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

CONTENTS

Annexes

SECTION A. General description of the project

A.1. Title of the project:

"Finger Shaft Furnace construction at OJSC Severstal, Cherepovets, Vologda region, Russian Federation".

Sectoral scope 9: Metal production.

Project design document (PDD) version 2.8

16 of March, 2012

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. The company also has a gold mining segment, managing important assets in Russia and Kazakhstan. Severstal is the Russian 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 steelmaking process on the climate by application of a more energy efficient technology. Existed open-hearth steel production process was replaced by an electric arc steelmaking process. Emissions of GHG were reduced significantly as a result of the project implementation. In order to achieve the goal of the project, Severstal constructed a new Finger Shaft Furnace (SHF) #2.

Before project

There was an electric arc shop composed of four electric arc furnaces (EAF) with annual capacity of about 800 thousand tonnes of liquid steel. This shop was renovated in 1997-1999. EAFs were dismantled. On their site a new Finger Shaft Furnace #1 and ladle furnace were constructed. They were made by Fuchs Systemtechnik GmbH. Some of the existing auxiliary equipment (after the EAFs dismantling) is used for FSF#1 operating:

- logistics system for raw materials and products transportation;
- power reducing/distribution unit;
- deairing equipment;
- exhaust gases purification system;
- slag removing system;
- water preparation system.

Capacity of FSF#1 and LF is approximately 1 million tonne of liquid steel per year.
There was the open-hearth plant. This plant produced about 1million tonnes of liquid steel per year (average for three year 2003-2005, but it can be maximized if necessary) and comprised following operating capacity: a double-hearth furnace and two open hearth furnaces. Open-heath steel was poured

into the molds. After solidification of the steel the ingot molds are mechanically "stripped" or pulled away from the ingot. In the next step the ingots are directed to slabbing-blooming mills for blooms or slabs production. Before slabbing-blooming mills, ingots are placed in tightly covered soaking pits. The soaking pits consume coke oven gas as fuel in order to achieve required uniform temperature throughout the ingot. The slabbing-blooming mills capacity exceeded needs the OHP because it could cover possible ingots production in basic-oxygen and electric furnace shops (several million tonnes of blooms or slabs production per year).
Also there was basic-oxygen shop and it composed of three basic-oxygen converters with total annual capacity of about 8 million tonnes of liquid steel. Basic-oxygen steel production at Severstal requires about 7 million tonnes of liquid pig iron and significant volume of oxygen. The blast-furnace department produces about 8 million tonnes of pig iron. Its part is directed for arc-furnace steel and open hearth steel production. Severstal did not have any additional available capacity for pig iron and oxygen manufacture.

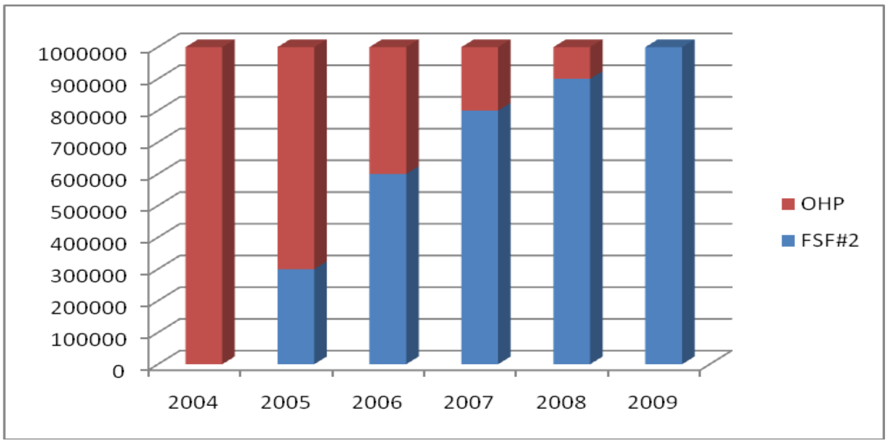
Project scenario and status

The project consists of construction of a new Finger Shaft Furnace #2 with a ladle furnace. The Finger Shaft Furnace #2 and the ladle furnace were constructed on the site of dismantled EAFs (#1, 2) in 2005. Annual capacity of new Finger Shaft Furnace #2 and LF is about 1 million tonnes of steel. The following auxiliary equipment was installed together with the FSF#2 and the LF:

- new exhaust gases purification system;
- new water preparation system for FSF#2;
- new distribution unit (RU 35kV);
- new Main reducing sub-station (GPP);
- new slag removing system;
- new logistics system for raw materials and products transportation.
- reconstruction of aspiration systems;
- enlargement of metal stock loading system;

Also FSF#2 has more recent gas burners and oxygen injectors system than FSF#1 (injector can be used as burner). FSF #2 and LF are using existing deairing equipment and CCMs capacity. The open hearth production will be replaced stage by stage while FSF#2 will be starting operation and expanding its capacity. The schedule of the production replacing is presented below. Project implementation schedule is presented in Table A.4.2.2. The slabbing-blooming mill will be decommissioned after the OHP stop. Project boundary covers only liquid steel production by reason of conservative calculation of emission reduction and since the slabbing-blooming mill is used for blooms and slabs production from other steelmaking shops at Severstal.

Schedule A.2.1: Schedule of the open hearth plant replacement



Source: Severstal

Baseline scenario

In the baseline scenario it is assumed that the level of liquid steel production will be equal to the project scenario level. In the absence of the project, required steel would be supplied by the open-hearth plant at Severstal. The detailed description of the baseline scenario is presented in Section B.1. Technical characteristic and consumption of OHP are presented in Table A.2.1.

Table A.2.1: Main technical data of the Open Hearth Plant.

Indicator	Unit	OHP
Capacity	t	1 072 346[1]
Pig iron consumption	kg/t	693
Oxygen consumption	m^3/t	64
Natural gas consumption	m^3/t	117
Residual fuel oil consumption	kg /t	14
Limestone consumption	kg /t	36
Lime consumption	kg /t	28

Source: Severstal

Project background and description

Preparation of project documents was begun at the beginning of 2004. Preparation of project site had begun at the end of 2004. A plan of technical and economic development was approved in February 2005. At the time of the project approval, GHGs emission reduction and additional revenues earned due to project implementation as JI has been taken into account. It makes possible economic indicators improving and minimizes project realization risks. The project primary task was to replace the open hearth plant with steel production using new up-to-date energy efficient equipment. Severstal decided to begin modernization of steel production in order to achieve this task (increase of electric arc steel production instead of production of open hearth steel). The plant considered GHGs reduction and additional revenues earning due to project implementation as JI. The project implementation as JI makes possible to improve economical indicators and minimize project realization risks. The project

[1] Average for three year 2002-2004

documentation for this project was developed by LLC "Severstal-proekt". The project documentation for Finger Shaft Furnace was approved by Glavgosexpertiza of Russian Federation in May 2005. FSF was commissioned at the end of 2005. 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)	OJSC Severstal	No
Party B - The Netherlands	Global Carbon BV	No

Role of the project participants:

- OJSC Severstal is the largest steelmaking company in Russia. 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, north-west of Russia on the territory of 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 (highlighted in red)

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 the 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 Region is about 1 million 227 thousands 800 people.

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

Cherepovets is the biggest city in Vologda Region, Russia, located on the bank of the Rybinskoye pool of the Volga River. Population: 311,869 (2002 Census); 310,463 (1989 Census). The big plants like OJSC 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 be considered as an industrially developed.

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 software Google Earth).

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

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 modernisation of production using modern energy-efficient technologies.

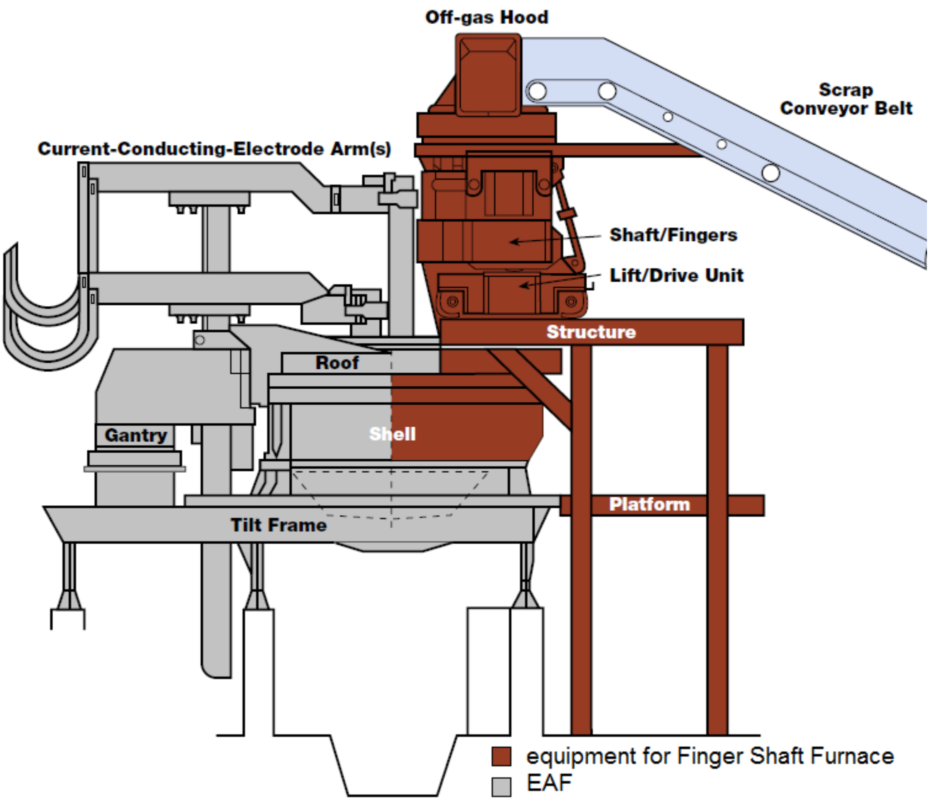
The project consists of construction of Finger Shaft Furnace #2.

The stages of the steel plant are described below. Main technical data of the equipments are presented in Table A.4.2.1 below.

Steelmaking (Finger Shaft Furnace)

At present the most energy-efficient EAF is the Finger Shaft Furnace (FSF). The Finger Shaft Furnace allows optimum usage of energy available in process gases by preheating scrap in a shaft placed above the furnace.
Utilizing the furnace off-gases during the heat cycle, scrap can be preheated to a temperature of approximately 800 °C prior to final melting in the furnace vessel. This means considerable energy and cost savings with a substantial reduction in tap-to-tap times. The most advanced shaft furnace design is represented by the finger shaft furnace, which features a unique scrap retaining system using so-called fingers. A schematic diagram of a Finger Shaft Furnace is given in Figure A.4.2.1 below.

Figure A.4.2.1: Schematic Diagram of a Finger Shaft Furnace



Source: FUCHS Systemtechnik

The arc-furnace process generally follows the following pattern:
- Charging
- Melting
- Oxidising
- Deoxidising or refining

Process begins with the ignition of the electric arc. After melting, further scrap can be added. An additional injection of oxygen and fuel-gas mixture can accelerate the melting phase. The FSF#2 has more recent gas burners and oxygen injectors system (injector can be used as gas burner). The maximum transferable electric power and the heat stability of the refractory lining determine the time needed for melting. The most up-to-date furnaces with a high specific apparent power (UHP furnaces) achieve melting periods of about 40 to 60 minutes and tap-to-tap times of about 1.5 hours.

During the refining stage, iron oxides included in the slag react with the carbon of the bath. This gives rise to the gaseous carbon monoxide, which causes the heat to boil, and rinses impurities such as phosphorus, hydrogen, nitrogen and non-metallic compounds from the heat. These impurities escape as gases or are included in the slag. Sulphur cannot be completely eliminated. After refining stage when the temperature and composition are correct, the steel is tapped out into a preheated ladle furnace.

Ladle furnace

The ladle furnace (LF) is used to correct the temperature and composition of liquid melt. This also allows the molten steel to be kept ready for use in case of a delay later in the steelmaking process. After treatment in the ladle furnace, which consists of only the refractory roof and electrode, furnace steel is processed by vacuum in the de-airing equipment and having reached its optimal chemical composition, is appropriately cleaned. After ladle furnace steel can be directed to Continuous Casting Machine *(*CCM) for bloom and slab production or deairing equipment for steel degassing processes.

Deairing equipment

Part of liquid steel can be directed for steel degassing processes for increase steel quality. Steel degassing is an essential process in secondary steel-making. Its value is in its rapid and effective removal of dissolved contaminant gases from primary steel (principally hydrogen and carbon monoxide) and the reduction in dissolved carbon levels, resulting in higher quality, higher value steel product with more widespread applicability.
Vacuum degassing (VD) The basic VD process usually lasts 15-20 minutes and is conducted at pressures in the region of 0.5torr/0.67mbar. Under these conditions much of the dissolved hydrogen and carbon monoxide gases in the liquid metal desorb into the atmosphere above the steel and are evacuated. After degassing processes steel is directed to Continuous Casting Machine *(*CCM) for bloom and slab production.

The advantages of arc-furnace process are:
- All possible grades of steel can be melted
- Low capital outlay
- The melting process can be programmed and automated
- Good efficiency

Table A.4.2.1: Main technical data of the Finger Shaft Furnace and the ladle furnace.

Indicator	Unit	FSF	LF
Transformer power	MW	100	32
Current frequency	Hz	50	50
Electricity consumption	kWh/t	288	49
Furnace capacity	t	150	120

Source: Severstal

Project implementation schedule is presented in Table A.4.2.2 below.

The plant trains staff continuously in the metallurgical college of Cherepovets. The college training covers the main subject areas of (several qualifications):

- cokemaking;
- blast-furnace metallurgist;
- steelmaker.

Table A.4.2.2: 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	Project documents development	■	■	■	■	■	■	■	■												
2	Preparation of project site (electric furnace shop)				■	■															
3	FSF#2 installation					■	■														
3	LF installation						■														
3	Auxiliary equipment installation							■													
4	Start-up FSF							■													
5	Commissioning FSF								■												
6	Decommissioning a open hearth furnace in OHP								■												
5	Decommissioning a open hearth furnace in OHP												■								
5	Decommissioning a double-hearth furnace in OHP																	■			
5	Decommissioning the slabbing-blooming mill																		■		

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:

The proposed JI project aims at replacement of open-hearth plant with a new FSF#2.
Steel industry causes 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 steel production.
The main benefit of electric arc steelmaking process is that it allows using up to 100 % of metal scrap during steel production in comparison with open hearth steel. Also a production of open hearth steel consumes the big amount of fossil fuels. The open hearth plant at Severstal consumes about 700 kg of pig iron per 1 tonne of steel. FSF#2 consumes about 400 kg of pig iron per 1 tonne of steel. Thus, FSF allows reducing of pig iron usage in steel production but it may not be excluded fully due to steel corrosion and increase steel consumption in the world. Pig iron production also leads to significant CO_2 emission.
Fossil fuel consumption is reduced significantly due to project implementation (replacement of OHP by FSF#2). Production of open hearth steel requires larger amount of fossil fuels comparing to FSF technology. Also electricity consumption by the FSF in terms of GHG emission (with Russian emission factor for electricity generation) is less than GHG emission from fossil fuels combustion by the OHP. Also a Finger Shaft Furnace is more environmentally friendly than ordinary electric arc furnaces (EAF) which does not use scrap metal heating by off-gases. GHG emissions will be reduced due to project implementation. Information on baseline setting and additionality is presented in Section B. Total estimated amount of emission reductions due to project implementation is 3,168,120 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 provided in Section E.

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

	Years
Length of the crediting period	4.16
Year	Estimate of annual emission reductions in tonnes of CO_2 equivalent
2008	105,552
2009	770,338
2010	742,656
2011	774,787
2012	774,787
Total estimated emission reductions over the crediting period (tonnes of CO_2 equivalent)	3,168,120
Annual average of estimated emission reductions over the crediting period (tonnes of CO_2 equivalent)	633,624

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	774,787
2014	774,787
2015	774,787
2016	774,787
2017	774,787
2018	774,787
2019	774,787
2020	774,787
Total estimated emission reductions over the period indicated (tonnes of CO_2 equivalent)	6,198,298
Annual average of estimated emission reductions over the period indicated (tonnes of CO_2 equivalent)	774,787

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 February 2011 No 2011JI03.

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)[2], 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)[3] (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[4], 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 satisfaction of domestic metal demand.[5] OJSC Severstal does not have any obligations for construction of new production capacity;

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

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

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

[5] http://www.minprom.gov.ru/activity/metal/strateg/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. Capacity of FSF#2 is equivalent the OHP capacity. In case of the project absence the OHP would operate and satisfy steel demand. The OHP emissions are determined in line with the methodological approach as described in Annex 2**;**

c) **Availability of capital (including investment barriers).** Capital is available but high bank rate and high country investment risk make new equipment introduction in Russia unprofitable;

d) **Local availability of technologies/techniques, skills and know-how and availability of best available technologies/techniques in the future.** Steel production process by OHF, EAF, and BOF are better-known and applied in Russia. Steel production by FSF is not widely practised in Russia. Similar FSF was installed in Severstal in 1999. But the new FSF has project and technological differences.

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 of 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 steel is not influenced by the project and is identical in the project and the baseline scenario.

Step 2. Application of the approach chosen

OJSC Severstal produces electric arc steel, open-hearth steel and basic oxygen steel. Usage of pig iron in steelmaking process is general historic practice in steel industry. Basic oxygen steel requires using of pig iron (about 70%) during production. Average iron consumption for all steelmaking processes in Russia is 55.24% (OHF = 45.27%; BOF = 76.6%). Basic oxygen steel is the predominant steel in Russia (58.9%). Production of arc-furnace steel is similar to production by OHF (23% and 18.2%)[6]. Arc-furnace steel allows using up to 100 % of metal scrap during steel production. Lately scrap usage drives out pig iron during steelmaking process. But pig iron can not be eliminated fully due to increasing of steel demand and steel corrosion. Thus additional pig iron volume is required for additional steel volume production.

Proposed project aims to construct the new finger shaft furnace using recent achievements in this field Also it allows usage up to 40% of pig iron as metal stock. Liquid steel production capacity in the project scenario corresponds to production of the existing OHP. The OHP was operating at Severstal during a long period and it had demonstrated good results.

Baseline analysis and investment analysis are conducted as at the moment of taking the decision on the project implementation (i.e. beginning of 2005). Annual project capacity is about 1 million tonnes of liquid steel. This steel can be produced with following production capacity:

[6] Worldsteel Committee on Economic Studies – Brussels, 2009. Steel Statistical Yearbook 2008(Table 6).

Production capacity:

a. The existing open hearth plant;
b. Construction of a Finger Shaft Furnace #2 with old OHP dismantling;
c. Construction of a new Basic Oxygen Furnace with old OHP dismantling.

CCM and Blooming-slabbing mill can be used for slab/blooms production. A CCM is more environmental friendly than a blooming-slabbing mill. Also a blooming-slabbing mill is outdated technology with high fuel (natural gas) consumption. Nevertheless liquid steel processing into bloom/slabs is not included in the project boundary for conservative reasons. Therefore emission associated with this stage is not included into baseline and project emission calculations.

These scenarios are described below in more details.

1) Continuation of a situation existing prior to the project (the existing open hearth plant continues its operation)

It is the continuation of the situation without project. That means continuation of the existing open hearth plant operation. Annual steel production of OHP will be about 1 million tonnes. It corresponds to the annual average production for three years before the project implementation (2002-2004). There are no legal or other requirements that enforce Severstal to stop or reduce steelmaking by OHP. Therefore this scenario does not contradict the main development goal of the Russian metallurgical industry “to satisfaction domestic metal demand”, because Severstal can operate OHP and save existing plant capacity. No additional significant investment is required from OJSC Severstal (only expenses for regular maintenance). Thus, scenario 1 is feasible and the most plausible.

2) Construction of Finger Shaft Furnace #2 with old OHF dismantling (Project activity not implemented as JI)

In this scenario, existing OHP will be dismantled and a new FSF installed. Steel production by FSF will be about 1.0 million tonnes of steel. Production of steel will depend on market demand. The open hearth production will be replaced stage by stage while FSF#2 will be starting its operation and expanding capacity. Construction of a FSF requires significant investments (see investment analysis in the Section B.2). Thus this scenario cannot be considered as a baseline scenario.

3) Construction of a new Basic Oxygen Furnace with old OHF dismantling

In this scenario, existing OHF will be dismantled and a new BOF installed. Expected total annual production of BOF will be approximately 1 million tonnes of steel. Steel production by BOF requires significant consumption of liquid pig iron (about 0.85 million tonne per year). Thus construction of BOF requires construction of additional ironmaking capacity. There is not available liquid pig iron capacity. Production basic oxygen steel requires significant production oxygen volume. Severstal does not have necessary oxygen capacity. There is not free place for new equipment installation in the basic oxygen shop. Also in the basic oxygen shop there are not free capacities for liquid steel processing. Existing liquid steel processing does not allow all steel grades production. Thus this scenario cannot be considered as a technologically favourable scenario.

Conclusions

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

Calculations of baseline emissions are provided in Sections D and E, as well as in Annex 2 below.

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

Data/Parameter	PP_y^{FSF2}
Data unit	Tonnes
Description	Steel production of FSF#2 in year *y*
Time of determination/monitoring	During the crediting period
Source of data (to be) use	Annual technical report
Value of data applied (for ex ante calculations/determinations)	1,009,180
Justification of the choice of data or description of measurement methods and procedures (to be) applied	It is defined according to the business plan of Severstal.
OA/QC procedures (to be) applied	Steel production in the baseline scenario by OHF is equal to project steel production by FSF#2 Steel production is calculated as sum of daily reports of the steelmaking shop. Monthly data is checked. The check is based on the monthly inventory reports of remaining raw materials and steel. The produced steel is measured by weight per unit length (for every nominal size) or directly weighted.
Any comment	Information is calculated by the steelmaking shop and transferred to the Environmental protection department.

Data/Parameter	BEF_y^{steel}
Data unit	tCO_2/tonnes of steel
Description	Baseline emission factor for OHP steel production in year *y*
Time of determination/monitoring	*Ex - ante*
Source of data (to be) use	According to Severstal annual technical report
Value of data applied (for ex ante calculations/determinations)	1.477
Justification of the choice of data or description of measurement methods and procedures (to be) applied	The parameter is calculated as a three years average (2003-2005).
OA/QC procedures (to be) applied	The internal quality system at Severstal is functioning in accordance with the national standards and regulations in force.
Any comment	-

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

The following 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[7] 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: Continuation of a situation existing prior to the project.
In the absence of project existing OHP will continue operation. The OHP could continue operating due to its technical conditions. Annual production of OHP is about 1 million tonnes of steel.

Alternative 2: Construction of Finger Shaft Furnace #2 with old OHF dismantling (the proposed project activity undertaken without being registered as a JI project activity). Expected total annual production will be approximately 1.0 million tonnes of steel. The open hearth production will be replaced stage by stage while FSF#2 will be starting its operation and expanding capacity.

Alternative 3: Construction of a new Basic Oxygen Furnace with old OHF dismantling. In this alternative the existing OHP will be dismantled and a new basic oxygen furnace will be constructed. In this scenario, expected total annual production of BOF will be approximately 1 million tonnes of steel. Steel production by BOF requires significant consumption of liquid pig iron (about 0.85 million per year) and oxygen. There is not available liquid steel processing in the basic oxygen shop. Thus construction of BOF requires construction of additional ironmaking, oxygen and liquid steel processing capacities.

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. The main development goal of the metallurgical industry is satisfaction of domestic metal demand.[8] The presented alternatives will not reduce domestic metal demand. They will provide available steel capacity for domestic metal demand.

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[7] http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-01-v5.2.pdf
[8] http://www.minprom.gov.ru/activity/metal/strateg/2

Outcome of Step 1b: Alternative 3 is neglected due to relevant reasons (absence of additional ironmaking, oxygen and liquid steel processing capacities at Severstal). Also there is not free place for new equipment installation in the basic oxygen department. Alternative 1 has been identified as realistic and credible alternative scenarios to the project activity that is 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 cost revenues due to existing OHP changing by the new liquid steel production capacity. Thus, this analysis method is not applicable.

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 and project realization, investment comparison analysis (Option II) is applied.

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

In principle, the following indicator, such as IRR, NVP, cost benefit ratio, or unit cost of service can be used for investment comparison analysis. Therefore cost of one tonne of steel (during project life time) is used to compare continuation of the existing situation (operating OHP) to construction of new FSF. This comparison is done taking into account discount rate and not accounting for discount rate.
Investment analysis was performed. The cash flow analysis focuses on comparison of expenditure for project (construction new FSF) and operating OHP. The following assumptions have been used based on the information provided by the enterprise:

1. Real annual average primary costs were used for comparison OHP and FSF (during 2004);
2. Primary cost of simple steel (carbon steel) was used for investment comparison analysis (simple steel is steel without alloying additions (ferroalloys).
3. Primary cost of open hearth steel are taken into account in line with the indicators achieve in 2004;
4. Primary cost of electric steel are taken into account in line with the indicators achieve in 2004 by FSF#1, because it has the same specific energy and raw material consumption but FSF#2 has technical and project difference (see common practice analysis);
5. Ferroalloys is excluded from primary cost FSF and OHP for the purpose to eliminate difference in steel grades (ferroalloy connects with alloy-treated steel, special steel);
6. Processing index of open hearth steel consumption is 1.17;
7. Processing index of electric steel consumption is 1.03;
8. Production of FSF is assumed as the maximum technical capacity of 1 million tonnes of steel per year;
9. The exchange rate (EUR/RUR) is 1/ 36.7205;
10. The project lifetime is around 15 years (lifetime of the main equipment).

The investment comparison analysis's financial indicators are presented in the Table B.2.1 below.

Table B.2.1. Financial indicators of the investment comparison analysis

	Construction FSF		**Operating OHP**	
	Productio n cost (EUR/t)	**Productio n cost (EUR/t)**	**Productio n cost (EUR/t)**	**Productio n cost (EUR/t)**
Basic Cash Flow	167.54	86.06	158.66	79.86

The investment comparison analysis shows OHP production cost is less. 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 four key indicators were considered in the sensitivity analysis: investment cost, natural gas, electricity, and 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.

The key components (investment cost, metal stock, natural gas and electricity) are changed within the corridor of ±10 % in Scenarios 1-8. OHP production cost is less in all cases (see Table B.2.2 below).

Table B.2.2: Sensitivity analysis (summary)

	Construction FSF		**Operating OHP**	
	Production cost (EUR/t)	**Production cost (EUR/t)**	**Production cost (EUR/t)**	**Production cost (EUR/t)**
Scenario 1	167.54	86.06	158.66	79.86
Scenario 2	167.14	85.67	158.66	79.86
Scenario 3	167.65	86.12	158.91	79.98
Scenario 4	167.43	86.00	158.42	79.73
Scenario 5	168.25	86.39	158.69	79.87
Scenario 6	166.83	85.73	158.64	79.85
Scenario 7	178.79	91.71	169.68	85.40
Scenario 8	156.29	80.41	147.64	74.31

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:

In project steel is produced by the Finger Shaft Furnace (it produces electric arc steel). FSFs are not spread in Russia. FSF uses the same steelmaking principle as EAF but there is scrap metal heating by off-gases. Electric arc steel production is not dominant in the Russian steelmaking industry. Share of arc furnace steel in total Russian steel output was 23% in 2006. Shares of basic oxygen steel and open hearth furnace steel were 58.9 % and 18.2 % corresponding.
The Finger Shaft Furnace technology is implemented at the Severstal only. There are no other FSFs installed in Russia. In 1999 there was a first FSF (FSF #1) installed at Severstal by the same company. The project (FSF#1) has replaced old EAFs installed at Severstal earlier. And some of the existing (old) auxiliary equipment (after the EAFs dismantling) is used for FSF#1 operating:

- logistics system for raw materials and products transportation;
- power reducing/distribution unit;
- deairing equipment;
- exhaust gases purification system;
- slag removing system;
- water preparation system.

Also FSF#1 has outdated gas burners and oxygen injectors system comparing to new FSF#2 (injector cannot be used as a burner). The FSF #1 was installed as an experimental unit and enjoyed some special contractual conditions between Severstal and technology developers. FSF #2 installation (project activity) required installation of new auxiliary equipment. The indicative list of the activities required surplus investments in FSF #2 comparing to FSF#1 are provided below:

- modern exhaust gases purification system for FSF#2 and LF#2 (FSF#1 with LF#1 used the old one);
- modern water preparation system for FSF#2;
- modern distribution unit (RU 35kV)
- modern Main reducing sub-station (GPP);
- new slag removing system;
- new logistics system for raw materials and products transportation;
- reconstruction of aspiration systems;
- enlargement of metal stock loading system.

These additional measures make this project activity almost twice more expensive than FSF#1 construction. Also this has made it possible to get full modern steelmaking capacity.
Thus the proposed JI project (FSF2) does not reflect a widely observed and commonly carried out activity and project FSF#1 installation can not be considered as a similar project 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.

Step 3. Provision of additionality proofs

Supporting documents including the calculation spreadsheets and other proofs will be made available to the accredited independent entity.

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 steel production:

- Emission from the raw materials (iron, coke, electrodes) during the steelmaking process;
- Fuel (gas) combustion;
- GHG emissions from the Russian electricity grid.

An overview of all emission sources in the steelmaking process of proposed project is given in Table B.3.1 below. The project boundary shall encompass all anthropogenic emissions by sources of GHGs which are:

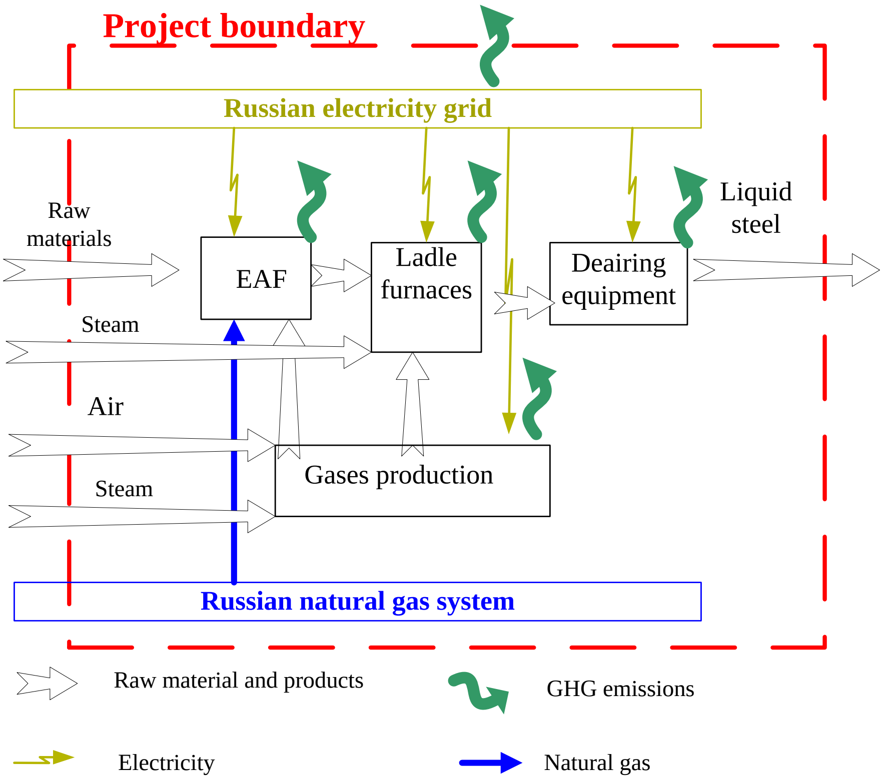
- Under the control of the project participants;
- Reasonably attributable to the project;
- Significant, i.e., as a rule of thumb, would by each source account on average per year over the crediting period for more than 1 per cent of the annual average anthropogenic emissions by sources of GHGs, or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

Table B.3.1: Sources of emissions during steel production

№	Source	Gas	Included/ excluded	Justification/Explanation
1	Electricity and steam consumption during the oxygen production	CO_2	Included	• 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.
2	Electricity consumption during the steelmaking process (FSF and LFs)	CO_2	Included	• The electricity consumption will be increased; • Emissions are calculated using standardized regional electricity factors for Russia.
3	Fuel consumption during the steelmaking process	CO_2	Included	• The fossil fuel combustion will be decreased.
4	Raw materials (lime, coke, pig iron) consumption during steelmaking process	CO_2	Included	• Raw material consumption will be changed after the project implementation.
5	Electrode consumption during smelting process	CO_2	Included	• In the project scenario and in the baseline amount of electrodes will be different.
6	Fuel consumption for steam generation (steam for ladle degassing).	CO_2	Included	• Emissions (from steam) are calculated using in-plant emission factors for steam production.
7	Methane origination during fuels burning	CH_4	Excluded	• The gas was excluded from the consideration due to relatively small volume of emissions (see the description in section D.1).
8	Nitrous oxide origination during fuels burning	N_2O	Excluded	• The gas was excluded from the consideration due to relatively small volume of emissions (see the description in section D.1).
9	Steam production for Deairing equipment	CO_2	Included	• The fossil fuel combustion will be increased. due to addional steam generation volume.
10	Electricity consumption for Deairing equipment	CO_2	Included	• Electricity consumption will be increased. due to the new equipment operating.

№	Source	Gas	Included/ excluded	Justification/Explanation
11	Scrap	CO_2	Excluded	• This pollutant is same in project scenario and baseline scenario. Average carbon content in scrap is 0.2%. Also it contributes to less than 1 % of the total emissions (CO_2 equivalent). Therefore omitting this pollutant for a steelmaking process is conservative.
12	Drop-hammer plant	CO_2	Excluded	• There are a briquette press and a scrap cutter in drop-hammer plant. It contributes to less than 1 % of the total emissions (CO_2 equivalent). Therefore omitting this pollutant for a scrap preparation process is conservative.

Figure B.3.1: Sources of emissions and project boundary for steelmaking 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 30 298 2310
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:

Project start date is 25 February 2005 when investment into project was approved by Severstal.

C.2. Expected operational lifetime of the project:

The operational lifetime of the project is 15 years or 180 months. This corresponds to expected operational lifetime of FSF - the biggest investment cost item.

C.3. Length of the crediting period:

Start of the crediting period: 02/11/2008 (Date when OHP was shut-down)
Length of the crediting period: 4.16 years or 50 months

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

SECTION D. Monitoring plan

D.1. Description of monitoring plan chosen:

In accordance with 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 steel demand in the market is the same in the project and baseline scenario (It will not allow possibility ER calculating due to steel production reducing);
- The type of fuel burning and raw material consumed in FSF is not influenced by the project (In case fuel change it will allow to calculate ER correct);
- The emissions from electricity consumption 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).

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

- The project emission is the emission from new FSF#2 and part of equipment (LF, DQ) emission, because steel are directed from FSF#1 and FSF#2 to these equipment (for correct calculation of project emission connected with other equipment) ;
- Blast furnace #4 pig iron production emission factor is used for calculation of emission from pig iron consumption (BF#4 is the most recent at Severstal so it has low energy consumption);
- Greenhouse emissions are determined using actual production data for 2008-2010 years (for calculation actual ER in this period);
- Greenhouse emissions during 2011-2012 are determined using performance data of 2010 year (for calculation ER on the ground of achieved data).

The baseline emissions are established in the following way:

- The baseline emission factor of the steel and pig iron production are established using the approach as given in Annex 2;

- Baseline emission factor of OHP is fixed ex-ante for three years (average 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 as GHG are taken into account. Major source of CH_4 and N_2O emission at a steelmaking process is the burning of fuel (coke and natural gas). Given fuel consumption, in normally blast furnace process for basic oxygen steel in Russia, CH_4 emission is of 99 g/tonne of steel and N_2O emissions of 15 g/tonne of steel compared with about 740 kg CO_2/ tonne of project steel (calculation according to 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Chapter 2, STATIONARY COMBUSTION and fuels consumption). Omitting these two pollutants for a steelmaking process is conservative, because they contribute to less than 1 % 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 in the baseline scenario. 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^{FSF2}	Annual plant calculations	tCO_2	C	Annually	100%	Electronic and paper	-
P3	PE_y^{LF}	Annual plant calculations	tCO_2	C	Annually	100%	Electronic and paper	-
P4	PE_y^{DE}	Annual plant calculations	tCO_2	C	Annually	100%	Electronic and paper	-
P5	$PE_{iron,y}^{FSF2}$	Annual plant calculations	tCO_2	C	Annually	100%	Electronic and paper	-
P6	$PE_{el,y}^{FSF2}$	Annual plant calculations	tCO_2	C	Annually	100%	Electronic and paper	-

P7	$PE_{coke\,y}^{FSF2}$	Annual plant calculations	tCO_2	C	Annually	100%	Electronic and paper	-
P8	$PE_{lime,y}^{FSF2}$	Annual plant calculations	tCO_2	C	Annually	100%	Electronic and paper	-
P9	$PE_{fuel,\,y}^{FSF2}$	Annual plant calculations	tCO_2	C	Annually	100%	Electronic and paper	-
P10	$PE_{RM,\;y}^{FSF2}$	Annual plant calculations	tCO_2	C	Annually	100%	Electronic and paper	-
P11	$PE_{O2,y}^{FSF2}$	Annual plant calculations	tCO_2	C	Annually	100%	Electronic and paper	-
P12	PEL_{y}^{FSF2}	Annual technical report, measuring instrumentation	MWh	M/C	Annually	100 %	Electronic and paper	-
P13	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.
P14	PC_{y}^{FSF1+2}	Annual technical report, measuring instrumentation	tonnes	M/C	Annually	100%	Electronic and paper	-
P15	$EF_{coke}^{production}$	IPCC	tCO_2/tonne of coke	C	Fixed ex ante	100 %	Electronic and paper	Default values (IPCC 2006)
P16	PP_{y}^{FSF2}	Annual technical report, measuring instrumentation	tonnes	M/C	Annually	100%	Electronic and paper	-
P17	PP_{y}^{FSF1}	Annual technical report, measuring instrumentation	tonnes	M/C	Annually	100%	Electronic and paper	-
P18	$PL_{lime,y}^{FSF1+2}$	Annual technical report, measuring	tonnes	M/C	Annually	100%	Electronic and paper	-

		instrumentation						
P19	EF_{lime}	IPCC	tCO_2/tonne of lime	C	Fixed ex ante	100 %	Electronic and paper	Default values (IPCC 2006)
P20	$PF^{FSF2}_{fuel\,i,\,y}$	Annual technical report, measuring instrumentation	tonne or 1000Nm3	M/C	Annually	100%	Electronic and paper	-
P21	EF_i	IPCC	tCO_2/GJ	C	Fixed ex ante	100 %	Electronic and paper	Default values (IPCC 2006)
P22	$NCV_{i,\,y}$	Annual technical report or IPCC	GJ/ m^3or tonne	C	Annually or Fixed ex ante	100 %	Electronic and paper	Default values (IPCC 2006)
P23	$PRM^{FSF2}_{RM\_i,y}$	Annual technical report, measuring instrumentation	tonnes	M/C	Annually	100%	Electronic and paper	-
P24	$EF_{RM\_i,}$	IPCC	tCO_2/tonne	C	Fixed ex ante	100 %	Electronic and paper	Default values (IPCC 2006)
P25	$PO^{FSF2}_{O2,y}$	Annual technical report, measuring instrumentation	$1000Nm^3$	M/C	Annually	100%	Electronic and paper	-
P26	$PPI^{FSF1+2}_{iron,y}$	Annual technical report, measuring instrumentation	tonnes	M/C	Annually	100%	Electronic and paper	-
P27	EF^{iron}	Annual plant calculations	tCO_2/tonne of pig iron	C	Annually	100%	Electronic and paper	See Annex 2
P28	$PE^{LF}_{el,\,y}$	Annual plant calculations	tCO_2	C	Annually	100%	Electronic and paper	**-**
P29	$PE^{LF}_{coke\,y}$	Annual plant calculations	tCO_2	C	Annually	100%	Electronic and paper	**-**
P30	$PE^{LF}_{RM,\,y}$	Annual plant calculations	tCO_2	C	Annually	100%	Electronic and paper	**-**
P31	PEL^{LF}_{y}	Annual technical report, measuring instrumentation	MWh	M/C	Annually	100 %	Electronic and paper	-
P32	PC^{LF}_{y}	Annual technical report, measuring instrumentation	tonnes	M/C	Annually	100%	Electronic and paper	-

P33	$PRM^{LF}_{RM\_i,y}$	Annual technical report, measuring instrumentation	tonnes	M/C	Annually	100%	Electronic and paper	-
P34	$PE^{DE}_{el,y}$	Annual plant calculations	tCO_2	C	Annually	100%	Electronic and paper	**-**
P35	$PE^{DE}_{steam\,y}$	Annual plant calculations	tCO_2	C	Annually	100%	Electronic and paper	**-**
P36	PEL^{DE}_{y}	Annual technical report, measuring instrumentation	MWh	M/C	Annually	100 %	Electronic and paper	-
P37	$PS^{DE}_{steam,y}$	Annual technical report, measuring instrumentation	Gcal	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:

Project emission is determined according to the following formula:

$$PE_y = PE_y^{FSF2} + PE_y^{LF} + PE_y^{DE} \quad (1)$$

Where:

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

PE_y^{FSF2} FSF#2 emissions in year *y* (tCO_2);

PE_y^{LF} Emission during treatment in ladle furnaces (LF) in year *y* (tCO_2);

PE_y^{DE} Emission during treatment in deairing equipment (DE) in year *y* (tCO_2).

Calculation of FSF2 emissions

Coke, pig iron, lime and limestone consumption by FSF#1 and FSF#2 cannot be monitored individually. Therefore FSF#1 steel production is also taken into account during the project emissions calculation but their GHG emissions are separated during emission reduction calculation.

$$PE_{y}^{FSF2} = PE_{el,y}^{FSF2} + PE_{coke,y}^{FSF2} + PE_{lime,y}^{FSF2} + PE_{fuel,y}^{FSF2} + PE_{RM,y}^{FSF2} + PE_{O2,y}^{FSF2} + PE_{iron,y}^{FSF2} \quad (2)$$

Where:

PE_{y}^{FSF2} Project FSF#2 emissions in year y (tCO_2);

$PE_{el,y}^{FSF2}$ Emission from electricity consumption in year *y* (tCO_2);

$PE_{coke\,y}^{FSF2}$ Emission associated with coke production in year *y* (tCO_2);

$PE_{lime,y}^{FSF2}$ Emission associated with lime production in year y (tCO_2);

$PE_{fuel,y}^{FSF2}$ Emission from fuel combustion in year *y* (tCO_2);

$PE_{RM,y}^{FSF2}$ Emission from raw materials consumption in year *y* (tCO_2);

$PE_{O2,y}^{FSF2}$ Emission associated with oxygen production in year *y* (tCO_2);

$PE_{iron,y}^{FSF2}$ Project emissions associated with pig iron consumption by FSF#2 in year *y* (tCO_2).

Emission from electricity is determined according to the following formula:

$$PE_{el,y}^{FSF2} = PEL_{y}^{FSF2} \times EF_{el} \quad (3)$$

Where:

$PE_{el,y}^{FSF2}$ Project emission from electricity consumption in year *y* (tCO_2);

PEL_{y}^{FSF2} Electricity consumption by FSF#2 in year *y* (MWh);

EF_{el} Carbon dioxide emission factor of electricity grid of Russia (tCO_2/MWh) (fixed *ex-ante* for 2008 – 2012, see Annex 2).

Emissions associated with coke production are determined according to the following formula:

$$PE_{coke,\,y}^{FSF2} = PC_{y}^{FSF1+2} \times EF_{coke}^{production} \times \frac{PP_{y}^{FSF2}}{PP_{y}^{FSF1} + PP_{y}^{FSF2}} \qquad (4)$$

Where:

$PE_{coke\,y}^{FSF2}$	Project emission associated with coke production in year *y* (tCO_2);
PC_{y}^{FSF1+2}	Coke consumption by FSF#1 and FSF#2 in year *y* (tonnes);
$EF_{coke}^{production}$	Default IPCC emission factor of coke production[9] (tCO_2/tonne of coke);
PP_{y}^{FSF2}	Steel production by FSF#2 in year *y* (tonnes of steel);
PP_{y}^{FSF1}	Steel production by FSF#1 in year *y* (tonnes of steel).

Emissions are associated with lime productions are determined according to the following formulas:

$$PE_{lime,\,y}^{FSF2} = PL_{lime,y}^{FSF1+2} \times EF_{lime} \times \frac{PP_{y}^{FSF2}}{PP_{y}^{FSF1} + PP_{y}^{FSF2}} \qquad (5)$$

Where:

$PE_{lime,y}^{FSF2}$	Emission associated with lime production in year y (tCO_2);
$PL_{lime,y}^{FSF1+2}$	Lime consumption by FSF#1 and FSF#2 in year y (tonnes);
EF_{lime}	Default emission factor for lime production[10] (tCO_2/tonne of lime);
PP_{y}^{FSF2}	Steel production by FSF#2 in year *y* (tonnes of steel);
PP_{y}^{FSF1}	Steel production by FSF#1 in year *y* (tonnes of steel).

The fuel is burnt during melting in the FSF. Emissions from natural gas combustion are calculated according to the formula 6. Coke is not used as a fuel. It is an

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

[10] IPCC Guidelines for National Greenhouse Gas Inventories (2006), Volume 3, Chapter 2, page 22.

additive in furnace feed, but when being combusted it generates CO_2 emissions. Therefore this emission from coke combustion is calculated according to the formula 6 too but NCV for coke is defined according to IPCC[11].

$$PE^{FSF2}_{fuel,y} = \sum_i PF^{FSF2}_{fuel\,i,\,y} \times EF_i \times NCV_{i,\,y} \quad (6)$$

Where:

$PE^{FSF2}_{fuel,\,y}$ Emissions from fuel (natural gas and coke) combustion in year y (tCO_2);

$PF^{FSF2}_{fuel\,i,\,y}$ Consumption of fuel *i* by FSF in year y (tonne or 1000 Nm^3);

EF_i Emission factor of fuel *i* (tCO_2/GJ);

$NCV_{i,\,y}$ Net Calorific Value of fuel *i* in year y (GJ/1000 Nm^3 or GJ/tonne of fuel).

Electrodes are raw materials. Emissions from raw materials (RM) consumption are calculated according to the following formula:

$$PE^{FSF2}_{RM,\,y} = \sum_i PRM^{FSF2}_{RM\_i,\,y} \times EF_{RM\_i} \quad (7)$$

Where:

$PE^{FSF2}_{RM,\,y}$ Project mission from raw materials (electrodes) consumption in year *y* (tCO_2);

$PRM^{FSF2}_{RM\_i,y}$ RM *i* (electrodes) consumption in year *y* (tonne of RM);

$EF_{RM\_i,}$ RM *i* emission factor (tCO_2/tonne of RM) [12].

Emissions associated with oxygen production are calculated according to the following formula:

$$PE^{FSF2}_{O2,y} = PO^{FSF2}_{O2,y} \times EF_{O2} \quad (8)$$

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

[12] EF of electrodes is calculated according to IPCC electrodes carbon content, 2006 IPCC Guidelines on National Greenhouse Gas Inventories, Volume 3, Chapter 4, page 27.

Where:

$PE_{O2,y}^{FSF2}$	Emission associated with oxygen production in year y (tCO_2).
$PO_{O2,y}^{FSF2}$	Oxygen consumption by FSF#2 in year y (1000 Nm^3);
EF_{O2}	Emission factor for oxygen production (t CO_2/1000 Nm^3) [13].

Emissions associated with iron consumption are calculated according to the following formulas:

$$PE_{iron,y}^{FSF2} = PPI_{iron,y}^{FSF1+2} \times \frac{PP_y^{FSF2}}{PP_y^{FSF1} + PP_y^{FSF2}} \times EF^{iron} \quad (9)$$

Where:

$PE_{iron,y}^{FSF2}$	Project emissions associated with pig iron consumption by FSF#2 in year y (tCO_2);
$PPI_{iron,y}^{FSF1+2}$	Consumption of pig iron by FSF#1 and FSF#2 in year y (tonne of pig iron);
PP_y^{FSF2}	Steel production by FSF#2 in year y (tonne of steel);
PP_y^{FSF1}	Steel production by FSF#1 in year y (tonne of steel);
EF^{iron}	Iron production emission factor, calculated according to formulas in Annex 2 (tCO_2/tonne of pig iron).

Calculation of LF emissions

LF#1 and LF#2 are used for secondary refining of steel. Steel from FSF#2 can be directed to any of them. Therefore emission from project FSF#2 is determined taking into account steel production by FSF#1 since steel from FSF#1 can be directed to any of the two LFs.

$$PE_y^{LF} = PE_{el,y}^{LF} + PE_{coke,y}^{LF} + PE_{RM,y}^{LF} \quad (10)$$

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

Where:

$PE_{el,y}^{LF}$	Emissions from electricity consumption in year y (tCO2);
$PE_{coke\,y}^{LF}$	Emissions associated with coke production in year y (tCO_2);
$PE_{RM,\ y}^{LF}$	Emissions from raw material (electrodes) consumption in year y (tCO_2).

Emissions associated with project electricity consumption of ladle furnaces are calculated according to the following formula:

$$PE_{el,y}^{LF} = PEL_y^{LF} \times \frac{PP_y^{FSF2}}{PP_y^{FSF1} + PP_y^{FSF2}} \times EF_{el} \qquad (11)$$

Where:

PEL_y^{LF}	Total electricity consumption of ladle furnaces in year *y* (MWh);
EF_{el}	Carbon emission factor of electricity grid of Russia (tCO_2/MWh) (it is fixed *ex-ante* for 2008 – 2012, see Annex 2).
PP_y^{FSF2}	Steel production by FSF#2 in year *y* (tonnes of steel);
PP_y^{FSF1}	Steel production by FSF#1 in year *y* (tonnes of steel).

Coke isn't used as fuel. It is additive in furnace feed, but when being combusted it generates CO_2 emissions. Therefore this emission from coke combustion is calculated according to the formula below, NCV for coke is defined accordingly IPCC[14].

Emission associated with coke production and combustion is determined according to the following formula:

$$PE_{coke,y}^{LF} = \left(PC_y^{LF} \times \frac{PP_y^{FSF2}}{PP_y^{FSF1} + PP_y^{FSF2}} \times EF_{coke}^{production} \right) + \left(PC_y^{LF} \times \frac{PP_y^{FSF2}}{PP_y^{FSF1} + PP_y^{FSF2}} \times EF_i \times NCV_{i,\ y} \right) \qquad (12)$$

Where:

PC_y^{LF}	Coke consumption of ladle furnaces in year y (tonnes);

[14] 2006 IPCC Guidelines on National Greenhouse Gas Inventories, http://www.ipcc-nggip.iges.or.jp/public/2006gl/vol2.html Volume 2, table 1.2.

$EF_{coke}^{production}$	Default emission factor of coke production[15] (tCO_2/tonne of coke);
PP_y^{FSF2}	Steel production of FSF#2 in year *y* (tonnes of steel);
PP_y^{FSF1}	Steel production of FSF#1 in year *y* (tonnes of steel);
EF_i	Emission factor of fuel *i* (coke) combustion (tCO_2/GJ);
$NCV_{i,y}$	Net Calorific Value of fuel *i* (coke) in year y (GJ/tonne of fuel).

Electrodes are raw materials. Emissions from raw materials (RM) consumption are calculated according to the following formula:

$$PE_{RM,\ y}^{LF} = \sum_i PRM_{RM\_i,\ y}^{LF} \times EF_{RM\_i} \times \frac{PP_y^{FSF2}}{PP_y^{FSF1} + PP_y^{FSF2}} \qquad (13)$$

Where:

$PE_{RM,\ y}^{LF}$	Project mission from raw materials (electrodes) consumption in year *y* (tCO_2);
$PRM_{RM\_i,y}^{LF}$	RM *i* (electrodes) consumption by LFs in year *y* (tonne of RM);
$EF_{RM\_i,}$	RM *i* emission factor (tCO_2/tonne of RM) [16];
PP_y^{FSF2}	Steel production of FSF#2 in year *y* (tonnes of steel);
PP_y^{FSF1}	Steel production of FSF#1 in year *y* (tonnes of steel).

Calculation of DE emissions

There is the deairing equipment. Steel from FSF#2 and FSF#1 is directed to DE. Therefore emission from project steel (FSF#2) is determined taking into account steel production by FSF#1. (Steel from FSF#1 is directed to this DE too).

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

[16] EF of electrodes is calculated according to IPCC electrodes carbon content, 2006 IPCC Guidelines on National Greenhouse Gas Inventories, Volume 3, Chapter 4, page 27.

$$PE_{y}^{DE} = PE_{el,\,y}^{DE} + PE_{steam,\,y}^{DE} \qquad (14)$$

Where:

PE_{y}^{DE} Emission during steel treatment in deairing equipment in year *y* (tCO_2);

$PE_{el,\,y}^{DE}$ Emissions associated with project electricity consumption by DE in year y (tCO2);

$PE_{steam\,y}^{DE}$ Emissions associated with production of steam consumed in the project in year y (tCO_2);

Emissions associated with project electricity consumption by DE are calculated according to the following formula:

$$PE_{el,\,y}^{DE} = PEL_{y}^{DE} \times \frac{PP_{y}^{FSF2}}{PP_{y}^{FSF1} + PP_{y}^{FSF2}} \times EF_{el} \qquad (15)$$

Where:

$PE_{el,\,y}^{DE}$ Emissions associated with project electricity consumption by DE in year y (tCO2);

PEL_{y}^{DE} Total electricity consumption by DE in year *y* (MWh);

EF_{el} Carbon emission factor of electricity grid of Russia (tCO_2/MWh) (it is fixed *ex-ante* for 2008 – 2012, see Annex 2).

PP_{y}^{FSF2} Steel production by FSF#2 in year *y* (tonnes of steel);

PP_{y}^{FSF1} Steel production by FSF#1 in year *y* (tonnes of steel).

Emission associated with production of steam used in DE is calculated according to the following formula:

$$PE_{steam,y}^{DE} = PS_{steam,y}^{DE} \times EF_{steam} \times \frac{PP_{y}^{FSF2}}{PP_{y}^{FSF1} + PP_{y}^{FSF2}} \qquad (16)$$

Where:

$PS_{steam,y}^{DE}$ Steam consumption by DE in year y (Gcal);

EF_{steam} Emission factor for steam production (tCO_2/ Gcal) [17];

PP_y^{FSF2} Steel production by FSF#2 in year *y* (tonnes of steel);

PP_y^{FSF1} Steel production by FSF#1 in year *y* (tonnes of steel).

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	PP_y^{FSF2}	Annual technical report, measuring instrumentation	tonnes	M/C	Annually	100%	Electronic and paper	-
B3	BEF_y^{steel}	Annual plant calculations	tCO_2/tonnes of steel	M/C	Fixed *ex-ante*	100%	Electronic and paper	**-**
B4	$PP_y^{FSF2,\ liquid}$	Annual technical report, measuring instrumentation	tonnes	M/C	Annually	100%	Electronic and paper	-
B5	PI_y^{FSF}	Annual technical report, measuring instrumentation	unit fraction	M/C	Annually	100%	Electronic and paper	-

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

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, baseline emissions have one source:

- Production of the open hearth plant.

Steel production by OHP

Steel production in the baseline scenario by OHP is equal to project steel production by FSF#2.

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

$$BE_y = PP_y^{FSF2,\,liquid} \times BEF_y^{steel} \quad (17)$$

Where:

BE_y	Baseline emissions in year *y* (tCO_2);
$PP_y^{FSF2,\,liquid}$	Liquid steel production by FSF#2 in year *y* (tonnes of steel);
BEF_y^{steel}	Baseline emission factor for steel production in year *y* (tCO_2/tonne of steel) (it is fixed *ex-ante*, see Annex 2).

Liquid steel production by FSF#2 can be monitored or calculated taking into account processing index of electric steel consumption (1.032[18])

$$PP_y^{FSF2,\,liquid} = PP_y^{FSF2} \times PI_y^{FSF}$$ Steel production by FSF#2 in year *y* (tonnes of steel);

Where:

PI_y^{FSF}	Processing index of electric steel consumption in year *y* (unit fraction).

[18] This parameter is average for 2010.

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

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

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

Not applicable

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

Not applicable

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

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

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

Not applicable

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

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):

$$ER_y = BE_y - PE_y \quad (18)$$

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.
P12, P31, P36	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.
P14, P32	Medium	Coke consumption for steelmaking process is calculated as sum of daily reports of steelmaking 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, P17, B2, B4	Medium	Steel production is calculated as sum of daily reports of the steelmaking shop. Monthly data is checked. The check is based on the monthly inventory reports of remaining raw materials and steel. The produced steel is measured by weight per unit length (for every nominal size). Information is calculated by the steelmaking shop and transferred to the Environmental protection department.
P18	Medium	Lime consumption for steelmaking process is calculated as sum of daily reports of Of the steelmaking 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.
P20	Medium	Natural gas consumption for FSF#2 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. Coke consumption for FSF#2 is calculated as sum of daily reports of the steelmaking shop (of the blast-furnace department). 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.
P23,P33	Medium	Raw materials consumption for steelmaking process is calculated as sum of daily reports of steelmaking 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 by the Production management department and transferred to the Environmental protection department.
P25	Medium	Oxygen consumption for FSF#2 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.

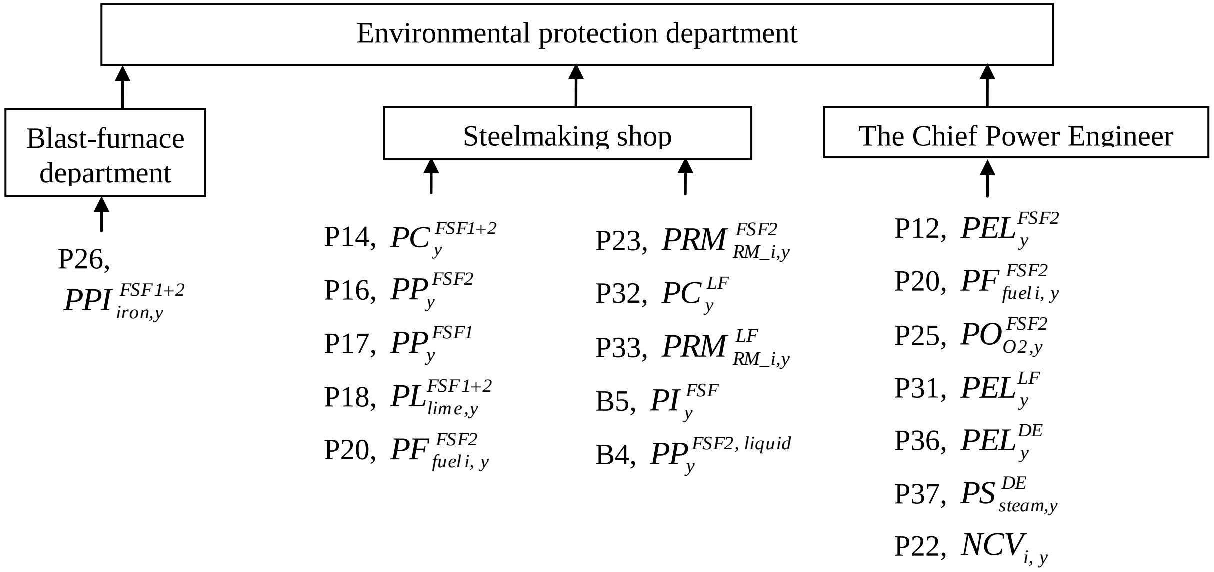
P26	Medium	Pig iron consumption for all steelmaking process (FSF#1,2) is calculated as sum of daily reports of the blast-furnace department. Monthly data is checked. The check is based on the monthly inventory reports of remaining raw materials and materials. The weighing apparatus is calibrated annually. Information is calculated by the steelmaking shop and transferred to the Environmental protection department.
P37	Medium	Steam consumption for DE is recorded and controlled by the Chief Power Engineer Department using meters calibrated and maintained in line with the Russian regulations and is transferred to the Environmental protection department.
B5	Medium	Processing index of electric steel consumption is calculated by daily reports of the steelmaking shop as ration of liquid steel to solid steel.

The internal quality system at Severstal is functioning in accordance with the national standards and regulations in force. Severstal has implemented standard for monitoring and measuring system (STO 00186217-SMK-7.6-01-2008/2010). This standard corresponds to the federal law #102-FZ and other requirements in Russia. Results of monitoring and measuring are stored in the Severstal's archive (not less than 10 years). 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, steelmaking 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 and air consumption and data received from the laboratory of the Gas transportation organization 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.

3) Steelmaking shop

Steelmaking shop is responsible for short term production strategy development and implementation. It will be responsible for steel production and data collection. Also, raw materials consumption and steel production are measured in the steelmaking. 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.

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

Mr Vladimir Shatunin, Chief engineer of environmental protection department is responsible for (see item one above):

- data storage and archiving;
- data processing;
- data reporting;
- monitoring report approval.

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

- Severstal, Mr Vladimir Shatunin, Chief engineer of environmental protection department
  Phone: +7 8202 56 73 39
  Fax: +7 8202 56 59 75
  E-mail: vashatunin@severstal.com
  OJSC Severstal is a project participant.

- Global Carbon BV, Mr Mikhail Butyaykin, JI Consultant
  Phone: +31 30 298 2310
  Fax: +31 70 891 0791
  E-mail: butyaykin@global-carbon.com
  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]	22,687	161,419	168,659	175,875	175,875
Coke	[tCO_2/y]	143	936	969	1,011	1,011
Electrodes	[tCO_2/y]	637	4,865	5,528	5,765	5,765
Natural gas	[tCO_2/y]	3,440	23,675	25,439	26,531	26,531
Oxygen	[tCO_2/y]	2,874	21,339	23,959	24,988	24,988
Steam	[tCO_2/y]	1,691	6,190	8,761	8,925	8,925
Raw materials production	[tCO_2/y]	4,892	37,334	45,205	47,146	47,146
Pig iron production	[tCO_2/y]	56,106	351,445	453,441	472,914	472,914
Total of project	[tCO_2/y]	92,470	607,203	731,961	763,156	763,156
Total 2010 - 2012	[tCO_2]	1,431,635				

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

Project emissions	Unit	2013	2014	2015	2016	2017	2018	2019	2020
Electricity	[tCO_2/y]	175,875	175,875	175,875	175,875	175,875	175,875	175,875	175,875
Coke	[tCO_2/y]	1,011	1,011	1,011	1,011	1,011	1,011	1,011	1,011
Electrodes	[tCO_2/y]	5,765	5,765	5,765	5,765	5,765	5,765	5,765	5,765
Natural gas	[tCO_2/y]	26,531	26,531	26,531	26,531	26,531	26,531	26,531	26,531
Oxygen	[tCO_2/y]	24,988	24,988	24,988	24,988	24,988	24,988	24,988	24,988
Steam	[tCO_2/y]	8,925	8,925	8,925	8,925	8,925	8,925	8,925	8,925
Raw materials production	[tCO_2/y]	47,146	47,146	47,146	47,146	47,146	47,146	47,146	47,146
Pig iron production	[tCO_2/y]	472,914	472,914	472,914	472,914	472,914	472,914	472,914	472,914
Total of project	[tCO_2/y]	763,156	763,156	763,156	763,156	763,156	763,156	763,156	763,156
Total 2013 - 2020	[tCO_2]	6,105,248							

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 FSF#2 after decommission the OHP

Parameter	Unit	11-12.2008	2009	2010	2011	2012
Steel production (solid)	t	129,940	903,926	967,626	1,009,180	1,009,180
Electricity consumption	MWh/t	0.2881	0.2942	0.2884	0.2884	0.2884
Electrode consumption	t/t	0.0013	0.0014	0.0016	0.0016	0.0016
Coke consumption	t/t	0.0057	0.0075	0.0080	0.0080	0.0080
Limestone consumption	t/t	0.0000	0.0116	0.0007	0.0007	0.0007
Lime consumption	t/t	0.0502	0.0470	0.0618	0.0618	0.0618
Natural gas consumption	$1000m^3$/t	0.0161	0.0159	0.0160	0.0160	0.0160

Oxygen consumption	1000m³/t	0.0460	0.0491	0.0515	0.0515	0.0515
Pig iron consumption	t/t	0.2732	0.2460	0.2965	0.2965	0.2965
Processing index of electric steel consumption		1.0320	1.0320	1.0320	1.0320	1.0320

Source: OJSC Severstal

Table E.1.4: Technical data of Steelmaking shop

Parameter	Unit	11-12.2008	2009	2010	2011	2012
Steel production FSF#1 (solid)	t	8,145	642,686	778,785	778,785	778,785
LFs						
Total steel production (solid)	t	138,085	1,546,612	1,746,411	1,787,965	1,787,965
Electricity consumption	MWh/t	0.0498	0.0535	0.0505	0.0505	0.0505
Electrode consumption	t/t	0.0004	0.0004	0.0004	0.0004	0.0004
Coke consumption	t/t	0.0003	0.0003	0.0003	0.0003	0.0003
DE						
Steel production (solid)	t	81,589	524,211	625,384	625,384	625,384
Electricity consumption	MWh/t	0.0064	0.0052	0.00614	0.00614	0.00614
Steam consumption	Gkal	3,857	22,727	33,932	33,932	33,932

Source: OJSC 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]	22,687	161,419	168,659	175,875	175,875
Coke	[tCO_2/y]	143	936	969	1,011	1,011
Electrodes	[tCO_2/y]	637	4,865	5,528	5,765	5,765
Natural gas	[tCO_2/y]	3,440	23,675	25,439	26,531	26,531
Oxygen	[tCO_2/y]	2,874	21,339	23,959	24,988	24,988
Steam	[tCO_2/y]	1,691	6,190	8,761	8,925	8,925
Raw materials production	[tCO_2/y]	4,892	37,334	45,205	47,146	47,146
Pig iron production	[tCO_2/y]	56,106	351,445	453,441	472,914	472,914
Total of project	[tCO_2/y]	92,470	607,203	731,961	763,156	763,156
Total 2010 - 2012	[tCO_2]	1,431,635				

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

Project emissions	Unit	2013	2014	2015	2016	2017	2018	2019	2020
Electricity	[tCO_2/y]	175,875	175,875	175,875	175,875	175,875	175,875	175,875	175,875

Coke	[tCO_2/y]	1,011	1,011	1,011	1,011	1,011	1,011	1,011	1,011
Electrodes	[tCO_2/y]	5,765	5,765	5,765	5,765	5,765	5,765	5,765	5,765
Natural gas	[tCO_2/y]	26,531	26,531	26,531	26,531	26,531	26,531	26,531	26,531
Oxygen	[tCO_2/y]	24,988	24,988	24,988	24,988	24,988	24,988	24,988	24,988
Steam	[tCO_2/y]	8,925	8,925	8,925	8,925	8,925	8,925	8,925	8,925
Raw materials production	[tCO_2/y]	47,146	47,146	47,146	47,146	47,146	47,146	47,146	47,146
Pig iron production	[tCO_2/y]	472,914	472,914	472,914	472,914	472,914	472,914	472,914	472,914
Total of project	[tCO_2/y]	763,156	763,156	763,156	763,156	763,156	763,156	763,156	763,156
Total 2013 - 2020	[tCO_2]	6,105,248							

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
OHP	[tCO_2/y]	198,022	1,377,541	1,474,617	1,537,943	1,537,943
Total	[tCO_2/y]	198,022	1,377,541	1,474,617	1,537,943	1,537,943
Total 2010 - 2012	[tCO_2]	6,126,067				

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

Baseline emissions	Unit	2013	2014	2015	2016	2017	2018	2019	2020
OHP	[tCO_2/y]	1,537,943	1,537,943	1,537,943	1,537,943	1,537,943	1,537,943	1,537,943	1,537,943
Total	[tCO_2/y]	1,537,943	1,537,943	1,537,943	1,537,943	1,537,943	1,537,943	1,537,943	1,537,943
Total 2013 - 2020	[tCO_2]	12,303,546							

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]	105,552	770,338	742,656	774,787	774,787
Total 2010 - 2012	[tCO_2]	3,168,120				

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

Emission reductions	Unit	2013	2014	2015	2016	2017	2018	2019	2020
Total	[tCO_2/y]	774,787	774,787	774,787	774,787	774,787	774,787	774,787	774,787
Total 2013 - 2020	[tCO_2]	6,198,298							

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	92,470	0	198,022	105,552
Year 2009	607,203	0	1,377,541	770,338
Year 2010	731,961	0	1,474,617	742,656
Year 2011	763,156	0	1,537,943	774,787
Year 2012	763,156	0	1,537,943	774,787
Total (tonnes of CO_2 equivalent)	2,957,947	0	6,126,067	3,168,120

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	763,156	0	1,474,617	711,461
Year 2014	763,156	0	1,474,617	711,461
Year 2015	763,156	0	1,474,617	711,461
Year 2016	763,156	0	1,474,617	711,461
Year 2017	763,156	0	1,474,617	711,461
Year 2018	763,156	0	1,474,617	711,461
Year 2019	763,156	0	1,474,617	711,461
Year 2020	763,156	0	1,474,617	711,461
Total (tonnes of CO_2 equivalent)	6,105,248	0	11,796,936	5,691,687

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:

Steel 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. 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 steelmaking shop reconstruction 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 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 25th July 2005 by the regional office of Glavgosexpertiza, in Vologda region (#09/4747). 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.

SECTION G. Stakeholders' comments

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

Proposed JI projects are not required to go through a local stakeholder consultation process, because public hearing was not organised. 25th July 2005 "The Main Agency of the State expertise" (FGU "Glavgosexpertiza" in Russian abbreviation) approved construction of the finger shaft furnace #2, positive conclusion of FGU "Glavgosexpertiza" #09/4747.
Severstal provided stakeholders with project information. Severstal had publications about the project in mass media. List of publications is presented below:

- www.rusmet.ru 04/07/2005 "FSF #2 is started in electric arc shop at Severstal for the arc-furnace steel production increase purpose".
- www.metallinfo.ru 03/06/2005 "FSF #2 will be started in the middle of June".

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 continuation operation of the existing open hearth plant.

In this case, the baseline emissions consist of production emissions by OHP at Severstal.

The baseline emission is calculated on the basis steel production emission factor (OHP) at Severstal.

Project emissions of CO_2 calculation's 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 compressed	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
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

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

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

Where:

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

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

EL_y^{oxygen} Total electricity consumption for oxygen generation in year *y* (MWh);

EF_{el} Carbon dioxide emission factor of electricity grid of Russia (tCO_2/MWh);

$S_{steam,y}^{oxygen}$ Steam consumption for oxygen generation in year y (Gcal);

EF_{steam} Emission factor for steam production (tCO_2/ Gcal).

Table Anx.2.2: Technical parameters of the steam production

Parameter	Unit	2006	2007	2008
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
Emission factor for steam generation	**tCO_2/Gcal**	**0.477**	**0.470**	**0.451**
Average for three years	**tCO_2/Gcal**	**0.466**		

Source: Severstal

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} Emission factor for steam production (tCO_2/ Gcal).

$SC_{fuel,y}^{steam}$ 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 year *y*;

7000 Combustion heat of coal equivalent (cal/kg);

$4{,}1868$ Conversion factor calorie to joule;

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 energy consumptions are calculated according to the following formula:

$$EC_j = \frac{EC_{j,y}}{BP_{j,y}} \qquad (3)$$

Where:

EC_j	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 3 too.
The average emission factor for oxygen production (EF_{O2}) is **0.48** tCO_2/1000 Nm^3 and fixed ex-ante.
The average emission factor for steam production (EF_{steam}) is **0.466** tCO_2/ Gcal and fixed ex-ante.

Baseline emission factor for OHP production

The data of technical parameters of the steel production by OHP at Severstal in 2003-2005 and average emission factor are presented in Table Anx.2.3 below:

Table Anx.2.3: Technical parameters of the steel production by OHP

	Unit	2003		2004		2005	
Steel production	t steel	464,562.91	464,473.93	658,781.66	520,904.10	612 486,30	282 659,40
Gas consumption	$1000m^3$	67,061.20	41,921.80	77,015.18	40,998.82	85 589,77	40 236,23
Residual fuel oil consumption	t	13,282.35	0.00	15,437.00	0.00	13 516,00	0,00
Electricity consumption	MWh	8,901.02	8,547.59	9,849.30	6,708.71	9 504,41	6 722,17
Oxygen consumption	1000m3	19,664.00	42,537.00	29,824.30	46,122.70	29 647,00	24 713,00
Oxygen consumption	1000m3	0.00	12.00	557.00	390.00	0,00	0,00
Iron consumption	t	292,148.60	364,973.70	401,501.00	422,516.60	382 223,50	218 817,50
Coke	t	103.00	1,022.00	258.00	770.11	192,00	434,69
Limestone	t	16,515.80	16,704.00	23,526.30	17,766.70	22 849,00	10 035,00
Lime	t	10,530.00	14,610.00	17,489.56	16,281.44	14 619,52	9 940,89
Coal	t	57.35	744.30	0.00	117.30	14,40	72,50
Dolomite	t	6,513.00	6,253.00	11,073.00	8,633.00	8 914,50	4 093,50
Burnt dolomite	t	5,012.00	7,148.00	6,827.00	9,216.00	6 061,30	4 337,41
Steam	Gcal	19506	0.00	21,902.00	0.00	19 828,00	0,00

Calculation of emission factor							
Emissions from gas	tCO2	128,987.43	80,633.59	148,133.20	78,858.30	164 625,81	77 391,51
Emissions from residual fuel oil	tCO2	41,515.50	0.00	48,250.09	0.00	42 245,79	0,00
Emissions from electricity consumption	tCO2	4,548.42	4,367.82	5,032.99	3,428.15	4 856,75	3 435,03
Emissions from oxygen consumption	tCO2	9,454.38	20,451.63	14,339.41	22,175.62	14 254,17	11 881,92
Emissions from residual fuel oil	tCO2	0.00	5.77	267.80	187.51	0,00	0,00
Emissions from pig iron	tCO2	461,734.84	576,833.40	634,564.05	667,778.77	604 096,36	345 836,55
Emissions from coke	tCO2	310.79	3,083.78	778.49	2,323.73	579,33	1 311,64
Emissions from limestone	tCO2	8,670.80	8,769.60	12,351.31	9,327.52	11 995,72	5 268,38
Emissions from lime	tCO2	7,897.50	10,957.50	13,117.17	12,211.08	10 964,64	7 455,66
Emissions from coal	tCO2	150.47	1,952.83	0.00	307.76	37,78	190,22
Emissions from dolomite	tCO2	3,113.21	2,988.93	5,292.89	4,126.57	4 261,13	1 956,69
Emissions from burnt dolomite	tCO2	4,589.53	6,545.49	6,251.54	8,439.17	5 550,38	3 971,80
Emissions from steam	tCO2	9,089.74	0.00	10,206.27	0.00	9 239,79	0,00
Total		680,062.60	716,590.35	898,585.22	809,164.19	872 707,65	458 699,40
Emission factor	**tCO2/t of steel**	**1.477**					

Source: Severstal

Emission factor for steel production by OHP at Severstal is calculated according to the following formula:

$$BE_y = BE^{OHP}_{iron,y} + BE^{OHP}_{coke,y} + BE^{OHP}_{fuel.y} + BE^{OHP}_{lime,y} + BE^{OHP}_{RM,y} + BE^{OHP}_{oxygen,y} \qquad (4)$$

Where:

$BE^{OHP}_{iron,y}$	Baseline emissions associated with iron production in year *y* (tCO_2);
$BE^{OHP}_{coke,y}$	Baseline emissions associated with coke production in year *y* (tCO_2);
$BE^{OHP}_{fuel,y}$	Baseline emissions from fuel combustion in year *y* (tCO_2);
$BE^{OHF}_{limestone,y}$	Baseline emissions from limestone consumption in year *y* (tCO_2);
$BE^{OHP}_{oxygen,y}$	Baseline emissions from oxygen production in year *y* (tCO_2);
$BE^{OHP}_{lime,y}$	Baseline emissions associated with lime production in year *y* (tCO_2).

Baseline emissions associated with iron and coke production are calculated according to the following formulae:

$$BE^{OHP}_{iron,y} = BIR^{OHP}_y \times EF^{iron} \qquad (5)$$

$$BE^{OHP}_{coke,y} = BC^{OHP}_y \times EF^{production}_{coke} \qquad (6)$$

Where:

BIR^{OHP}_y	Iron consumption for OHP in year *y* (tonnes);
EF^{iron}	Emission factor of iron production (tCO_2/tonne of iron);
BC^{OHP}_y	Coke consumption for OHP in year *y* (tonnes);
$EF^{production}_{coke}$	Default IPCC emission factor of coke production[19] (tCO_2/tonne of coke);

Two types of fuel are used in melting: natural gas and heavy fuel oil. Coke is not used as a fuel. It is an additive in furnace feed, but when being combusted it generates CO_2 emissions. Therefore this emission from coke combustion is calculated according to the next formula too. Emissions from the combustion of fuels are calculated according to the following formula:

$$BE^{OHF}_{fuel,y} = \sum_i BF^{OHF}_{fuel\_i,y} \times EF_i \times NCV_{i,y} \qquad (7)$$

Where:

$BF^{OHF}_{fuel\_i,y}$	Fuel (or coke BC^{OHP}_y) consumption of type *i* for OHFs in year *y* (GJ);
EF_i	Emission factor of fuel *i* (tCO_2/GJ);
$NCV_{i,y}$	Net Calorific Value of fuel *i* in year y (GJ/1000 Nm^3 or GJ/tonne of fuel)[20].

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

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

Emissions are associated with lime productions are determined according to the following formulas:

$$BE_{lime,y}^{OHP} = BL_{y}^{OHP} \times EF_{lime} \qquad (8)$$

Where:

$BE_{lime,y}^{OHP}$	Baseline emissions associated with lime production in year *y* (tCO_2).
BL_{y}^{OHP}	Lime consumption by OHP in year y (tonnes);
EF_{lime}	Default emission factor for lime production[21] (tCO_2/tonne of lime).

Limestone is one of additives. In the OHF the calcium carbonate is decomposed into calcium oxide and carbon dioxide. Emissions from raw materials (RM) consumption are calculated according to the following formula:

$$BE_{RM,\,y}^{OHP} = \sum_{i} BRM_{RM\_i,\;y}^{OHP} \times EF_{RM\_i} \qquad (9)$$

Where:

$BE_{RM,\,y}^{OHP}$	Project mission from raw materials (electrodes) consumption in year *y* (tCO_2);
$BRM_{RM\_i,\;y}^{OHP}$	RM *i* (limestone) consumption in year *y* (tonne of RM);
$EF_{RM\_i,}$	RM *i* emission factor (tCO_2/tonne of RM):

- emission factor for limestone is equal to 0.525[22];
- emission factor for dolomite is 0.478 (it is molar weight ration of $CaMg(CO_3)_2 \rightarrow 2CO_2$:
- emission factor for burnt dolomite is $\frac{0.478}{1-0.478} = 0,916$.

Emissions associated with oxygen production are calculated according to the following formula:

$$BE_{oxygen,y}^{OHP} = BO_{O2,y}^{OHP} \times EF_{O2} \qquad (10)$$

Where:

$BE_{oxygen,y}^{OHP}$	Emission associated with oxygen production in year *y* (tCO_2).
$PO_{O2,y}^{FSF2}$	Oxygen consumption by OHP in year y (1000 Nm^3);
EF_{O2}	Emission factor for oxygen production (t CO_2/1000 Nm^3).

Calculation of emission factors for iron production

The data of technical parameters of the iron production by BF#4 at Severstal in 2006-2008 and average emission factor are presented in Table Anx.2.4 below:

Table Anx.2.4: Technical parameters of the pig iron production

[21] IPCC Guidelines for National Greenhouse Gas Inventories (2006), Volume 3, Chapter 2, page 22.

[22] WBCSD, CO_2 Accounting and Reporting Standard for the Cement Industry (2005)

	Unit	2006	2007	2008
Blast furnace # 4				
Steelmaking pig iron production	**t pig iron**	**2,128,417**	**2,234,257**	**2,114,861**
Electricity consumption	MWh/t	0.025	0.03	0.031
Emissions from electricity	**tCO2**	**27191**	**34251**	**33502**
Coke consumption per tonnes	kg coke/t	0.4349	0.4266	0.4448
Emissions from coke combustion	**tCO2**	**2817057**	**2900705**	**2862834**
Limestone consumption	t limestone/t	0	0	0
Emissions from limestone	**tCO2**	**0**	**0**	**0**
Gas consumption	1000m3/t pig	0.111015749	0.113942577	0.121942293
Net calorific value of natural gas	GJ/1000 m3	33.54	33.45	33.42
Emissions from gas	**tCO2**	**444533**	**477707**	**483556**
Oxygen consumption	1000m3/t pig	0.0917	0.0923	0.118
Emissions from oxygen consumption	**tCO2**	**93840**	**99151**	**119984**
Blast furnace gas production	1000m3	3,466,556	3,510,721	3,389,608
Blast furnace gas consumption (preheater)	1000m3	909,709	1,172,586	999,469
Blast furnace gas consumption (flaring system)	1000m3	178,421	236,866	413,163
Blast furnace gas output	1000m3	2,378,427	2,101,268	1,976,977
Net calorific value of blast furnace gas (BF4)		883	899	955
Content of CO in blast furnace gas	%	23.9	24.6	25.9
Emissions during CO burnt	tCO2	**1115224**	**1015707**	**1006110**
Sinter consumption	t/t of pig	1.0641	0.925	0.9845
Emission connected with sinter production	**tCO2**	**452970**	**413338**	**416416**
Pellet consumption	t/t of pig	0.551	0.6476	0.6324
Emission connected with pellet production	**tCO2**	**35183**	**43407**	**40123**
Emission connected with coke production	**tCO2**	**518363**	**533755**	**526786**
Emission from steelmaking pig iron production	**tCO2**	**3273913**	**3486606**	**3477091**
EF for blast furnace	**tCO2/t pig**	**1.54**	**1.56**	**1.64**
Avarage EF for blast furnace	**tCO2/t pig**	**1.58**		

Source: Severstal

Iron production emission factor is calculated according to the following formula:

$$EF_y^{iron} = \frac{E_y^{iron}}{IP_y} \qquad (11)$$

Where:

EF_y^{iron} Iron production emission factor in year y (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:

$$E_y^{iron} = \sum_i Fuel_y^i \times NCV_{fuel\_i,\,y} \times EF_{fuel\_i} + PR_{slag,y} \times CA_{\ Ca,y} \times \frac{44}{56} + PR_{slag,y} \times MG_{\ Mg,y} \times \frac{44}{40} - \\ -(\sum_k SER_y^k \times CO_y^k) \times \frac{28}{22.4} \times \frac{88}{56} + E_y^{coke} + E_{pellet,y} + E_{sinter,y} + E_{oxygen,y} \quad (12)$$

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);
$NCV_{fuel\_i,\,y}$	Net Calorific Value of fuel of type *i* in year *y* (GJ/(tonnes or m^3));
EF_{fuel_i}	Emission factor of fuel of type *i* including coke (tCO_2/GJ);
$PR_{slag,y}$	Slag production by blast furnace in year *y* (tonnes);
$CA_{\ Ca,y}$	Content of CaO in BF slag in year *y* (fraction);
44	Molar weight of CO_2;
56	Molar weight of CaO;
$MG_{\ Mg,y}$	Content of MgO in BF slag in year *y* (fraction);
40	Molar weight of MgO;
SER_y^k	Secondary energy resource *k* (blast furnace, coke oven gases) output in year *y* (1000 m^3);
CO_y^k	Carbon monoxide content in *k* (blast furnace, coke oven gases) in year *y* (fraction);
28	Molar weight of carbon monoxide;
22.4	Gas molar volume (Avogadro's number);
88	Molar weight of two molecule of carbon dioxide ($2CO + O_2 \rightarrow 2CO_2$);
56	Molar weight of two molecule of carbon monoxide ($2CO + O_2 \rightarrow 2CO_2$);
E_y^{coke}	Emissions due to coke consumption emissions in year *y* (tCO_2);
$E_{pellet,y}$	Emissions due to pellet consumption emissions in year *y* (tCO_2);
$E_{sinter,y}$	Emissions due to sinter consumption emissions in year *y* (tCO_2).
$E_{oxygen,y}$	Emissions due to oxygen consumption emissions in year *y* (tCO_2).

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

$$E_y^{coke} = Coke_y \times EF_{coke}^{production} \quad (13)$$

$$E_{sinter,y} = \sum_j Sin_y \times SF_{i,y}^{sinter} \times EF_{fuel\_i} \times NCV_{fuel\_i,\,y} + Sin_y \times SF_{coke,y}^{sinter} \times EF_{coke}^{production} \quad (14)$$

$$E_{pellet,y} = \sum_j Pel_y \times SF_{i,y}^{pellet} \times EF_{fuel\_i} \times NCV_{fuel\_i,\,y} + Pel_y \times SF_{coke,y}^{pellet} \times EF_{coke}^{production} \quad (15)$$

$$E_{oxygen,y} = Oxy_y \times SC_{oxygen} \times EF_{el} \quad (16)$$

Where:

E_y^{coke} 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);

$EF_{coke}^{production}$ Default emission factor of coke production[23] (tCO_2/tonne of coke).

$E_{sinter,y}$ Sinter consumption emissions in year *y* (tCO_2).

$SF_{i,y}^{sinter}$ Fuel *i* (coke, oil residual, natural gas) consumption due to sinter production in year *y* (calculated above);

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));

$E_{pellet,y}$ Pellet consumption emissions in year *y* (tCO_2);

$SF_{i,y}^{pellet}$ Fuel *i* (coke, oil residual, natural gas) consumption due to pellet production in year *y* (1000Nm^3 or t/tonne of pellet);

SC_{oxygen} Energy consumption during energy consumption, 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 key data used to establish the baseline in tabular form is presented below.

Data/Parameter	PP_y^{FSF2}
Data unit	Tonnes
Description	Steel production of FSF#2 in year *y*
Time of determination/monitoring	During the crediting period
Source of data (to be) use	Annual technical report
Value of data applied (for ex ante calculations/determinations)	1,009,180
Justification of the choice of data or description of measurement methods and procedures (to be) applied	It is defined according to the business plan of Severstal.
OA/QC procedures (to be) applied	Steel production in the baseline scenario is equal to project steel production by FSF#2 Steel production is calculated as sum of daily reports of the steelmaking shop. Monthly data is checked. The check is based on the monthly inventory reports of remaining raw materials and steel. The produced steel is measured by weight per unit length (for every nominal size) or directly weighted.
Any comment	Information is calculated by the steelmaking shop and transferred to the Environmental protection department.

Data/Parameter	BEF_y^{steel}

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

Data unit	tCO_2/tonnes of steel
Description	Baseline emission factor for OHP steel production in year *y*
Time of determination/monitoring	Ex ante
Source of data (to be) use	According to Severstal annual technical report
Value of data applied (for ex ante calculations/determinations)	1.477
Justification of the choice of data or description of measurement methods and procedures (to be) applied	Average parameter is calculated according to data for three years (2003-2005).
OA/QC procedures (to be) applied	The internal quality system at Severstal is functioning in accordance with the national standards and regulations in force.
Any comment	-

Data/Parameter	EF_y^{iron}
Data unit	Tonne CO_2/tonne of iron
Description	Iron production emission factor in year *y*
Time of determination/monitoring	*Ex-ante*
Source of data (to be) used	According to Severstal annual technical report
Value of data applied (for ex ante calculations/determinations)	1.58
Justification of the choice of data or description of measurement methods and procedures (to be) applied	Average parameter is calculated according to data for three years (2006-2008) taken for the blast furnace #4 (last constructed BF at Severstal).
OA/QC procedures (to be) applied	The internal quality system at Severstal is functioning in accordance with the national standards and regulations in force.
Any comment	

Data/Parameter	$EF_{el,y}$
Data unit	tCO_2/MWh
Description	Standardized CO_2 emission factor for power grid
Time of determination/monitoring	*Ex-ante*
Source of data (to be) used	The study “Development of grid GHG emission factors for power systems of Russia” commissioned by “Carbon Trade and Finance” in 2008 (further in the text – Study)
Value of data applied (for ex ante calculations/determinations)	0.511 – for RES “Center”.
Justification of the choice of data or description of measurement methods and procedures (to be) applied	The standardized factor has been determined by Bereau Veritas.
OA/QC procedures (to be) applied	-
Any comment	This the standardized CO_2 emission factor is operated margin emission factor for RES “Center”

Data/Parameter	EF^{cok}
Data unit	tCO_2/t

Description	Emission factor during production of coke, sintering and pellet
Time of determination/monitoring	Fixed *ex-ante* during determination
Source of data (to be) use	2006 IPCC Guidelines on National GHG Inventories, http://www.ipcc-nggip.iges.or.jp/public/2006gl/vol3.html Volume 3,Chapter 4, page 25, table 4.2
Value of data applied (for ex ante calculations/determinations)	Coke – 0.56
Justification of the choice of data or description of measurement methods and procedures (to be) applied	-
OA/QC procedures (to be) applied	-
Any comment	-

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." [24].

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.

[24] 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

See Section D for monitoring plan.