF4)

$$PE_{other\,y}^{CO \to CO2} = (PBG_y^{BF4} \times CO_y^k) \times \frac{28}{22.4} \times \frac{88}{56} \qquad (8)$$

Where:

$PE_{other\,y}^{CO \to CO2}$	Emissions that are not connected with subproject (burning of blast furnace gas (only CO) in other equipment) in year *y* (tCO_2);
PBG_y^{BF4}	Blast furnace gas output to other equipment from BF#4 (without own preheater consumption and flaring of BFG) in year *y* (1000 m^3);
CO_y	Carbon monoxide content in blast furnace gas in year *y* (fraction);
28	Molar weight of carbon monoxide;
22.4	Gas molar volume (Avogadro's number);
88	Molar weight of two molecules of carbon dioxide ($2CO + O_2 \to 2CO_2$);
56	Molar weight of two molecules of carbon monoxide ($2CO + O_2 \to 2CO_2$).

Blast furnace gas output to other equipment from BF#4 is determined according to the following formula:

$$PBG_y^{BF4} = PBG_y^{BF4total} - (PBG_y^{BF4preheater} + \frac{PBG_y^{BF4total}}{PBG_y^{severstaltotal}} \times PBG_y^{severstal\,flaring}) \qquad (9)$$

Where:

PBG_y^{BF4}	Blast furnace gas output to other equipment from BF#4 (without own preheater consumption and flaring of BFG) in year *y* (1000 m^3);
$PBG_y^{BF4total}$	Total blast furnace gas production in BF#4 in year *y* (1000 m^3);
$PBG_y^{BF4preheater}$	Blast furnace gas for preheater of BF#4 in year *y* (1000 m^3);
$PBG_y^{severstaltotal}$	Total blast furnace gas production in Severstal in year *y* (1000 m^3);

$PBG_y^{severstal\ flaring}$ Total blast furnace gas combustion in Severstal flaring system in year *y* (1000 m^3)[29].

Subproject emissions factor due to coke production (COB4)

Emission factor of coke production by COB#3 is determined according to the following formula:

$$EF_{coke,y}^{COB3} = \frac{PE_y^{COB3}}{PR_{coke,y}^{COB3}} \qquad (10)$$

Where:

$EF_{coke,y}^{COB3}$ Emission factor of coke production by COB#3 in year *y* (tCO_2/tonne of coke);

PE_y^{COB3} Subproject emissions due to coke production in COB#3 in year *y* (tCO_2);

$PR_{coke,y}^{COB3}$ Coke production by COB #3 in year *y* (tonnes).

$$PE_y^{COB3} = PE_{COG,y}^{COB3} + PE_{BFG,y}^{COB3} + PE_{el,y}^{COB3} \qquad (11)$$

Where:

PE_y^{COB3} Subproject emissions due to coke production in COB#3 in year *y* (tCO_2);

$PE_{COG,y}^{COB3}$ Subproject emissions due to coke oven gas combustion in COB#3 (includes flaring system) in year *y* (tCO_2);

$PE_{BFG,y}^{COB3}$ Subproject emissions due to blast furnace gas combustion in COB#3 (only CO) in year *y* (tCO_2);

$PE_{el,y}^{COB3}$ Subproject emissions due to electricity consumption in year *y* (tCO_2).

Subproject emissions due to coke oven gas combustion in COB#3 (includes flaring system) is determined according to the following formula:

[29] BFG from BF4 which combustion in flaring system cannot be monitored individually (only total BFG which flaring).

$$PE_{COG,y}^{COB3} = (PG_{COG,y}^{COB3+4\,process} \times \frac{PR_{coke,y}^{COB3}}{PR_{coke,y}^{COB3+4}} + \frac{PR_{coke,y}^{COB3}}{PP_{coke,y}^{severstal}} \times PG_{COG,y}^{Severstalflaring}) \times EF_{COG} \times NCV_{COG,y} \quad (12)$$

Where:

$PE_{COG,y}^{COB3}$ Subproject emissions due to coke oven gas combustion in COB#3 (includes Severstal flaring system) in year *y* (tCO_2) [30];

$PG_{COG,y}^{COB3+4\,process}$ Total consumption of coke oven gas in the coke oven battery #3 and #4 in year *y* (Nm^3);

$PR_{coke,y}^{COB3}$ Coke production by COB #3 in year *y* (tonnes);

$PR_{coke,y}^{COB3+4}$ Coke production by COB #3 and #4 in year *y* (tonnes);

$PP_{coke,y}^{severstal}$ Total coke production in Severstal in year *y* (tonnes);

$PG_{COG,y}^{Severstalflaring}$ Total COG combustion in Severstal flaring system in year *y* (1000 m^3);

$NCV_{COG,y}$ Net calorific value of fuel of type COG in year *y* (GJ/ Nm^3);

EF_{COG} Emission factor of COG (tCO_2/GJ) [31].

Subproject emissions due to blast furnace gas combustion is determined according to the following formula:

$$PE_{BFG,y}^{COB3} = (PBG_y^{COB3} \times CO_y) \times \frac{28}{22.4} \times \frac{88}{56} \quad (13)$$

Where:

$PE_{BFG,y}^{COB3}$ Subproject emissions due to blast furnace gas combustion in COB#3 (only CO) in year *y* (tCO_2);

PBG_y^{COB3} Blast furnace gas combustion in COB #3 in year *y* (1000 m^3);

[30] COG from COB#3 which combustion in flaring system cannot be monitored individually (only total COG which flaring). BFG for COB#3 cannot be monitored individually (only total for COB#3 and COB#4).

[31] IPCC Guidelines for National Greenhouse Gas Inventories (2006), Volume 2, Chapter 2, table 2.3.

CO_y	Carbon monoxide content in blast furnace gas in year *y* (fraction);
28	Molar weight of carbon monoxide;
22.4	Gas molar volume (Avogadro's law);
88	Molar weight of two molecules of carbon dioxide ($2CO + O_2 \rightarrow 2CO_2$);
56	Molar weight of two molecules of carbon monoxide ($2CO + O_2 \rightarrow 2CO_2$).

Subproject emissions due to electricity consumption is determined according to the following formula:

$$PE_{el,y}^{COB3} = EF_{el} \times \left(PEL_{el,y}^{COB3+4batteries+coke\,quenching} \times \frac{PR_{coke,y}^{COB3}}{PR_{coke,y}^{COB3+4}} + PEL_{el,y}^{severstal\,coal\,preparation} \times \frac{PR_{coke,y}^{COB3}}{PP_{coke,y}^{severstal}} \right) \quad (14)$$

Where:

$PE_{el,y}^{COB3}$	Total subproject emissions due to electricity consumption in year *y* (tCO_2) [32];
EF_{el}	Standardized CO_2 emission factor of the relevant regional electricity grid in year *y* (tCO_2/MWh), fixed ex-ante (see Annex 2);
$PEL_{el,y}^{COB3+4batteries+coke\,quenching}$	Electricity consumption during coke production by COB#3, COB#4 and coke quenching in year *y* (MWh);
$PEL_{el,y}^{severstal\,coal\,preparation}$	Electricity consumption during coal charging preparation for all coke oven batteries in Severstal in year *y* (MWh);
$PR_{coke,y}^{COB3+4}$	Coke production by COB #3 and #4 in year *y* (tonnes);
$PP_{coke,y}^{severstal}$	Total coke production in Severstal in year *y* (tonnes).

[32] Electricity consumption of COB#3 cannot be monitored individually (only total for COB3 and COB4).

D.1.1.3. Relevant data necessary for determining the baseline of anthropogenic emissions of greenhouse gases by sources within the project boundary, and how such data will be collected and archived:								
ID number *(Please use numbers to ease cross-referencing to D.2.)*	Data variable	Source of data	Data unit	Measured (m), calculated (c), estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment
B1	BE_y	Annual plant calculations	tCO_2	C	Annually	100%	Electronic and paper	-
B2	$BE_{iron,y}$	Annual plant calculations	tCO_2	C	Annually	100%	Electronic and paper	-
B3	$BE_{elect,y}$	Annual plant calculations	tCO_2	C	Annually	100%	Electronic and paper	-
B4	$BE_{steam,y}$	Annual plant calculations	tCO_2	C	Annually	100%	Electronic and paper	-
B5	PP_y^{BF4}	Annual technical report, measuring instrumentation	tonnes	M/C	Annually	100%	Electronic and paper	-
B6	BEF_y^{iron}	Annual plant calculations	tCO_2/tonnes steel	M/C	Annually or fixed *ex-ante*	100%	Electronic and paper	See Annex 2
B7	PEG_y^{TRT}	Annual technical report, measuring instrumentation	MWh	M/C	Annually	100 %	Electronic and paper	-
B8	EF_{el}	See Annex 2	tCO_2/ MWh	C	Fixed *ex-ante*	100 %	Electronic and paper	Electricity grid GHG emission factor for JI projects in Russian Regional Energy System "Center". See Annex 2.

B9	$PSG_{steam,y}^{DQP(3\text{-}4)}$	Annual technical report, measuring instrumentation	Gcal	M/C	Annually	100%	Electronic and paper	-
B10	EF_{gas}	IPCC	tCO_2/GJ	C	Fixed *ex-ante*	100 %	Electronic and paper	Default values (IPCC 2006)

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

As further described in Annex 2, the baseline emissions have four sources:

- Production by other pig iron plants (displacing production).
- Production by other coke producers (displacing production).
- Electricity generated in electricity grid of Russia.

$$BE_y = BE_{iron,y} + BE_{elect,y} + BE_{steam,y} \qquad (15)$$

Where:

BE_y Baseline emissions in year *y* (tCO_2);

$BE_{iron,y}$ Baseline emissions due to displacing pig iron production in year *y* (tCO_2) (see also Annex 2);

$BE_{steam,y}$ Baseline emissions due to steam generation in year *y* (tCO_2);

$BE_{elect,y}$ Baseline emissions due to displacing electricity generation in year *y* (tCO_2).

Displacing pig iron production

Displacing pig iron production of the baseline scenario is equal to project pig iron production by BF#4.

Baseline emissions due to displacing production are determined according to the following formula:

$$BE_{iron,y} = PP_y^{BF4} \times BEF_y^{iron} \qquad (16)$$

Where:

$BE_{iron,y}$ Baseline emissions due to displacing pig iron production in year *y* (tCO_2) (see also annex 2);

PP_y^{BF4} Subproject production by BF#4 in year *y* (tonne of pig iron);

BEF_y^{iron} Baseline emission factor for displacing pig iron production in year *y* (tCO_2/t steel) (see Annex 2).

Emission from other coke producers is taken into account during calculation BEF_y^{iron} (IPCC emission factor is used for other coke producers).

Electricity generated in electricity grid of Russia

In project electricity is generated by TPT (Top-Pressure recovery Turbine). Baseline emissions due to electricity generation by RES (Regional Energy System) are determined according to the following formula:

$$BE_{elect,y} = PEG_y^{TRT} \times EF_{el} \quad (17)$$

Where:

$BE_{elect,y}$ Baseline emissions due to displacing electricity generation in year *y* (tCO_2);

PEG_y^{TRT} Project electricity generation by Top pressure Recovery Turbine in year *y* (MWh);

EF_{el} Carbon emission factor of electricity grid of Russia (tCO_2/MWh) (it is a fixed value for 2008 – 2012, see Annex 2);

In project dry-Quenching Plant (3-4) generates steam which together with steam from other Dry-Quenching Plants is used for electricity generation by the steam turbine and other needs. Baseline emissions due to additional steam generation by a boiler are determined according to the following formula:

$$BE_{steam,y} = \frac{PSG_{steam,y}^{DQP(3\text{-}4)} \times 4.1868}{0.92} \times EF_{gas} \quad (18)$$

Where:

$BE_{steam,y}$ Baseline emissions due to steam generation in year *y* (tCO_2);

EF_{gas} Emission factor of natural gas, usage of gas as fuel in the baseline scenario is conservative (tCO_2/GJ) [33].

$PSG^{DQP(3\text{-}4)}_{steam,y}$ Project steam generation by Dry-Quenching Plant #3-4 in year *y* (Gcal);

4.1868 Converting coefficient Gcal to GJ;

0.92 Efficiency for new natural gas fired boiler[34], it is conservative than usage of efficiency for boiler at Severstal (fraction);

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

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

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

Not applicable

D.1.2.2. Description of formulae used to calculate emission reductions from the project (for each gas, source etc.; emissions/emission reductions in units of CO_2 equivalent):

Not applicable

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

---

[33] IPCC Guidelines for National Greenhouse Gas Inventories (2006), Volume 2, Chapter 2, table 2.3.
[34] According to CDM Methodological tool "Tool to determine the baseline efficiency of thermal or electric energy generation systems" (Version 01), table 1.

D.1.3.1. If applicable, please describe the data and information that will be collected in order to monitor leakage effects of the project:								
ID number *(Please use numbers to ease cross-referencing to D.2.)*	Data variable	Source of data	Data unit	Measured (m), calculated (c), estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment

Not applicable

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

In the baseline scenario energy consumptions (natural gas, coke) is bigger than in project scenario. Because estimated leakage is neglected by applying conservative method of ER calculation.

D.1.4. Description of formulae used to estimate emission reductions for the project (for each gas, source etc.; emissions/emission reductions in units of CO_2 equivalent):

$$ER_y = BE_y - PE_y \qquad (19)$$

Where:

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

BE_y Baseline emissions in year *y* (tCO_2);

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

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

The main relevant Russian Federation environmental regulations:

- Federal law of Russian Federation "On Environment Protection" (10 January 2002, N 7-FZ);
- Federal law of Russian Federation "On Air Protection" (04 May 1999, N 96-FZ).

According to national requirements, emissions connected with the plant operation have to be measured once a year or once in three years. It is described in the Volume of Maximum Allowable Emissions approved by Rostekhnadzor RF (Russian Federal Service for Ecological, Technical and Atomic Supervision) and Rospotrebnadzor (Federal Service on Surveillance for Consumer rights protection and human well-being). Severstal will systematically collect pollution data that may have negative impact on the local environment. Monitoring, data collection and archiving is done by Severstal laboratory. Collected and archived Data will be stored for more than five years in hardcopy and electronically.

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.
P10, P12, P13, P35, P36	Medium	Coke and raw material consumption/production for iron-making process is calculated as sum of daily reports of ironmaking shop. Monthly data is checked. The check is based on the monthly inventory reports of remaining raw materials and materials. The weighing apparatus is calibrated annually. Information is calculated and transferred to the Environmental protection department.
P16, P19	Medium	Natural gas, oxygen consumption for BF#4 is recorded and controlled by the Chief Power Engineer Department using fuel meters calibrated and maintained in line with the Russian regulations and is transferred to the Environmental protection department.
P17, P22	Medium	The laboratory of the suppliers provides data on the net calorific value of the natural gas consumed with its certificate. Data received from the laboratory of the Gas transportation organization is transferred to Environmental protection department.
P24, P42, P43	Medium	The electricity consumption is recorded and controlled by the Chief Power Engineer Department using electricity meters calibrated and maintained in line with the Russian regulations. Results of measurement are recorded and archived and transferred to the Environmental protection department.
P26	Medium	Carbon monoxide content in blast furnace gas is measured by plant laboratory. These data will be collected in Ecology department.
P27, P28, P29, P30, P34, P37, P41	Medium	Blast furnace gas Coke oven gas production/consumption are recorded and controlled by the Chief Power Engineer Department using fuel meters calibrated and maintained in line with the Russian regulations and is transferred to the Environmental protection department.

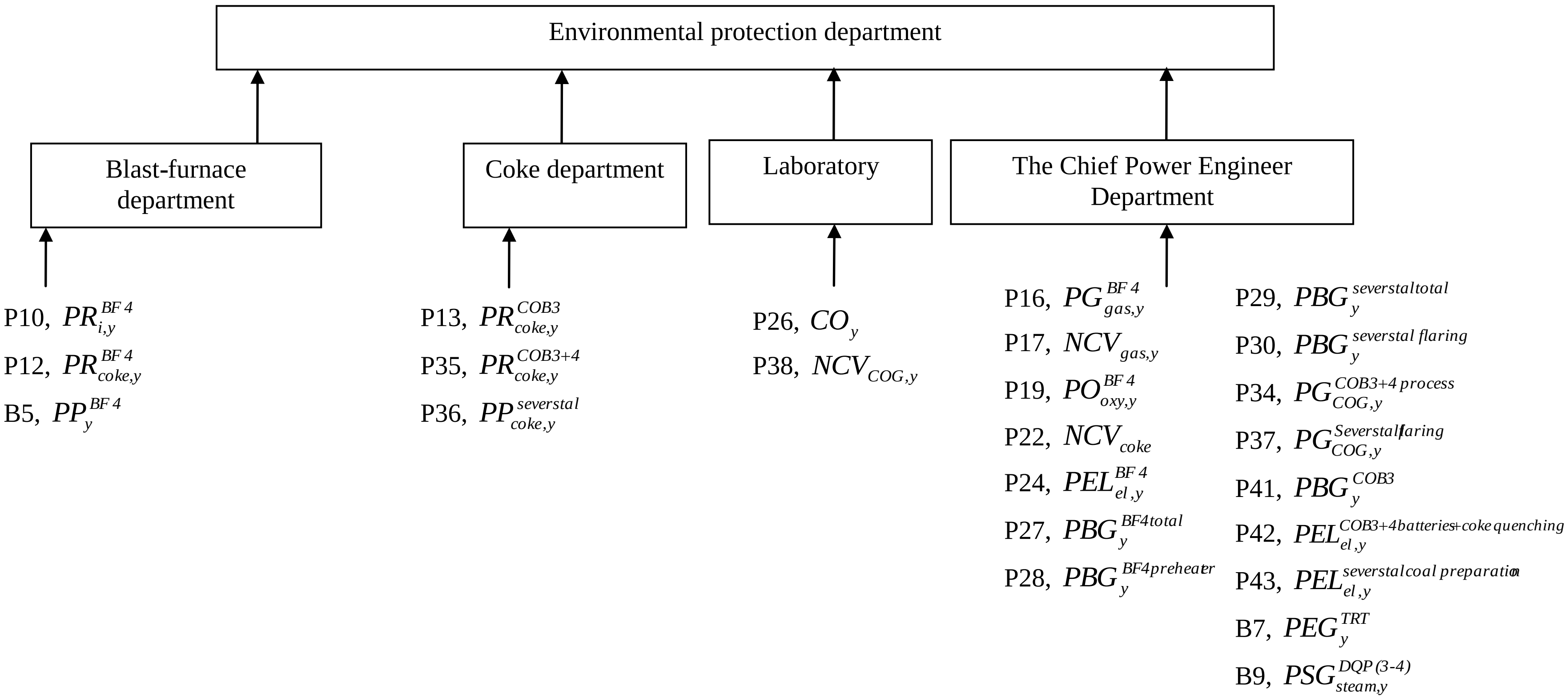
P38	Medium	Net Calorific Value of the BOG is measured by plant laboratory. Data received from the laboratory is transferred to Environmental protection department.
B5	Medium	Pig iron production is calculated as sum of daily reports of ironmaking shop. Monthly data is checked. The check is based on the monthly inventory reports of remaining and sold/consumed pig iron. The weighing apparatus is calibrated annually. Information is calculated and transferred to the Environmental protection department.
B7	Medium	The electricity generation is recorded and controlled by the Chief Power Engineer Department using electricity meters calibrated and maintained in line with the Russian regulations. Results of measurement are recorded and archived and transferred to the Environmental protection department.
B8	Medium	The steam generation is recorded and controlled by the Chief Power Engineer Department using electricity meters calibrated and maintained in line with the Russian regulations. Results of measurement are recorded and archived and transferred to the Environmental protection department.

The internal quality system at Severstal is functioning in accordance with the national standards and regulations in force. Electricity and gas meters for commercial accounting and master gages are calibrated by accredited organizations. Plant meters are calibrated by master gages. Certificated automatic system for commercial accounting of power consumption is introduced at Severstal.

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

The scheme of monitoring data collection at Severstal is described in Figure D.3.1.

Figure D.3.1: Data collection, quality assurance and monitoring at Severstal



Source: Severstal

Collecting information for monitoring purposes will consist on the following stages:

1) Environmental protection department
The Environmental protection department will be responsible for Monitoring plan implementation and logs keeping, i.e. for organizing and storing the data and the calculation of the emission reductions. It will also prepare the annually monitoring reports to be presented to the verifier of the emission reductions. The blast-furnace department, ironlmaking shop and The Chief Power Engineer Department of Severstal will submit relevant data to Environmental protection department. It will also store the data received from external organizations for three years for the purpose of the audit. Monitoring results will be kept at least for two years after the last transfer of project ERUs. In addition to the preparation of the monitoring reports, the department will conduct an internal audit annually to assess project performance and, if necessary, make corrective actions.
2) The Chief Power Engineer Department
Chief Power engineer Department is responsible for electricity consumption at Severstal. It collects data from the individual electricity meters installed at the production units that consume electricity and data of the commercial electricity meter. Data from individual electricity meters is cross-checked with the data of the commercial meter. For the purposes of monitoring, the energy department will report the level of electricity consumption of the equipments, and provide it to the environmental protection department for monitoring purposes. The Chief Power Engineer Department reports fuel, oxygen, BFG, COG and air consumption and data received from the laboratory are transferred to Environmental protection department. The laboratory of the Gas transportation organization provides data on the Net Calorific Value of the natural gas consumed with its certificate. Carbon monoxide content in BFG and coke NCV are measured by the laboratory at Severstal.
3) Coke department
Coke department is responsible for short term production strategy development and implementation. It will be responsible for coke production and data collection. Also, raw materials consumption and coke production are measured there. These data will be transferred to the environmental protection department for monitoring purposes.
4) Blast-furnace department
Blast-furnace department is responsible for short term production strategy development and implementation. It will be responsible for pig iron production and data collection. Also, pig iron production is measured in the blast-furnace department. This data will be transferred to the environmental protection department for monitoring purposes.
5) Laboratory
Carbon monoxide content in BFG and coke NCV are measured by the laboratory at Severstal. These data are transferred to Environmental protection department.

Global Carbon will visit Severstal for preparation of the monitoring report, template and the manual (two months before the project commissioning).

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

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  JSC Severstal is a project participant.

- Global Carbon BV, Mr Mikhail Butyaykin, JI Consultant
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  Global Carbon BV is a project participant.

SECTION E. Estimation of greenhouse gas emission reductions

E.1. Estimated project emissions:

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

Project emissions	Unit	2008	2009	2010	2011	2012
Electricity	[tCO_2/y]	33,502	43,040	41,309	41,146	41,146
Coke production/ consumption	[tCO_2/y]	3,353,998	3,771,512	3,706,434	3,691,520	3,691,520
Natural gas	[tCO_2/y]	483,556	532,507	465,136	463,301	463,301
Raw materials production	[tCO_2/y]	456,539	552,889	517,367	515,326	515,326
Oxygen	[tCO_2/y]	119,984	114,314	69,490	69,215	69,215
Not project emission	[tCO_2/y]	1,006,110	1,161,450	1,013,095	1,009,097	1,009,097
Total of project	[tCO_2/y]	3,441,469	3,852,811	3,786,641	3,771,411	3,771,411
Total 2008 - 2012	[tCO_2]	18,623,743				

Table E.1.2: Estimated project emissions after the crediting period, tCO_2/y

Project emissions	2013	2014	2015	2016	2017	2018	2019	2020
Electricity	41,146	41,146	41,146	41,146	41,146	41,146	41,146	41,146
Coke production/ consumption	3,691,520	3,691,520	3,691,520	3,691,520	3,691,520	3,691,520	3,691,520	3,691,520
Natural gas	463,301	463,301	463,301	463,301	463,301	463,301	463,301	463,301
Raw materials production	515,326	515,326	515,326	515,326	515,326	515,326	515,326	515,326
Oxygen	69,215	69,215	69,215	69,215	69,215	69,215	69,215	69,215
Not project emission	1,009,097	1,009,097	1,009,097	1,009,097	1,009,097	1,009,097	1,009,097	1,009,097
Total of project	3,771,411	3,771,411	3,771,411	3,771,411	3,771,411	3,771,411	3,771,411	3,771,411
Total 2013 - 2020	30,171,286							

In Table E.1.3 and Table E.1.4 technical data used for calculation of project emissions are presented. All emissions calculations for the baseline and the project scenario are made according to the formulas presented in Sections D.1.1.2 and D.1.1.4.

Table E.1.3: Technical data of pig iron production

Parameter	Unit	2008	2009	2010	2011	2012
Pig iron production	t pig	2,114,861	2,406,479	2,449,666	2,440,000	2,440,000
Electricity consumption	MWh/t	0.031	0.035	0.033	0.033	0.033
Coke consumption	t/t	0.445	0.441	0.428	0.428	0.428
Limestone consumption	t/t	0	0	0	0	0
Natural gas consumption	$1000m^3/t$	0.122	0.118	0.101	0.101	0.101
Net calorific value of natural gas	$GJ/1000\ m^3$	33.423	33.506	33.511	33.511	33.511
Blast furnace gas production	$1000m^3$	3,389,608	3,926,780	4,026,885	4,010,996	4,010,996
Blast furnace gas consumption	$1000m^3$	999,469	1,344,380	1,651,378	1,644,862	1,644,862

Parameter	Unit	2008	2009	2010	2011	2012
Blast furnace gas output	$1000m^3$	1,976,977	2,291,797	2,156,176	2,147,668	2,147,668
Content of CO in blast furnace gas	%	25.9	25.8	23.9	23.9	23.9
Sinter consumption	t/t	0.985	1.112	0.967	0.967	0.967
Pellet consumption	t/t	0.632	0.247	0.593	0.593	0.593
Electricity generation by the top-pressure recovery turbine	MWh	47,276	37,444	37,250	43,920	43,920

Source: JSC Severstal

Table E.1.4: Technical data of coke production

Parameter	Unit	2008	2009	2010	2011	2012
Electricity consumption	MWh	6,540	5,781	6,482	6,482	6,482
Coke oven gas consumption in flaring system	$1000м^3$	2,924	694	778	778	778
Coke oven gas consumption	$1000м^3$	6,570	8,508	9,538	9,538	9,538
Net calorific value of coke oven gas	$GJ/1000\ m^3$	16.7472	16.7472	16.7472	16.7472	16.7472
Blast furnace gas consumption	$1000м^3$	315,397	299,744	336,050	336,050	336,050
Content of CO in blast furnace gas	%	25.91	25.80	23.92	23.92	23.92
Steam generation by the dry coke quenching	Gcal	181,645	256,266	256,266	256,266	256,266

Source: JSC Severstal

E.2. Estimated leakage:

Not applicable

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

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

Project emissions	Unit	2008	2009	2010	2011	2012
Electricity	[tCO_2/y]	33,502	43,040	41,309	41,146	41,146
Coke production/ consumption	[tCO_2/y]	3,353,998	3,771,512	3,706,434	3,691,520	3,691,520
Natural gas	[tCO_2/y]	483,556	532,507	465,136	463,301	463,301
Raw materials production	[tCO_2/y]	456,539	552,889	517,367	515,326	515,326
Oxygen	[tCO_2/y]	119,984	114,314	69,490	69,215	69,215
Not project emission	[tCO_2/y]	1,006,110	1,161,450	1,013,095	1,009,097	1,009,097
Total of project	[tCO_2/y]	3,441,469	3,852,811	3,786,641	3,771,411	3,771,411
Total 2008 - 2012	[tCO_2]	18,623,743				

Table E.3.2: Estimated project emissions inclusive leakage after the crediting period, tCO_2/y

Project emissions	2013	2014	2015	2016	2017	2018	2019	2020
Electricity	41,146	41,146	41,146	41,146	41,146	41,146	41,146	41,146
Coke production/ consumption	3,691,520	3,691,520	3,691,520	3,691,520	3,691,520	3,691,520	3,691,520	3,691,520
Natural gas	463,301	463,301	463,301	463,301	463,301	463,301	463,301	463,301
Raw materials production	515,326	515,326	515,326	515,326	515,326	515,326	515,326	515,326
Oxygen	69,215	69,215	69,215	69,215	69,215	69,215	69,215	69,215
Not project emission	1,009,097	1,009,097	1,009,097	1,009,097	1,009,097	1,009,097	1,009,097	1,009,097
Total of project	3,771,411	3,771,411	3,771,411	3,771,411	3,771,411	3,771,411	3,771,411	3,771,411
Total 2013 - 2020	30,171,286							

E.4. Estimated baseline emissions:

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

Baseline emissions	Unit	2008	2009	2010	2011	2012
Other iron plants	[tCO_2/y]	3,639,084	4,140,877	4,215,190	4,198,557	4,198,557
Steam generation	[tCO_2/y]	46,375	65,426	65,426	65,426	65,426
Electricity generation	[tCO_2/y]	24,158	19,134	19,035	22,443	22,443
Total	[tCO_2/y]	3,709,617	4,225,436	4,299,650	4,286,426	4,286,426
Total 2008 - 2012	[tCO_2]	20,807,554				

Table E.4.2: Estimated baseline emissions for the project after the crediting period, tCO_2/y

Baseline emissions	2013	2014	2015	2016	2017	2018	2019	2020
Other iron plants	4,198,557	4,198,557	4,198,557	4,198,557	4,198,557	4,198,557	4,198,557	4,198,557
Steam generation	65,426	65,426	65,426	65,426	65,426	65,426	65,426	65,426
Electricity generation	22,443	22,443	22,443	22,443	22,443	22,443	22,443	22,443
Total	4,286,426	4,286,426	4,286,426	4,286,426	4,286,426	4,286,426	4,286,426	4,286,426
Total 2013 - 2020	34,291,407							

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

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

Emission reductions	Unit	2008	2009	2010	2011	2012
Total	[tCO_2/y]	268,147	372,625	513,009	515,015	515,015
Total 2008 - 2012	[tCO_2]	2,183,811				

Table E.5.2: Difference representing the emission reductions of the project after the crediting period, tCO_2/y

Emission	2013	2014	2015	2016	2017	2018	2019	2020

reductions								
Total	515,015	515,015	515,015	515,015	515,015	515,015	515,015	515,015
Total 2013 - 2020	4,120,121							

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

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

Year	Estimated project emissions (tonnes of CO_2 equivalent)	Estimated leakage (tonnes of CO_2 equivalent)	Estimated baseline emissions (tonnes of CO_2 equivalent)	Estimated emission reductions (tonnes of CO_2 equivalent)
Year 2008	3,441,469	0	3,709,617	268,147
Year 2009	3,852,811	0	4,225,436	372,625
Year 2010	3,786,641	0	4,299,650	513,009
Year 2011	3,771,411	0	4,286,426	515,015
Year 2012	3,771,411	0	4,286,426	515,015
Total (tonnes of CO_2 equivalent)	18,623,743	0	20,807,554	2,183,811

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

Year	Estimated project emissions (tonnes of CO_2 equivalent)	Estimated leakage (tonnes of CO_2 equivalent)	Estimated baseline emissions (tonnes of CO_2 equivalent)	Estimated emission reductions (tonnes of CO_2 equivalent)
Year 2013	3,771,411	0	4,286,426	515,015
Year 2014	3,771,411	0	4,286,426	515,015
Year 2015	3,771,411	0	4,286,426	515,015
Year 2016	3,771,411	0	4,286,426	515,015
Year 2017	3,771,411	0	4,286,426	515,015
Year 2018	3,771,411	0	4,286,426	515,015
Year 2019	3,771,411	0	4,286,426	515,015
Year 2020	3,771,411	0	4,286,426	515,015
Total (tonnes of CO_2 equivalent)	30,171,286	0	34,291,407	4,120,121

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:

Pig iron production has a certain impact on the local environment. In Russia emission levels in industry are regulated by operating licenses issued by the regional offices of Ministry of Natural Resources and Environment of Russian Federation on an individual basis for every enterprise that has significant impact on the environment. Environmental Impact Assessment (EIA) in Russia is regulated by the Federal Law "On the Environmental Expertise" and consists of two stages EIA (OVOS –in Russian abbreviation) and state environmental expertise (SEE). Significant changes into this procedure were made by the Law on Amendments to the Construction Code effective of January 1st, 2007[35]. This Law reduced the scope of activities subject to SEE, transferring them to so called State expertise (SE) in accordance with Article 49 of the Construction Code of RF. In compliance with the Construction code the Design Document should contain Section "Environment Protection". Compliance with the environmental regulations (so called technical regulations in Russian on Environmental Safety) should be checked during the process of SE. In the absence of the abovementioned regulations compliance is checked in a very general manner.

For the definition of the influence of the blast furnace and coke oven battery construction on air pollution in Cherepovets City, calculation of air pollution is made by program complex UPRZA "PDV-Ekolog" in accordance with OND-86 ("Methodology of calculation of harmful substances content in free air, contained in plants emissions" Goskomgydromet RF, 1987). The air pollution analysis demonstrated there is no excess of maximum allowable concentration for all substances. Project impact is insignificant. Qualitative composition of atmospheric air in residential area after project start up will remain within emission limits. The pollutions connected with burned natural gas are reduced after decommission of OHFs. Non organic dust pollution are reduced due to installation of new gas cleaning units in other equipment at Severstal too

The border of sanitary zone of the plant does not change after project implementation and represents 1 kilometer. Section "Environment Protection" of the project documents was approved on 14th November 2005 by the regional office of Glavgosexpertiza, in Vologda region (#09/7523) for the blast furnace construction. Section "Environment Protection" of the project documents was approved on 18th October 2006 by the regional office of Glavgosexpertiza, in Vologda region (#09/7677) for the coke oven battery construction.The project does not have any transboundary environmental impacts.

Following documents were taken into consideration during environmental impact assessment: State Law "About environment protection" N7 –FZ dated 10 Jan 2002; State Law "About sanitary and epidemiological wellness of the population" N52-FZ dated 17 March 1999 and others.

F.2. If environmental impacts are considered significant by the project participants or the host Party, please provide conclusions and all references to supporting documentation of an environmental impact assessment undertaken in accordance with the procedures as required by the host Party:

As it is shown in Section F1 project does not have significant negative environmental impact.

[35] Town Planning Code RF 2004 http://base.garant.ru/12138258/

SECTION G. Stakeholders' comments

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

Proposed JI project is not required to go through a local stakeholder consultation process, therefore public hearing was not organised. 14th November 2005 and 18th October 2006 "The Main Agency of the State expertise" (FGU "Glavgosexpertiza" in Russian abbreviation) approved construction of the blast furnace #4 and coke oven battery, positive conclusion of FGU "Glavgosexpertiza" #09/7523 and #09/7677 corresponding.

Severstal provided stakeholders with project information. Severstal had publications about the project in mass media. List of some publications is presented below:

- http://www.rosinvest.com/news/159784/ Blast furnace start up at Severstal;
- http://www.infogeo.ru/metalls/news/?act=show&news=16257 Severstal start up the blast furnace.

Annex 1

CONTACT INFORMATION ON PROJECT PARTICIPANTS

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Annex 2

BASELINE INFORMATION

As shown in Section B.1.above, the most plausible baseline scenario is that the coke and iron production equipment will not be installed and third Party producers will supply iron instead.

In this case, the baseline emissions consist of production emissions generated by other metallurgical plants (iron producers).

The displacing baseline emission is calculated on the basis of iron production emission factor (other iron plants) in Russia.

Project emissions of CO_2 calculation approach is described in Section D.1.1.2. Methodologies and calculations for definition of project fixed parameter used are shown bellow.

Project fixed parameters

Average technical parameters of steam and oxygen production

The data of technical parameters of the steam and oxygen production at Severstal in 2006-2008 and average amounts are presented in Table Anx.2.1 and Anx.2.2 below:

Table Anx.2.1: Technical parameters of the oxygen production

Parameter	Unit	2006	2007	2008
Total electricity consumption for air separation and gas compression	MWh	1,197,658	1,217,630	882,520
Total oxygen production	$1000m^3$	1,680,750	1,640,613	1,235,066
Steam consumption	Gcal	388,382	356,171	332,992
Specific emissions during oxygen production	**$tCO_2/1000m^3$**	**0.47**	**0.48**	**0.49**
Average for three years	**$tCO_2/1000m^3$**	**0.48**		

Source: Severstal, technical repot of power engineer

Emission factor for oxygen production at Severstal is calculated according to the following formula:

$$EF_{O2} = \frac{EL_y^{oxy} \times EF_{el} + S_{steam,y}^{oxy} \times EF_{steam}}{PO_{O2,y}^{oxy}} \qquad (1)$$

Where:

EF_{O2} Emission factor for oxygen production at Severstal (t CO_2/1000 Nm^3);

$PO_{O2,y}^{oxy}$ Oxygen production at Severstal in year y (1000 Nm^3);

EL_y^{oxy} Total electricity consumption for oxygen generation in year *y* (MWh);
EF_{el} Carbon dioxide emission factor of electricity grid of Russia (tCO_2/MWh);
$S_{steam,y}^{oxy}$ Steam consumption for oxygen generation in year y (Gcal);
EF_{steam} Specific emission factor for steam production (tCO_2/ Gcal).

Table Anx.2.2: Technical parameters of the steam production

Parameter	Unit	2006	2007	2008
Specific fuels consumption for steam generation	kg of coal equivalent/Gcal	174	174	175
Composition of fuel for steam generation				
Blast furnace gas	%	54	56	51
Coke oven gas	%	26	33	29
Natural gas	%	15	8	14
Coal	%	6	1	2
Breeze coke	%	-	-	1
Other coke	%	0.1	2	2
Specific emission for steam generation	**tCO_2/Gcal**	**0.477**	**0.470**	**0.451**
Average for three years	**tCO_2/Gcal**		**0.466**	

Source: Severstal, technical repot of power engineer

Emission factor for steam production at Severstal is calculated according to the following formula:

$$EF_{steam} = \sum_i \frac{SC_{fuel,y}^{steam} \times CF_{fueli,y}^{steam} \times 7000 \times 4{,}1868}{1000000} \times EF_i + \\ + \frac{SC_{fuel,y}^{steam} \times CF_{fuel,BFG,y}^{steam} \times 7000 \times 4{,}1868}{1000000} \times \frac{1}{NCV_{BFG,y}} \times CO_y^k \times \frac{28}{22.4} \times \frac{88}{56} \quad (2)$$

Where:
EF_{steam} Specific emission factor for steam production (tCO_2/ Gcal).
$SC_{fuel,y}^{steam}$ Specific fuel consumption for steam generation (kg of coal equivalent/Gcal);
$CF_{fueli,y}^{steam}$ Content of fuel *i* (coke oven gas, natural gas, coal, coke) in total fuel for steam generation
in EF_i Emission factor of fuel *i* (coke oven gas, natural gas, coal, coke) (tCO_2/GJ);
$NCV_{BFG,y}$ Net calorific value of Blast Furnace Gas in year *y* (GJ/ 1000 Nm^3 or tonne);
CO_y Carbon monoxide content in blast furnace gas in year *y* (fraction);
28 Molar weight of carbon monoxide;
22.4 Gas molar volume (Avogadro's number);
88 Molar weight of two molecules of carbon dioxide ($2CO + O_2 \rightarrow 2CO_2$);
56 Molar weight of two molecules of carbon monoxide ($2CO + O_2 \rightarrow 2CO_2$).

The specific energy consumptions are calculated according to the following formula:

$$EC_j = \frac{EC_{j,y}}{BP_{j,y}} \tag{3}$$

Where:

EC_j	Specific energy consumption parameter *j* (MWh/1000m^3);
$EC_{j,y}$	Total electricity consumption for *j* production in year *y* (MWh);
P_{j_y}	Total production of *j* in year *y* (1000m^3);
j	Air, oxygen;
y	Years 2005, 2006, 2007.

Average parameters (for the three years) are calculated according to Formula 1 too.
The average emission factor for oxygen production (EF_{O2}) is **0.48** tCO2/1000 Nm3and fixed ex-ante. The average Specific emission factor for steam production (). (EF_{steam}) is **0.466** tCO2/ Gcal and fixed ex-ante.

Baseline emission factor for displacing production

Methodological approach
The baseline emissions of the incremental production are calculated on the basis of iron production covered by the third party producers.
The iron industry is a transparent market where standardized types of iron products exist. Within a certain region or country iron can be transported from the producer to the consumer without constrains.

A similar situation exists in an electricity system where electricity can be transported from the producer to the consumer without significant transmission constraints. Given the similarity, the following approach takes into account the underlying principles of the "Tool to calculate the emission factor for an electricity system" (version 02) (hereinafter referred to as "CDM Tool"), adopted by the CDM Executive Board, which deals with the capacity additions to the electricity grid.

About the iron industry and emissions
Pig iron production is a complex and multilevel process. It consists of:
- Sinter (or pellet) production;
- Coke production;
- Iron production;
- Other auxiliary production.

Most of the big metal works are integrated facilities comprising all these production stages but some enterprises outsource some stages like sinter and coke production.

At each stage different types of fuels are burned and different types of raw materials are used. Emissions from these fuels and raw materials are direct emissions. Also there are indirect emissions which are associated with electricity consumption.

For iron production iron is used as raw material and for iron production coke and sinter (or pellet) are used as raw materials. Therefore total emissions at the each stage include emissions from previous stages, for example, emissions from iron production include emissions from used energy resources and used raw material at this stage and emissions which are associated with coke and sinter (pellet) production.

At each stage some energy resources are used, for example: coal, natural gas, residual oil, coke, electricity and etc. Also almost at each production stage derived gases are being produced, which are used in other stages of production:

- Sinter gas is produced during the sinter production;
- Coke oven gas and coke breeze are produced during coke production. They are used in sinter, iron, steel production and also for electricity and heat production at the local power plants or boilers,
- Blast furnace gas is produced during iron production and it can be used in the sinter, coke, iron production, for electricity and heat production and in rolling process (in the heating furnaces).

Therefore when emissions are being calculated at each stage emissions from derived gases burning offsite should be excluded.

Multiple default emission factors
In accordance with IPCC Guidelines[36] there are three methods for calculating CO_2 emissions by iron industry:

- Tier 1 method – calculation of emissions is based on the production data at all stages of production;
- Tier 2 method – calculation of emissions is based on the data of energy resources and raw materials consumption;
- Tier 3 method – the use of facility's emission data.

All these methods take into account only direct emissions (from fuel, limestone and etc.) and don't take into account indirect emissions (from electricity, oxygen production and etc.). Also they don't take into account indirect emissions associated with raw materials (iron, coke, sinter and pellet) production at the previous stages for non-integrated facilities. Therefore indirect emissions should be included in total emissions for purpose JI project.

Tier 3 and Tier 2 methods are preferably to be used for emission calculations (with indirect emissions).

Tier 1 method can be used for emission calculations for coke production only if data of energy resources and raw materials consumption is not available. According to IPCC Guidelines multiple default emission factor for Tier 1[37] is:

- for sinter production – 0.2 tCO_2/tonne of sinter;
- for pellet production – 0.03 tCO_2/tonne of pellet;
- for lime production – 0.75 tCO_2/tonne of lime;
- for coke production – 0.56 tCO_2/tonne of coke.

But it is impossible for iron production as the most CO_2 (approximately 70 %) is emitted at these stages (see discussion tree of IPCC Guidelines[38]).

Methodological approach of emission factors calculation using Tier 2 method for pig iron production (when Tier 1 multiple default emission factors are used for coke, sinter, pellet production) are described below.

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[36] 2006 IPCC Guidelines for National Greenhouse Gas Inventories.

[37] These factors are more conservative than emission factors of sinter (pellet) and coke production calculated in accordance with Tier 2 method because they don't include indirect emissions.

[38] 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Chapter 4: Metal Industry Emission, p.4.19.

Calculation of emission factors for iron production
Iron production emission factor is calculated according to the following formula:

$$EF_y^{iron} = \frac{E_y^{iron}}{IP_y} \qquad (4)$$

Where:

EF^{iron}	Iron production emission factor (tCO_2/tonne of iron);
E_y^{iron}	Iron production emissions in year *y* (tCO_2);
IP_y	Iron production by metal works in year *y* (tonnes).

Iron production emissions inclusive emissions from burned fuels, raw materials and emissions associated with sinter (pellet) and coke production are calculated in accordance with following formula:

$$E_y^{iron} = \sum_i Fuel_y^i \times NCV_{fuel\_i,\,y} \times EF_{fuel\_i} + \sum_j RM_y^j \times EF^j - (\sum_k SER_y^k \times CO_y^k) \times \frac{28}{22.4} \times \frac{88}{56} + E_y^{sin} + E_y^{pel} + E_y^{coke} + E_{oxygen,y} \qquad (5)$$

Where:

E_y^{iron}	Iron production emissions in year *y* (tCO_2);
$Fuel_y^i$	Fuel *i* (gas, coal, coke) consumption in year *y* (tonnes or m^3);
RM_y^j	Raw material *j* (limestone, dolomite and etc) consumption in year *y* (tonnes);
SER_y^k	Secondary energy resource *k* (blast furnace, coke oven gases) output in year *y* (1000 m^3);
CO_y^k	Carbon oxide content in *k* (blast furnace, coke oven gases) in year *y* (fraction);
28	Molar weight of carbon oxide;
22.4	Gas molar volume (Avogadro's law);
88	Molar weight of two molecule of carbon dioxide ($2CO + O_2 \rightarrow 2CO_2$);
56	Molar weight of two molecule of carbon oxide ($2CO + O_2 \rightarrow 2CO_2$);
EF_{fuel_i}	Emission factor of fuel of type *i* including coke (tCO_2/GJ);
$NCV_{fuel\_i,\,y}$	Net Calorific Value of fuel of type *i* in year *y* (GJ/(tonnes or m^3));
$E_y^{\sin}$	Sinter consumption emissions in year *y* (tCO_2);
E_y^{pel}	Pellet consumption emissions in year *y* (tCO_2);
$E_{oxygen,y}$	Emissions due to oxygen consumption emissions in year *y* (tCO_2).
E_y^{cok}	Coke consumption emissions in year *y* (tCO_2).

Sinter (pellet) and coke production emissions are calculated in accordance with the following formulae:

$$E_y^{cok} = Coke_y \times EF^{cok} \qquad (6)$$

$$E_y^{\sin} = Sin_y \times EF^{\sin} \qquad (7)$$

$$E_y^{pel} = Pel_y \times EF^{pel} \qquad (8)$$

$$E_{oxygen,y} = Oxy_y \times SC_{oxygen} \times EF_{el} \qquad (9)$$

Where:

$E_y^{\sin}$ Sinter consumption emissions in year *y* (tCO_2);

E_y^{pel} Pellet consumption emissions in year *y* (tCO_2);

E_y^{cok} Coke consumption emissions in year *y* (tCO_2);

Coke_y, Sin_y, Oxy_y, Pel_y Coke, sinter, oxygen and pellet consumption in year *y* (tonnes or $1000m^3$);

EF^{cok} Coke production emission factor equals 0.56 tCO_2/ tonne of coke;

$EF^{\sin}$ Sinter production emission factor equals 0.2 tCO_2/ tonne of sinter;

EF^{pel} Pellet production emission factor equals 0.03 tCO_2/ tonne of pellet;

$SC_{oxygeni,y}$ Specific energy consumption during oxygen production, 1000 kWh/$1000m^3$, fixed ex-ante;

EF_{el} Standardized CO_2 emission factor of the relevant regional electricity grid in year *y* (tCO_2/MWh), fixed ex-ante.

The displacing CO_2 emission factor of iron production is calculated as "operating margin" (OM). The operating margin refers to a cluster of metallurgical works whose iron production would be affected by the proposed JI project.

Operating margin (OM) emission factor

It is not feasible to define exactly which other existing metal works would produce the incremental amount of iron. The most transparent approach is to calculate the weighted average of specific CO_2 emission factor.

$$OM_y = \frac{\sum_m E_y^{iron,m}}{\sum_m SP_y^m} \qquad (10)$$

Where:

OM_y Emission factor or Operating Margin for iron production in year *y* (tCO_2/tonne of iron);

$E_y^{iron,m}$ Iron production emissions by a blast furnace process *m* in year *y* (tCO_2);

SP_y^m Iron production by metal works using blast furnace process *m* in year *y* (tonnes).

Build margin (BM) emission factor

In absence of the project, a competitor could decide to build new metal works/installations or extend an existing iron production capacity to meet the market demand. It is not feasible to define exactly what new metallurgical works/installations would be built and produce the incremental amount of iron. Four options can be applied to calculate the BM emissions:

a) The five most recent capacity additions built within the last 10 years are taken into account. This approach is applicable if relevant capacity additions can be observed;
b) Alternatively, five new capacity additions planned for the near future can be taken into account, if their implementation is realistic/probable;
c) Provided objective data exist, it can be assumed, for reasons of conservativeness, that an installation would be built based on Best Available Technology (BAT) of steel production;

d) If no recent capacity additions have occurred and it is unclear which new installations will be built or when, it is reasonable and most realistic to assume the BM emission factor to be zero ex-ante, but monitor it during the crediting period ex-post. In this context, the five most recent capacity additions built within the last 10 years (or all, if less than five exist) are taken into account, in accordance with the formula below.

$$BM_y = \frac{\sum_i E_y^{iron,i}}{\sum_i SP_y^i} \tag{11}$$

Where:

BM_y	Build Margin Emission factor for iron production in year *y* (tCO_2/tonne of iron);
$E_y^{iron,i}$	Emission at the new metallurgical works/installations *i* in year *y* (tCO_2/tonne of iron);
SP_y^i	Iron production of new metallurgical works/installations *i* in year *y* (tonnes).

The BM_y emission factor can either be calculated and fixed ex-ante for the whole crediting period, or estimated ex-ante and monitored and calculated ex-post in case of option a), it is fixed ex-ante in case of options b) and c), and it is monitored and calculated ex-post in case of option d).

Combined margin (CM) emission factor

The CM emission factor is calculated by weighing the OM emission factor and the BM emission factor on a 50 % / 50 % basis.

$$CM_y = \frac{OM_y + BM_y}{2} \tag{12}$$

Where:

CM_y	CM emission factor for incremental steel production (tCO_2/tonne of iron).

The CM emission factor is used for estimating/calculating the baseline emissions of the incremental production, unless the BM emission factor is zero, as described in option d) above. In the latter case, only the OM emission factor is taken into account.

In principle, the CM emission factor can either be calculated and fixed ex-ante for the whole crediting period, or estimated ex-ante and monitored and calculated ex-post.

JI projects with a final positive determination under the JI Track 2 procedure and projects approved under the JI Track 1 procedure[39] and shown accordingly on the UNFCCC JI website are excluded from the sample units for the OM/BM/CM emission factor calculation.

If the data required to calculate the OM/BM/CM emission factors for year y is only available later than six months after the end of year y, the emission factors of the previous year (y-1) may be used. If the data is only available for more than 18 months after the end of year y, the emission factors of the year preceding the previous year (y-2) may be used. The same data vintage (y, y-1 or y-2) should be used throughout the crediting period.

[39] Under the JI Track 1 procedure, it is the sole responsibility of the Host Party to verify emission reductions (or enhancements of removals) as being additional to any that would otherwise occur.

Application of methodological approach

Background data for the calculation of the OM emission factor
Information on the metallurgical works and emissions and emission factors calculation for iron production in 2007 are presented in the Table Anx.2.3 and the Table Anx.2.4.

Table Anx.2.3: Results of emissions and emission factors calculations for steelmaking pig iron production

Facility	Iron production	Total emissions	Emission factors
	Tones	tCO_2	tCO_2/tonne of iron
JSC "MMK"	9,482,448	15,900,695	1.677
JSC "NTMK"	5,333,614	9,171,425	1.720
JSC "NKMK"	1,471,977	2,923,987	1.986
JSC "Uralsteel"	2,791,373	5,014,937	1.797
JSC "Cherepovecky MK"	8,758,538	13,328,789	1.522
JSC "NLMK"	9,050,188	17,121,344	1.892
JSC "ZSMK"	5,246,170	8,875,330	1.692
JSC "Kosogorsky MK"	279,611	515,213	1.843
JSC "Chusovskoy MZ"	610,996	1,109,560	1.816
JSC "Verhnesaychihinsky MZ"	163,374	403,683	2.471
JSC "TulaCherMet"	2,663,584	4,344,263	1.631
JSC "Chelyabinsky MK"	3,685,893	6,548,669	1.777
JSC "MZ imeni Serova"	366,642	635,354	1.733
JSC "Svobodny Sokol"	514,391	863,393	1.678
Total	**50,418,799**	**86,756,641**	**1.721**

Source: LLC "Korporatsiya proizvoditeley chernykh metalov"

Iron production emission factor is equal to **1.721** tCO_2/tonne of iron (see Table Anx.2.4).

Data of electricity consumption by blast furnaces and electricity used for compressed air production is not available. Therefore emissions associated with this electricity consumption do not include the emissions from the mentioned above sources.

This emission factor is fixed ex-ante as three years average.

The OM_y emission factor is estimated ex-ante for the purpose of emission reduction estimation in sector E and monitored and calculated ex-post.

Background data for the calculation of the BM emission factor
Some modernisations of BFs (significant changing of technical capability) have been recently and are presented in the Table Anx.2.6. But they may get JI status.

Table Anx.2.4: Blast furnace (changing of technical capability) in Russia

Blast Furnace	year	Status	Note

OJSC NTMK (BF#6)	2004	JI	Maintenance, capacity is increased (but BF#2 and #3 are shut down), installation modern auxiliary equipment.
OJSC NTMK (BF#5)	2006	JI	
JSC Severstal (BF#4)	2006	JI	-

There are no new installations of BFs for the last year in Russia. Only maintenances were at the metallurgical plants. They support technical capability on previous level. According to the data of LLC “Korporatsiya proizvoditeley chernih metalov” forty six blast furnaces are operated in 2007. And about twelve BFs are shut down or mothballed. New BF installations are not planed.

Therefore, it is reasonable and most realistic to assume the BM emission factor to be zero ex-ante, but monitor it during the crediting period ex-post. In this context, the five most recent capacity additions built within the last 10 years (or all, if their quantity is less than five) are taken into account.

OM or CM emission factor
This emission factor is fixed ex-ante as three years average.

For the reasons mentioned above, the BM emission factor is set to be zero ex-ante, but monitored during the crediting period ex-post. If none relevant capacity additions can be identified, the OM emission factor is applied, otherwise the CM emission factor is used on a 50 % / 50 % basis.

The baseline emission factor for the displacing iron production (BEF_y) is therefore can be estimated ex-ante, the level of the ex-ante OM emission factor. During the crediting period it is either the relevant ex-post OM or CM emission factor, in accordance with the definition above.

The key data used to establish the baseline in tabular form is presented below.

Data/Parameter	PP_y^{BF4}
Data unit	Tonnes
Description	Displacing steelmaking iron production in the baseline scenario in year *y*
Time of determination/monitoring	*Ex-post*. During the crediting period
Source of data (to be) used	Plant records
Value of data applied (for *ex-ante* calculations/determinations)	2,440,000
Justification of the choice of data or description of measurement methods and procedures (to be) applied	In the baseline scenario displacing iron production is equal to iron production of reconstructed BF #4 in the project scenario in year *y*. The weighting method is used to identify the amount of iron. The weighting equipment is being calibrated and checked by the plant staff.
OA/QC procedures (to be) applied	The company has special Department for Control and Measuring devices. This department is in charge of supervision of measuring devices operation and performance. It checks and substitutes devices (adjusted and calibrated) from the reserve if necessary. The company has approved regulations for measurements, registration and archiving data and the annual schedule for calibration and replacement of devices.
Any comment	This parameter is being used for emissions calculations for

	displacing production (by other plants).

Data/Parameter	BEF_y^{iron}
Data unit	tCO_2/tonnes of steelmaking pig iron
Description	Baseline emission factor for displacing steelmaking pig iron production in year *y*
Time of determination/monitoring	*Ex-ante*
Source of data (to be) used	Calculated according to LLC "Korporatsiya proizvoditeley chernih metalov" annual statistical report "Russian Chermet information", Russia in 2007, chapter 1, operation of blast furnaces and coke oven batteries. This report contains the data of annual steel and iron production and annual fuel and electricity consumption at Russian steel plants.
Value of data applied (for *ex-ante* calculations/determinations)	1.721 (2007)
Justification of the choice of data or description of measurement methods and procedures (to be) applied	The approach of "Tool to calculate the emission factor for an electricity system" is used. IPCC default values are used for CO_2 emission factor of fossil fuels. The default grid emission factors for the regional power systems of Russia are used. Please see Annex 2 for more detail information.
OA/QC procedures (to be) applied	-
Any comment	If data required to calculate the baseline emission factors for the year y is usually available six months later after the end of the year y, alternatively emission factors of the previous year (y-1) may be used. If data is available latter than 18 months after the end of year y, emission factors of the year preceding the previous year (y-2) may be used. The same data vintage (y, y-1 or y-2) should be used throughout the crediting period. After the data for the last three years is available, emission factor may be fixed *ex-ante* as three-year average. Pig iron is usually separated into two major groups of grades according to their composition and further use: foundry and steelmaking. Specific fuel consumption for these grades differs. Therefore their production emission factors are calculated individually.

Data/Parameter	$Fuel_y^i$
Data unit	tonnes or m^3
Description	Fuel *i* (gas, coal, coke) consumption in year *y*
Time of determination/monitoring	*Ex-post.* During the crediting period
Source of data (to be) used	LLC "Korporatsiya proizvoditeley chernih metalov" annual statistical report "Russian Chermet information ". This report contains the data of annual steel and iron production and annual

	fuel and electricity consumption at Russian steel plants.
Value of data applied (for *ex-ante* calculations/determinations)	According to the annual report made by LLC "Korporatsiya proizvoditeley chernih metalov" for every pig iron producer in Russia.
Justification of the choice of data or description of measurement methods and procedures (to be) applied	-
OA/QC procedures (to be) applied	-
Any comment	-

Data/Parameter	SER_y^k
Data unit	1000 m^3
Description	Secondary energy resource *k* (blast furnace, coke oven gases) output in year *y*
Time of determination/monitoring	*Ex-post.* During the crediting period
Source of data (to be) used	Calculated according to LLC "Korporatsiya proizvoditeley chernih metalov" annual statistical report "Russian Chermet information ". This report contains the data of annual steel and iron production and annual fuel and electricity consumption at Russian steel plants.
Value of data applied (for *ex-ante* calculations/determinations)	According to the annual report made by LLC "Korporatsiya proizvoditeley chernih metalov" for every pig iron producer in Russia.
Justification of the choice of data or description of measurement methods and procedures (to be) applied	-
OA/QC procedures (to be) applied	-
Any comment	Usual part of blast furnace gas is used outside of the blast furnace plant as fuel for other equipment.

Data/Parameter	Coke_y, Sin_y, Oxy_y, Pel_y
Data unit	tonnes or 1000m^3
Description	Coke, sinter, oxygen and pellet consumption in year *y*
Time of determination/monitoring	*Ex-post.* During the crediting period
Source of data (to be) used	Calculated according to LLC "Korporatsiya proizvoditeley chernih metalov" annual statistical report "Russian Chermet information ". This report contains the data of annual steel and iron production and annual fuel and electricity consumption at Russian steel plants.
Value of data applied (for *ex-ante* calculations/determinations)	According to the annual report made by LLC "Korporatsiya proizvoditeley chernih metalov" for every pig iron producer in Russia.
Justification of the choice of data or description of measurement methods and	-

procedures (to be) applied	
OA/QC procedures (to be) applied	-
Any comment	-

Data/Parameter	CO_y^k
Data unit	fraction
Description	Carbon monoxide content in *k* (blast furnace, coke oven gases) in year *y*
Time of determination/monitoring	*Ex-post*. During the crediting period
Source of data (to be) used	Calculated according to LLC "Korporatsiya proizvoditeley chernih metalov" annual statistical report "Russian Chermet information ". This report contains the data of annual steel and iron production and annual fuel and electricity consumption at Russian steel plants.
Value of data applied (for *ex-ante* calculations/determinations)	According to the annual report made by LLC "Korporatsiya proizvoditeley chernih metalov" for every pig iron producer in Russia.
Justification of the choice of data or description of measurement methods and procedures (to be) applied	If the plant provides them separately to LLC "Korporatsiya proizvoditeley chernih metalov", then these parameters are taken separately for steelmaking pig iron and separately for foundry pig iron. If the plant provides consolidated data for steelmaking pig iron and foundry pig iron together, as one figure, than this figure can be used for calculation of BEF_y^{iron}, because it is connected with steelmaking and foundry pig iron production by the same blast furnace.

Standardized electricity grid emission factor

In this PDD, a standardized CO_2 emission factor is used to calculate emissions related to electricity consumption in the project and baseline scenarios.

Standardized CO_2 emission factors were elaborated for Russian power systems in the Study commissioned by “Carbon Trade and Finance SICAR S.A.” [40].

Based on approved CDM “Tool to calculate the emission factor for an electricity system” (version 01.1), operating, build and combined margin emission factors were calculated for seven regional Russian electricity systems (RESs). Within these RESs no major transmission constraints exist, while they operate at the same time relatively “independently” from each other (i.e. electricity exchange between regional systems is rather insignificant).

For the PDD at hand, emission related characteristics of the relevant regional electricity system, RES “Center”, the largest unified power system of the national energy system of Russia, were taken into account.
For calculation of emission from project is applied and fixed ex-ante

$EF_{el,y}$ = 0.511 tCO_2/MWh.

For calculation of emission from baseline displacing steel is applied and fixed ex-ante

Regional power system	EF_{CM} (tCO_2/MWh)
“Center”	0.511
“North-West”	0.548
“Mid Volga”	0.506
“Urals”	0.541
“South”	0.5
“Siberia”	0.894
RES “East”	0.823

[40] The study “Development of grid GHG emission factors for power systems of Russia” commissioned by “Carbon Trade and Finance” in 2008.

Annex 3

MONITORING PLAN

General

Severstal has the measuring system in line with national requirements for monitoring of all parameters of the proposed JI project. Quality management systems of Severstal are certificated, Severstal has ISO 9001:2000 certificate.

Environmental protection department of Severstal will prepare the monitoring plan. The department accesses to all data necessary for emission reduction calculations.

For more detailed information on the quality control and quality assurance of the proposed project, please see Section D.2 and D.3.

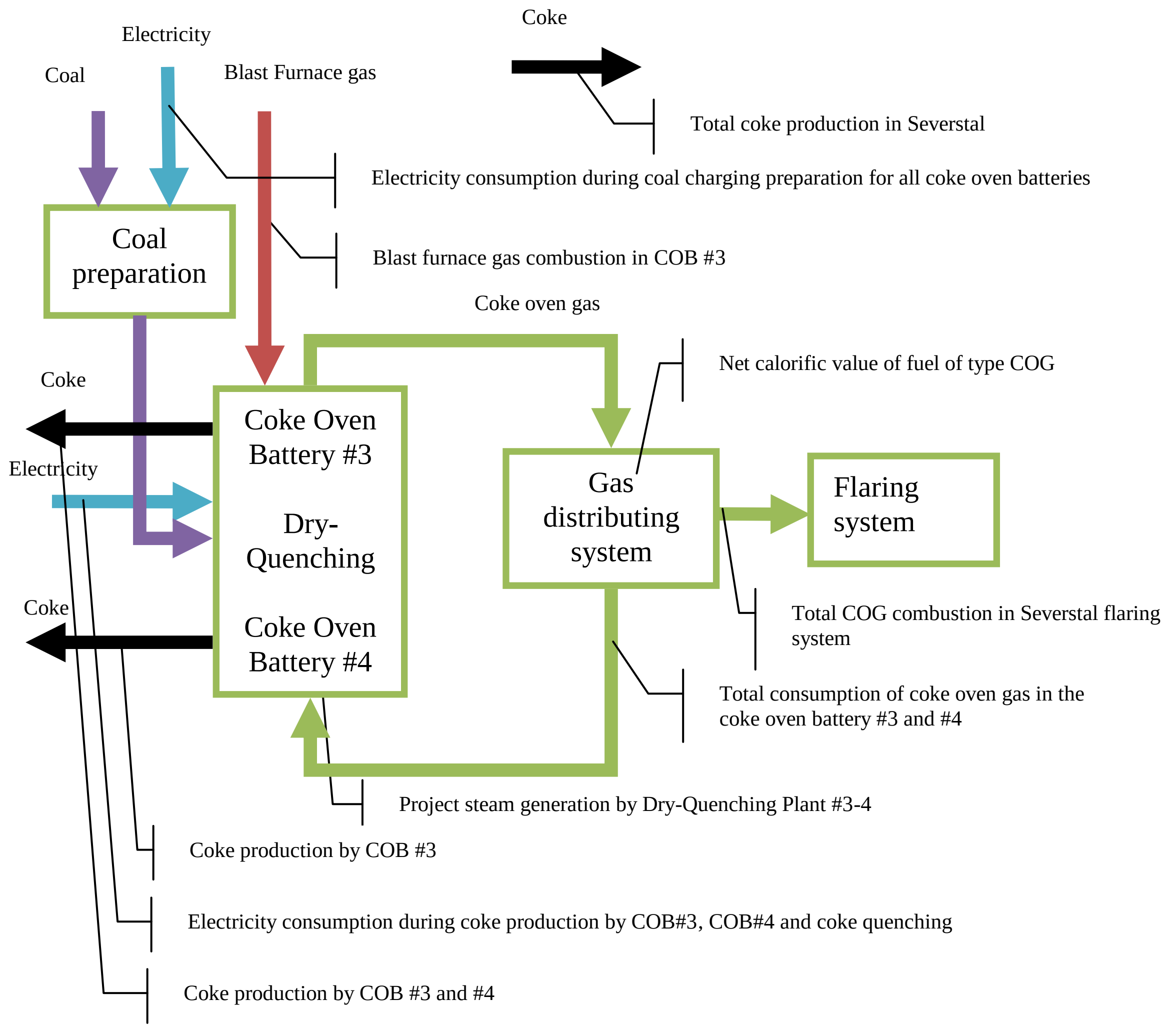
Subproject 1. Construction of coke oven battery #3

During monitoring process of the subproject 1 the following parameters will be measured at Severstal shops:

- Coke production;
- Electricity consumption;
- Carbon monoxide content in blast furnace gas;
- Blast furnace gas Coke oven gas production/consumption;
- Coke oven gas which combust in flaring system at Severstal;
- Steam generation;
- Net calorific value of coke oven gas.

The schema of measured parameters of the subproject 1 is presented on Figure Anx.3.1.

Figure Anx.3.1: The schema of measured parameters of the subproject 1



For more detail information of the measured parameters for project and baseline scenario, please see Sections D.1.1.1 and D.1.1.3, respectively.

The following fixed parameters will be used for estimation of emissions in project or baseline scenarios:

- The default IPCC CO_2 emission factors of natural, coke oven gases;
- The regional Russian standardized grid emission factor;

Description, sources of data and values of these fixed parameters are presented in Sections D.1.1.1 and D.1.1.3 in tabular form.

The project emission from coke oven battery #3are included as coke production emission factor in calculation BF project emission. The coke production baseline emissions are calculated as IPCC coke production emission factor in calculation pig iron emission factor of other pig iron producers.

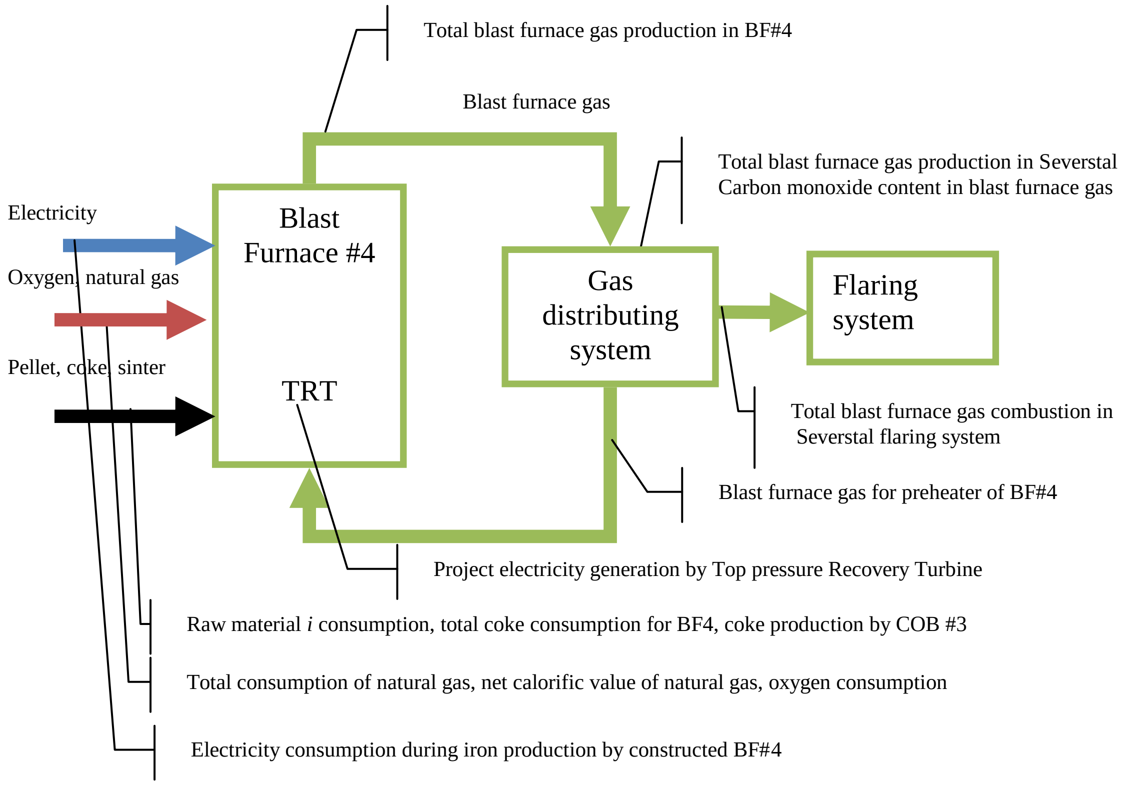
Subproject 2. Construction of blast furnace #4
During monitoring process of the subproject 2 the following parameters will be measured at Severstal shops:

1. Pig iron production;
2. Raw material consumption;

3. Natural gas, oxygen consumption for BF#4;
4. Electricity consumption;
5. Carbon monoxide content in blast furnace gas;
6. Blast furnace gas production/consumption;
7. Electricity generation.

The schema of measured parameters of the subproject 2 is presented on Figure Anx.3.2.

Figure Anx.3.2: The schema of measured parameters of the subproject 2



The net calorific value of natural gas will be provided by supplier every month.

For more detail information of the measured parameters for project and baseline scenario, please see Sections D.1.1.1 and D.1.1.3, respectively.

The following fixed parameters will be used for estimation of emissions in project or baseline scenarios:

- The default IPCC CO_2 emission factors of natural, coke;
- The default IPCC net calorific value of natural, coke;
- The default IPCC CO_2 emission factors of coke(only part), sinter, pellet production;
- The regional Russian standardized grid emission factor;

Description, sources of data and values of these fixed parameters are presented in Sections D.1.1.1 and D.1.1.3 in tabular form.
The project, baseline emissions and emission reduction of the subproject 2 are calculated according to the formulae are presented in Sections D.1.1.2, D.1.1.3 and D.1.4, respectively.

The project emission from coke oven battery #3are included as coke production emission factor in calculation BF project emission. The coke production baseline emissions are calculated as IPCC coke production emission factor in calculation pig iron emission factor of other pig iron producers.

Description, sources of data and values of project fixed parameters are presented in in Annex 2 (CO_2 emission factor for electricity consumption from grid, specific energy consumption for air production and specific energy consumption for oxygen production).