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

A.1. Title of the project:

Reconstruction of the steelmaking at JSC "Ashinskiy Metallurgical Works", Asha, Russian Federation

Sectoral scope: (9) Metal production

Version: 04

Date: 17/01/2011

A.2. Description of the project:

The project of the reconstruction of the steelmaking at JSC "Ashinskiy Metallurgical Works" (AMW) is implemented with purpose of modern electrical steelmaking complex building, steel production increase, energy efficiency and GHG emission reductions. The reconstruction of the steelmaking at JSC "Ashinskiy Metallurgical Works" is performed by means of construction of the continuous-casting machine and the electric arc furnace. That provides to shut-down the open-hearth furnaces and steel casting into moulds.

Situation existing prior to the starting date of the project:

JSC "Ashinskiy Metallurgical Works" specializes in the production and shipment of corrosion-proof and electric steel, derived plate steel, wire products, amorphous tapes and powders as well as a wide variety of consumer products. The company's major market is in Russia. The main customers of the company are medium and small businesses from the construction, oil and gas, power and chemical industries.

JSC "Ashinskiy Metallurgical Works" operates three open-hearth furnaces of 200 t capacity each, one ladle furnace and four rolling mills (mill #2850, mill #1500, mill #1400, mill #720) located in three distinct workshops of the plant. The principal operational scheduled prior to the starting date of the project was: steel smelting in the open-hearth furnaces, steel processing in the ladle furnace, steel casting into moulds and rolled metal production from the ingots by the mill #2850.[1] The plant's performance in the production of steel and rolled products in 2006-2008 is illustrated in Table A.2-1.

Table A.2-1. Production of steel and rolled metal at Ashinskiy Metallurgical Works in 2006-2008[2]

Activity	2006	2007	2008
Production of steel, tonnes	643,660	652,183	649,520
Production of rolled metal (mill #2850), tonnes	469,100	493,040	485,100

History of the project

In 2003, JSC "Ashinskiy Metallurgical Works" adopted a comprehensive program for retrofitting the steel plant that includes 3 stages (launch areas): construction of the out-of-furnace steel processing

[1] The rolling mill #1500, mill #1400, mill #720 is excluded from the further consideration as the project has not influence on they operation.

[2] Technical reports of JSC "AMW" for 2006-2008.

"ladle furnace" (LF), construction of the continuous-casting machine (CCM), construction of the electric arc furnace (EAF).

The construction of the LF was completed successfully in 2003-2005, which increased the steel production capacity of the plant more than 650,000 tonnes per year by reducing the duration of melting, which in turn produced savings on raw materials and fuel. The use of the out-of-furnace steel processing technology improved the quality of the steel, and allowed for the production of high quality steel and rolled metal that fully comply with consumer requirements.

In 2005, on the initial stage of the construction of the CCM and EAF, was made a decision to continue the implementation of the program using mechanisms of the Kyoto Protocol which would allow raising additional investments for the implementation of the project and secure its realization notwithstanding technological and financial barriers.

The preparation of the project documentation for CCM construction is completed in 2005-2006, for EAF construction – in 2007-2008. The construction and installation of the equipment is provided for CCM in 2006-2007, for EAF – in 2008-2010. The CCM is commissioned on 25.09.2007. The EAF will be commissioned in the middle of 2010.

Project scenario

The project scenario is included the following activities: construction of the EAF with loading conveyor CONSTEEL and CCM. As a result of the implementation of the specified activities, steel and rolled products will be produced according to the following scheme: begin 2008 – middle 2010 (after CCM commissioning – till EAF commissioning) melting of steel in the open-hearth furnaces, processing of steel in the ladle furnace, steel casting in the CCM and into the moulds, rolling of steel billets in the rolling plant #1; since 2010 (after EAF commissioning) melting of steel in the EAF, processing of steel in the ladle furnace, steel casting in the CCM, rolling of steel slabs in the rolling plant #1. The production of steel in the EAF shall amount to 1,000,000 tonnes per year. The output of rolled metal shall amount to 595,000 tonnes per year. The output of steel slabs as finished product for sale shall amount to 310,000 tonnes per year.

The project will allow to:

- shut-down the open-hearth furnaces;
- create a new steelmaking electric furnace;
- increase steel production;
- continuously cast steel into slabs instead of casting into moulds;
- improve working environment;
- reduce production costs;
- reduce pollution (environmental adverse effects);
- reduce greenhouse gas emissions.

Baseline scenario

The baseline scenario is the continuation of the current situation. The production of steel in the open-hearth furnaces, processing of steel in the ladle furnace, casting of steel into moulds, rolling of steel billets at the rolling plant #1. Without the implementation of the project, steel production at

JSC "Ashinskiy Metallurgical Works" would be performed in open-hearth furnaces with a total output more than 650,000 tonnes per year. The open-hearth steel would be processed in the ladle furnace and cast into moulds. The output of ready rolled products from ingots according to the baseline scenario would be of 500,000 tonnes per year. Notwithstanding a smaller output of steel and rolled metal, the baseline scenario would offer steel and rolled metal of a quality similar to the project scenario through the use of the out-of-furnace technology in the ladle furnace. While the implementation of the project allows for an increase of steel and rolled metal production, the baseline scenario provides for an added-on output of steel about 420,000 tonnes per year at other iron-and-steel works in Russia.

Greenhouse gas emission reductions

The implementation of the project will reduce greenhouse gas emission by the following reasons:

- Decrease in raw material consumption for steel production in steel plant;
- Decrease in fuel consumption for steel and rolled metal production;
- Decrease in metal losses when casting steel into moulds;
- Decrease in steel consumption for production of rolled metal;
- Decrease in raw materials and fuel consumption in auxiliary works (foundry shop, lime shop, etc.).

The expected reduction of GHG emissions over the crediting period (2008-2012) will be about 1,975 th. tonnes of CO_2 or in average 395 th. tonnes of CO_2 per year.

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 Russian Federation (Host Party)	• JSC "Ashinskiy Metallurgical Works"	No
Party B Not determined[3]	-	-

A.4. Technical description of the project:

A.4.1. Location of the project:

[3] Party B is not determined on the moment of PDD elaboration and will be determined later.

The project is located on the territory of the JSC "Ashinskiy Metallurgical Works", Asha, Chelyabinsk Region, Russian Federation.

A.4.1.1. Host Party(ies):

Russian Federation

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

Chelyabinsk Region

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

Asha

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

The project is to be implemented at JSC "Ashinskiy Metallurgical Works", situated in Asha, Chelyabinsk Region, Russia (Fig. A.4-1., A.4-2.).

Asha is the administrative center of the Ashinsky District of the Chelyabinsk Region. Asha is situated 400 km west of Chelyabinsk on the river Sim. The population is of 33,000 inhabitants.

Geographical coordinates of the project: 55°00' NL, 57°15' EL.

Fig. A.4-1. Russian Federation, Chelyabinsk Region

Fig. A.4-2. Asha, Chelyabinsk Region

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

The project consists in the construction of a continuous-casting machine (CCM) and an electric arc furnace (EAF) with loading conveyor CONSTEEL with each commissioning in two stages: first CCM in 2007, second EAF in 2010. The main equipment and technologies of the project are described below.

The main equipment of the CCM includes:

- Continuous-casting machine (with an output of 1,000 th. tonnes of slab per year);

- Cranes;

- Transfer bogies;

- Equipment for repairing refractory lining of intermediate buckets;

- Stand for canting intermediate buckets with an oil station;

- Machine for shaking-out the refractory lining of intermediate buckets;

- Equipment for the machine shop;

- Equipment for the electrician’s workshop;

- Equipment for the hydraulic workshop;

- Equipment for the instrumentation workshop.

The main equipment of the EAF includes:

- **Electric arc furnace** (with a capacity of 120 tonnes, with an output of 1,000 th. tonnes per year):

    - Sloping platform with swinging scaffolds;

- Replaceable case and the furnace bottom;
- Case panels;
- Big vault;
- Raising – turning system of the vault and raising – lowering system of the electrodes;
- Power hydraulic unit of the arc steel furnace;
- Centralized lubrication system;
- Current-carrying electrode holders;
- Water-cooled cables for the low-voltage circuit;
- Bunker for loading of additives;
- Bay discharge with the hydraulic drive of the wicket.

- Loading conveyor CONSTEEL:

- Conveyor for heating of charge;
- Static sealing system;
- Mobile setting square log;
- Connecting cart of the conveyor;
- System for CO gas afterburning;
- Hydraulic system.

- Auxiliary equipment:

- Transfer buggy of the EAF steel bucket;
- System of bottom blowing of metal in the steel bucket with inert gas;
- Station for electrodes joining;
- Equipment for monitoring oxygen temperature and activity in metal;
- Module system for oxygen, natural gas and carbon;
- Automatic control system.

Besides the main equipment, it is foreseen to build transmission lines (35 kV) over a distance of 70 km and a scaling substation for powering the EAF.

The vendors of main equipment:

- CCM – STB (Italy);
- EAF – DANIELI (Italy).

The steelmaking technology after CCM commissioning till EAF commissioning consists in the following stages:

1. Preparation of the furnace charge (scrap, iron) and loading into the open-hearth furnaces.

3. Melting of semi-finished steel in the open-hearth furnaces.

4. Discharge of the steel into the ladle furnace and its transportation to the out-of-furnace steel processing.

5. Out-of-furnace steel processing of semi-finished steel in the ladle furnace and reaching the chemical composition of steel to the defined grade, temperature and oxidation required for casting into the CCM.

6. Transportation of liquid steel to the section of casting.

7. Steel casting on the CCM resulting in steel billets – slabs or steel casting into the moulds resulting in steel billets – ingots.

8. Transportation of the steel billets to the rolling plant #1 (mill #2850).

9. Steel billets rolling producing suitable rolled metal.

The steelmaking technology since EAF commissioning consists in the following stages:

1. Preparation of the furnace charge (scrap, iron) and loading onto the conveyor.

2. Transportation of the furnace charge and loading into the EAF.

3. Melting of semi-finished steel in the EAF.

4. Discharge of the steel into the ladle furnace and its transportation to the out-of-furnace steel processing.

5. Out-of-furnace steel processing of semi-finished steel in the ladle furnace and reaching the chemical composition of steel to the defined grade, temperature and oxidation required for casting into the CCM.

6. Transportation of liquid steel to the section of continuous casting.

7. Steel casting on the CCM resulting in steel billets - slabs.

8. Transportation of the slabs to the rolling plant #1 (mill #2850).

9. Steel billets rolling producing suitable rolled metal.

The scheduled project activities is shown in Diagram A.4-1.

Diagram A.4-1. Schedule of activities according to the project

№	Stage	2005	2006	2007	2008	2009	2010
1.	**Construction of the CCM**						
1.1.	Preparation of project documentation						
1.2.	Construction						
1.3.	Installation						
1.4.	Commissioning						

2.	**Construction of the EAF**						
2.1.	Preparation of project documentation						
2.2.	Construction						
2.3.	Installation						
2.4.	Commissioning						
3.	**Construction of the transmission lines and substation**						
3.1.	Preparation of project documentation						
3.2.	Construction						
3.3.	Installation						
3.4.	Commissioning						

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:

Greenhouse gas emissions occur at metallurgical plants due to the use of carbonaceous feeds in processes (iron, limestone, coke, etc.), fuel burning (fuel oil, natural gas). Such emissions also take place outside the metallurgical plant: in the national energy system when supplying power from the grid, as a result of using fossil fuel for power production. The same processes occur at metallurgical plants during manufacturing of metal products that are used at other metallurgical plants or substitute production of other metallurgical products.

The implementation of the project (according to the project scenario) will reduce the consumption of fuel and carbonaceous feed for steel and rolled metal manufacturing if compared with the baseline scenario (Table A.4.3-1). However, according to the project scenario, power consumption will increase once the electric arc furnace has been constructed.

Table A.4.3-1. Comparative data of the project and the baseline for fuel, carbonaceous feed and energy consumption for steel and rolled metal production

№	Indicator	Unit	Baseline scenario	Project scenario	
				After CCM commissioning	After EAF commissioning
1.	Steel production[4]				
1.1.	Iron consumption	t / t steel	0,038	0,038	0,013
1.2.	Scrap iron consumption	t / t steel	0,078	0,078	0,027
1.3.	Scrap steel consumption	t / t steel	1,064	1,064	1,064
1.4.	Natural gas consumption	th. m^3 / t steel	0,114	0,114	0,003
1.5.	Fuel oil consumption	t / t steel	0,051	0,051	-

[4] Specific consumption for steel production in baseline scenario and project scenario (after CCM commissioning) is determined based on actual data for the period 11/2007 – 12/2008 (source of data: Technical reports of open-hearth plant). Specific consumption for steel production in project scenario (after EAF commissioning) is determined based on Technological definition for electric steel making at JSC “AMW”.

1.6.	Graphite electrodes consumption	t / t steel	-	-	0,001
1.7.	Electric power consumption	MWh / t steel	0,007	0,007	0,375
1.8.	Oxygen consumption	th. m^3 / t steel	0,022	0,022	0,041
1.9.	Moulds consumption[5]	t / t steel	0,024	0,026	-
2.	Steel billets production[6]				
2.1.	Ingots steel billets	%	100,0%	15,0%	0,0%
2.2.	Slabs steel billets	%	0,0%	85,0%	100,0%
2.3.	Natural gas consumption	th. m^3 / t steel billets	-	0,113	0,113
2.4.	Electric power consumption	MWh / t steel billets	-	0,027	0,027
2.5.	Compressed air consumption	th. m^3 / t steel billets	-	0,089	0,089
3.	Rolled metal production (Rolling plant #1)[7, 8]				
3.1.	Steel billets consumption	t / t rolled metal	1,355	1,184	1,162
3.2.	Natural gas consumption	th. m^3 / t rolled metal	0,083	0,083	0,083
3.3.	Electric power consumption	MWh / t rolled metal	0,034	0,034	0,034
3.4.	Compressed air consumption	th. m^3 / t rolled metal	0,046	0,046	0,046

As results of project implementation will be significantly increase the consumption of scrap steel and electricity. For cover the demand on steel scrap it is organized the daughter enterprises of the JSC "AMW" specialized in scrap steel collection in the following regions: Chelyabinsk region, Tatarstan, Bashkortostan, Khanty-Mansi Autonomous Area. The rate of steel scrap supplied to the JSC "AMW" from the own enterprises amounts to 47% of the scrap steel consumed in 2009. [9] The electricity for new EAF will be supplied from the grid: the transmission lines and substation is constructed for this (see also the sections A.4.2, B.1.). The implemented actions allow cover the increased feed resources consumption.

[5] Moulds consumption is provided in the unit: t (moulds) / t (steel casted into moulds)

[6] Specific consumption for steel billets production is determined based on actual data of CCM operation for the period 11/2007 – 12/2008. Source of data: Technical reports of open-hearth plant.

[7] The rolling plant #1 includes the rolling mill # 2850. The rolling mill #1500, mill #1400, mill #720 is excluded from the consideration as the project has not influence on they operation.

[8] Specific consumption for rolled metal production is determined based on actual data for the period 11/2007 – 12/2008, excepting steel billets consumption in the Baseline determined based on actual data for the period 01/2006 – 10/2007. Source of data: Technical reports of rolling plant #1.

[9] Source: http://www.amet.ru/reports.html

The main performance indicators and CO_2 emissions averaged over a period of 2008-2012 are shown in Table A.4.3-2. A detailed description of CO_2 emissions according to the baseline and project scenarios is shown in sections B and E of the project documentation (PDD).

Table A.4.3-2. Steel production and CO_2 emissions (average values for the years 2008-2012)[10]

№	Indicator	Baseline scenario	Project scenario	Reduction
1	Production of steel, t/year[11]	904,457	813,439	97,018
2	Production of rolled metal, t/year	554,778	554,778	0
3	Specific emissions of CO_2 by steel production, tCO_2/t	1.063	0.697	0.366
4	Emissions of CO_2, tCO_2/year	961,438	566,967	394,471

Under the existing Russian legislation regulating anthropogenic emissions of greenhouse gases, there are no restrictions for activities that lead to greenhouse gas emissions. Thereby, the project of reconstruction of the steelmaking at JSC “Ashinskiy Metallurgical Works” can be developed according to any of the possible scenarios that ensure a level of steel and rolled metal manufacturing acceptable to the company. Upon the impossibility of raising additional investments for the project due to flexibility mechanisms of the Kyoto Protocol, the project would be developed according to the baseline scenario (justification for the baseline scenario is shown in section B.1.-B.2.).

Thereby, the baseline scenario is not in contradiction with the country’s and industry policies as for greenhouse gas emission regulations and would be implemented in the absence of the project activity, which would not reduce greenhouse gas emissions.

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

	Years
Length of the crediting period	5 years (60 months)
Year	Estimate of annual emission reductions in tonnes of CO_2 equivalent
2008	183,559
2009	131,130
2010	374,242

[10] Estimation including initial data is attached in an excel file.

[11] Steel production in the baseline is more than in the project scenario as the specific consumption of steel billets for rolled metal production in the baseline is more than in the project scenario. The reduction of steel production in the project scenario is achieved because of steel casting in CCM instead of steel casting into moulds.

2011	641,739
2012	644,739
Total estimated emission reductions over the crediting period (tonnes of CO_2 equivalent)	1,975,409
Annual average of estimated emission reductions over the crediting period (tonnes of CO_2 equivalent)	395,082

Table A.4-2. Estimated amount of emission reductions after the crediting period

	Years
Length of the period after the crediting period	8 years (96 months)
Year	Estimate of annual emission reductions in tonnes of CO_2 equivalent.
2013	644,739
2014	644,739
2015	644,739
2016	644,739
2017	644,739
2018	644,739
2019	644,739
2020	644,739
Total estimated emission reductions over the period after the crediting period (tonnes of CO_2 equivalent)	5,157,912
Annual average of estimated emission reductions over the period after the crediting period (tonnes of CO_2 equivalent)	644,739

A.5. Project approval by the Parties involved:

The project “Reconstruction of the steelmaking at JSC “Ashinskiy Metallurgical Works”, Asha, Russian Federation” is approved as JI project by the Order of Ministry of Economic Development #709 dated on 30.12.2010.

SECTION B. Baseline

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

Description and justification of the baseline chosen is provided in accordance with "Guidance on criteria for baseline setting and monitoring", (Version 02).[12]

A **JI specific approach**[13] is used for description and justification of the baseline chosen that includes the following steps:

1. Indication and description of the approach chosen regarding baseline setting
2. Application of the approach chosen

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

The JI specific approach for baseline setting is elaborated in accordance with Appendix B of the JI guidelines[14] and paragraph 23 through 29 of the Guidance on criteria for baseline setting and monitoring (Version 02).

The baseline is identified by listing and describing plausible future scenarios on the basis of conservative assumptions and selecting the most plausible one taking into account the key factors that affect a baseline.

The **following steps** are implemented for baseline setting:

1. Identification and description of plausible future scenarios

At this stage the plausible future scenarios are defined and checked if they are in line with the current legislation and if they are available to the project participants.

2. Analysis of the key factors that affect the implementation of the plausible future scenarios

The key factors are directly or indirectly factors to the plausible future scenarios that affect their implementation. The following factors considered as the key factors that affect the plausible future scenarios implementation: investment barrier, technological barriers, financial barrier (the description and application of the mentioned key factors are provided by Step 2 of the approach chosen). The other factors stated in paragraph 25 of the Guidance on criteria for baseline setting and monitoring (Version 02) can not be considered as the key factors that affect the baseline.

3. Selecting the most plausible scenario

This stage results in defining of the baseline. The baseline is the most attractive future scenario.

Step 2. Application of the approach chosen

1. Identification and description of plausible future scenarios

The list of the future scenarios shall be developed according to the following terms:

- all future scenarios shall be available to the project participants;

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

[13] In accordance with paragraph 9(a) "Guidance on criteria for baseline setting and monitoring", (Version 02). The approved CDM methodologies are not used for choice, justification and setting of the baseline.

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

- all future scenarios shall be provide outputs in comparable quantities and with comparable quality and properties.

The list of future scenarios:

Future scenario 1. Construction of a continuous-casting machine (CCM) and an electric arc furnace (EAF) with loading conveyor CONSTEEL with each commissioning in two stages: first CCM in 2007, second EAF in 2010. Production of steel in the open-hearth furnaces, processing of steel in the ladle furnace, casting of steel into slabs in CCM and into moulds, rolling of steel billets at the rolling plant #1 since 2008 till middle 2010. Production of steel in EAF, processing of steel in the ladle furnace, casting of steel into slabs in CCM, rolling of steel slabs at the rolling plant #1 since middle 2010. The steel slabs produced in the CCM and not rolled in the rolling plant #1 will be sold as finished product.[15]

Future scenario 2. The continuation of the current situation. The production of steel in the open-hearth furnaces, processing of steel in the ladle furnace, casting of steel into moulds, rolling of steel billets at the rolling plant #1.[16]

Future scenario 3. Reconstruction of the open-hearth plant with steel production increase. The production of steel in the open-hearth furnaces, processing of steel in the ladle furnace, casting of steel into moulds, rolling of steel billets at the rolling plant #1.

Future scenario 4. Reconstruction of the open-hearth plant with steel production increase and construction of CCM. The production of steel in the open-hearth furnaces, processing of steel in the ladle furnace, casting of steel into slabs in CCM, rolling of steel slabs at the rolling plant #1.

Future scenario 5. Construction of oxygen blown converters (and CCM). The production of steel in oxygen blown converters, processing of steel in the ladle furnace, casting of steel into moulds (or into slabs in CCM), rolling of steel billets at the rolling plant #1.

Future scenario 6. Construction of a continuous-casting machine (CCM) and an electric arc furnace (EAF) with vertical bath with each commissioning in two stages: first CCM in 2007, second EAF in 2010.

Description of future scenarios:

Future scenario 1

Future scenario 1 is included the following activities: construction of the EAF with loading conveyor CONSTEEL and CCM. As a result of the implementation of the specified activities, steel and rolled products will be produced according to the following scheme: begin 2008 – middle 2010 (after CCM commissioning – till EAF commissioning) melting of steel in the open-hearth furnaces, processing of steel in the ladle furnace, steel casting in the CCM and into the moulds, rolling of steel billets in the rolling plant #1; since 2010 (after EAF commissioning) melting of steel in the EAF, processing of steel in the ladle furnace, steel casting in the CCM, rolling of steel slabs in the rolling plant #1. The production of steel in the EAF shall amount to 1,000,000 tonnes per year. The output of rolled metal shall amount to 595,000 tonnes per year. The output of steel slabs as finished product for sale shall amount to 310,000 tonnes per year.

The construction of CCM and EAF could not be provided at JSC "AMW" in the same time because of lack of investment (investment barrier). The analysis of investment barrier is provided below.

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[15] Implementation of the project without it being registered as a JI project.

[16] Later will be showed that this future scenario is the baseline.

Future scenario 2

The continuation of the current situation allows for the production of steel in the open-hearth furnaces, processing of steel in the ladle furnace, casting of steel into moulds, rolling of steel billets at the rolling plant #1 without implementing any significant changes in the technological process. According to this scenario, the production of steel at the open-hearth plant will be more than 650,000 tonnes per year and the output of rolled metal up to 500,000 tonnes per year. As the implementation of the future scenario 1 allows for an increase in steel and rolled metal production, it is assumed that the added steel output would be produced by the future scenario 2 at other iron-and-steel works in Russia (about 420,000 t steel per year after EAF commissioning).

Future scenario 3

The implementation of the future scenario 3 allows to steel production increase in the open-hearth furnaces. The technological scheme is the same as in the future scenario 2.

The future scenario 3 is not available for project participant as the increase of steel billets (steel casted into the moulds) does not allow to roll all steel billets in the rolling plant #1[17] and steel billets can not be saled because of lack of demand on steel billets (ingots casted into the moulds).

Future scenario 4

The implementation of the future scenario 4 allows to steel production increase in the open-hearth furnaces and steel casting in CCM. The technology scheme includes the following stage: melting of steel in the open-hearth furnaces, processing of steel in the ladle furnace, steel casting in the CCM, rolling of steel billets in the rolling plant #1.

Future scenario 5

Construction of oxygen blown converters (and CCM) allows to production of steel in oxygen blown converters, processing of steel in the ladle furnace, casting of steel into moulds (or into slabs in CCM), rolling of steel billets at the rolling plant #1.

The future scenario 5 is not available for project participant. The steel can be produced in the oxygen blown converters only by using the liquid pig iron[18] as there is not a blast-furnace plant at the JSC "AMW" where the liquid pig iron can be produced the future scenario 5 is not available for project participants.

Future scenario 6

The future scenario 6 includes the following activities: construction of the EAF with vertical bath and CCM.[19] The technology scheme, quality and quantity outputs by the future scenario 6 is the same as in the future scenario 1.

The implementation of all future scenarios will allow producing steel of comparable qualities because all future scenarios allow for the out-of-furnace steel processing in the ladle furnace. The all future

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[17] The maximal production of rolled metal from steel billets in the rolling plant #1 at the JSC "AMW" is 500 000 t/year. See description of parameneters used to establish the baseline (below in the section B.1.)

[18] V. Kudrin. Theory and technology of steel production: manual for the higher educational institutions. – Moscow: Mir, 2003 - p. 170-227

[19] This scenario was considered at the investment stage of the project. The comparative information of EAF with CONSTEEL System and with top charge is attached.

scenarios will be provide steel outputs in comparable quantities produced at the JSC “AMW” or integrally at the JSC “AMW” and at the other iron-and-steel works.

Therefore the future scenarios #1, #2, #4 and #6 are available for project participants and provide outputs in comparable quantities and with comparable quality and properties.

Compliance of the chosen scenarios with the current legislation and regulations

The main current document that regulates the development of the Russian metallurgical works is Strategy of the development of metallurgy in the Russian Federation up to 2020. The Strategy determines the goal and tasks of Russian mettalurgy development. There are a task of increase of steel production in EAF and casting of steel in CCM.[20] Therefore the future scenarios 1 and 6 are fully in compliance with the state Strategy. It is stated in the Strategy that the steel production in the open-hearth furnaces will be reduced till 2020. But this is not an obligatory requerment for mettalurgical works. In accordance with the Strategy the replacement of open-hearth furnaces is provided by owner without state assistance, the exact time of open-hearth furnaces operation is not determined, the plan of reconstruction can be prolonged.[21] Therefore the continuation of the steel production in the open-hearth furnaces not contradict the state Strategy. The future scenario 2 and 4 are in compliance with current legislation. Futhemore the steel production in the future scenarios 2 and 4 includes the steel processing in the ladle-furnace that provids to high quality steel and rolled metal production that is in accordance with basic expected result of state Strategy implementation[22]. There are not regulations in Russia that regulate the GHG emissions by sources. So the future scenarios are in compliance with state regulations in area of environmental protection.

The list of the future scenarios corresponding to the current legislation and available to the project participants:

<u>Future scenario 1.</u> Construction of a continuous-casting machine (CCM) and an electric arc furnace (EAF) with loading conveyor CONSTEEL with each commissioning in two stages: first CCM in 2007, second EAF in 2010. Production of steel in the open-hearth furnaces, processing of steel in the ladle furnace, casting of steel into slabs in CCM and into moulds, rolling of steel billets at the rolling plant #1 since 2008 till middle 2010. Production of steel in EAF, processing of steel in the ladle furnace, casting of steel into slabs in CCM, rolling of steel slabs at the rolling plant #1 since middle 2010. The steel slabs produced in the CCM and not rolled in the rolling plant #1 will be sold as finished product.

<u>Future scenario 2.</u> The continuation of the current situation. The production of steel in the open-hearth furnaces, processing of steel in the ladle furnace, casting of steel into moulds, rolling of steel billets at the rolling plant #1.

<u>Future scenario 4.</u> Reconstruction of the open-hearth plant with steel production increase and construction of CCM. The production of steel in the open-hearth furnaces, processing of steel in the ladle furnace, casting of steel into slabs in CCM, rolling of steel slabs at the rolling plant #1.

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[20] Strategy of the development of metallurgy in the Russian Federation up to 2020, approved by Order of Minpromtorg # 150 dated on 18.03.2009, p. 28-29, 47, 94. Source: http://www.minprom.gov.ru/activity/metal/strateg/2

[21] Strategy of the development of metallurgy in the Russian Federation up to 2020, approved by Order of Minpromtorg # 150 dated on 18.03.2009, p. 36, 42-43

[22] Strategy of the development of metallurgy in the Russian Federation up to 2020, approved by Order of Minpromtorg # 150 dated on 18.03.2009, p. 27

Future scenario 6. Construction of a continuous-casting machine (CCM) and an electric arc furnace (EAF) with vertical bath with each commissioning in two stages: first CCM in 2007, second EAF in 2010.

2. Analysis of the key factors that affect the implementation of the future scenarios

The key factors are directly or indirectly factors to the future scenarios that affect their implementation.

The list of the key factors that affect the implementation of the future scenarios[23]:

1) Investment barrier.
2) Technological barriers:
   2.1) Lack of infrastructure for implementation of the altenative scenarios;
   2.2) Absence of prevailing practice («first of its kind»);
   2.3) Absence of skilled and/or properly trained labour.
3) Financial barrier (cost efficiency).

Definition of key factors

Investment barrier

Investment barrier represents the availability of own or dept capital for financing the project.

Lack of infrastructure for implementation of the altenative scenarios

This barrier represents the absence of an infrastructure (pipelines, transmission lines, etc.) allowing the supply of raw materials, fuel, power, etc. for production according to the project and within appropriate amounts and quality.

Absence of prevailing practice («first of its kind»)

The use of equipment, technologies or production methods that are not a prevailing practice in the relevant geographical area represents a high technological risk. The new equipment, technology or production methods are defined in this case as “first of its kind”.

Absence of skilled and/or properly trained labour

Absence of skilled and/or properly trained labour to control and maintain the process (equipment) represents a high risk of equipment malfunction and outage due to human error.

Financial Barrier (cost efficiency)

The presence of a financial barrier for a specific scenario means that economic parameters of the scenario are not acceptable for the project participants.

The presence of the above barriers for implementation of future scenarios means that they may not be implemented if there is a more profitable scenario or there is no possibility of overcoming them.

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[23] The factors that are not provided in the list of the key factors (including factors provided in the paragraph 25 of Guidance on criteria for baseline setting and monitoring (Version 02)) have not an influence on future scenarios implementation.

Analysis of the key factors that affect the implementation of the future scenarios

Investment Barrier

The future scenarios (## 1, 4, 6) that include the reconstruction of steelmaking plant, construction of new facilities (steel making furnaces, CCM) require the significant investment (the future scenario 1 requires investments in an amount of 8.7 billion rubles). The following reasons make it difficult for JSC "Ashinskiy Metallurgical Works" to raise a considerable investment:

1. JSC "Ashinskiy Metallurgical Works" is considered as a small company in the industry with regard to its production output, assets and working capital[24];
2. JSC "Ashinskiy Metallurgical Works" does not belong to a large holding company[24];
3. Limited access to debt financing[25];
4. Absence of governmental investments into development of metallurgical plants[25].

Important influence of the implementation of the project in metallurgical works has a world financial and economy crisis – many of investment project in Russian metallurgical works were stopped becase of investment barriers[26]. At the moment of financial crisis beginning the project of the JSC "AMW" was underway as the financing of the project is provided in step-wise approach: to complete the reconstruction JSC "AMW" requires the additional 35% of the funds.

For support the investment projects in Russian metallurgical works is provided the state policy included the following actions: state support of system-making enterprises and state guarantee for crediting of investment projects in metallurgy[27]. However the JSC "AMW" references for Russian government concerning state assistance for project implementation (in accordance with any the above mentioned supporting mechanism) were rejected.

Therefore the investment barrier exists for the furure scenarios ## 1, 4 and 6. The investment barrier does not influence the implementation of the future scenario 2 because it does not require any additional investments.

Consequently there are serious obstacles for raising the required funds and for completing the implementation of the project. According to the Strategy of the development of metallurgy in the Russian Federation up to 2020, projects for the reconstruction of metallurgical works, and the construction of new facilities, are basically financed from company funds, but an additional source is the possibility of implementing projects under the joint implementation of the Kyoto Protocol.[28] The explanation of how registration of the project as a JI project will reduce the effect of the investment barrier is provided in the section B.2.

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[24] Assessment of Russian ferrous industry development in 1990-2005 years. FGUP "Central Research Institute "Ferrous industry" n.a. I.P.Bardina", 2006, p. 42.

[25] Strategy of the development of metallurgy in the Russian Federation up to 2020, approved by Order of Minpromtorg # 150 dated on 18.03.2009, p.42-44. Source: http://www.minprom.gov.ru/activity/metal/strateg/2

[26] Strategy of the development of metallurgy in the Russian Federation up to 2020, approved by Order of Minpromtorg # 150 dated on 18.03.2009, p.42.

[27] Source: http://www.minprom.gov.ru/activity/metal/news/87

[28] Strategy of the development of metallurgy in the Russian Federation up to 2020, approved by Order of Minpromtorg # 150 dated on 18.03.2009, p.42-45.

Technological barriers:

Lack of infrastructure for implementation of the altenative scenarios

The future scenarios 1 and 6 foresee the construction of an EAF with the output of up to 1,000,000 tonnes of steel per year. Operating this EAF to its full capacity requires some 375,000 MWh per year. JSC "Ashinskiy Metallurgical Works" does not have the capacity for production of the required electricity and has to cover its power needs from the grid. Power supply requires the construction of transmission lines (35 kV) over a distance of 70 km and of a step-down substation.

The required infrastructure to implement future scenarios 2 and 4 including raw materials and fuel supply is available since it does not foresee any changes in the raw materials and fuel consumption.

Absence of prevailing practice («first of its kind»)

The future scenarios 1, 4 and 6 forsee the operation of open-hearth furnaces with CCM.[29] This practice was introduced for the first time by JSC "Ashinskiy Metallurgical Works" and did not exist in any iron-and-steel works in Russia[30], due to difficulties in combining steel melting in open-hearth furnaces with continuous casting[31]. When replacing open-hearth furnaces, it is a prevailing practice to launch a CCM together with an EAF (or after launching an EAF). Therefore, the construction of a CCM at JSC "Ashinskiy Metallurgical Works" and its operation together with open-hearth furnaces can be defined as "first of its kind".

The facility foreseen for the EAF at JSC "Ashinskiy Metallurgical Works" (future scenario 1) will have a capacity of 120 tonnes with a CONSTEEL conveyor (the furnace charge loaded by conveyor). This EAF will be the first of its kind in Russia and can be considered as "first of its kind".[32]

Future scenario 2 can be considered as common practice with regard to equipment and technology process.

Absence of skilled and/or properly trained labour

The construction of the CCM and EAF in accordance with the future scenarios 1, 4 and 6 requires skilled and properly trained labour for equipment operating and performing maintenance, as the equipment and technologies are unfamiliar to the plant's engineers. These future scenarios foresee such technologies (production of steel in open-hearth furnaces with casting in the CCM) and equipment (EAF with conveyor furnace charge loading) that are not prevailing practice in the relevant geographical area (iron-and-steel works in Russia). Thereby, should technical failures arise during operation of the equipment (due to low qualification and lack of experience of the personnel) that can not be quickly repaired, no third party specialists or equipment vendors can be promptly made available.

The training of the labor requires a significant financing as the project foresees a new for the JSC "AMW" equipment and technology. The training should be provided at Russian and foreign companies. The cost of training and take the project's equipment into operation is more than 680 th. Euro.

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[29] Future scenarios 1 and 6 foresee the construction of a CCM before building the EAF. Thereby, before launching the operation of the EAF, the steel will be produced in open-hearth furnaces and casted on the CCM.

[30] Strategy of the development of metallurgy in the Russian Federation up to 2020, approved by Order of Minpromtorg # 150 dated on 18.03.2009, p.94.

[31] Smirnov A.N., Safonov V.M. Role of open-hearth furnace in the history. Source: http://uas.ukrsteel.org/node/138

[32] Source: http://www.metalinfo.ru/ru/news/40771

If the project develops according to future scenario 2, then there is no requirement for additional personnel retraining and training since the implementation of this scenario does not affect the operating processes. The plant's engineers have a long positive experience of working with the existing equipment.

Financial Barrier (cost efficiency)

In order to assess the impact of the financial barrier it is necessary to review the economical efficiency of the investment budget of the presented future scenarios. In our case, the review of the economical efficiency of the investment budget is performed only for future scenario 1 (project scenario).

Additional economical effects from implementation of the project were defined in order to assess the economical efficiency of the project. Spreadsheet with calculation of economical efficiency indicators is presented in Excel file. Microsoft Office Excel 97-2003 Worksl

Results from the performed review of the economical efficiency for future scenario 1 are listed in Table B.2-1.

Table B.2-1. Results of the review of the economical efficiency of the future scenario 1

Indicator	Value
Investments, thousands rubles	8,717,018
Additional return, thousands rubles per year	3 714,542
Additional operating costs, thousands rubles per year	3,685,982
Depreciation, thousands rubles per year	726,418
Discount rate, %	1.27%
Net discount income, thousands rubles	- 245,851

It is clear from Table B.2-1 that future scenario 1 does not represent a commercially viable scenario, which is represented by the presence of a significant financial barrier.

Table B.2-2. Result of the sensetivity analysis of the future scenario 1

Indicator/ Changing	+10 %	-10 %
Influence of investment changing		
Net discount income, thousands rubles	- 199,989	- 291,713
Influence of operational cost changing		
Net discount income, thousands rubles	- 3,038,735	2,547,033

The project is considered steady if at all scenarios it is effective and financially realized.[33] It is clear from table B.2-2 that in the future scenario 1 indicators of the project economic efficiency are not acceptable at change of key parameters.

The future scenario 2 is a continuation of the current situation, and does not require any additional investments and therefore is not affected by the financial barrier.

3. Choice of the most plausible scenario – baseline

The results from the review of the key factors affected the implementation of the future scenarios allow drawing a conclusion that the most plausible scenario is the future scenario 2: The continuation of the current situation. The production of steel in the open-hearth furnaces, processing of steel in the ladle furnace, casting of steel into moulds, rolling of steel billets at the rolling plant #1.

Future scenario 2 is the baseline scenario.

The following parameters are used **to establish the baseline** (estimation of greenhouse gas emissions according to the baseline).

Data / parameter	$P_{STEEL,RP,BL,y}$
Data unit	t
Description	rolled metal production in rolling plant under Baseline
Time of determination/monitoring	Monthly according to the monitoring plan
Source of data (to be) used	Calculated parameter
Value of data (for ex ante calculations/determinations)	2008: 481 050; 2009: 500 000; 2010: 500 000; 2011: 500 000; 2012: 500 000
Justification of the choice of data or description of measurement methods and procedures (to be) applied	For year 2008 - calculated by the formula (1.9.1.1) of the section D.1.1.4. based on average historical data for the period 2006-2007. For years 2009-2012 - calculated by the formula (1.9.1.2) of the section D.1.1.4. based on and forecast of rolled metal production in 2009-2012
QA/QC procedures (to be) applied	Measuring instruments are calibrated in compliance with state regulations, internal standards of AMW and approved methodologies. The forecast of rolled metal production is made by Planning and Economic Department of the JCS AMW
Any comment	-

[33] Methodological guidelines for assessement of investement projects, approved by Order № ВК 477 on 21.06.1999, p. 75.

Data / parameter	**$P_{STEEL,SP,BL,y}$**
Data unit	T
Description	steel production in steelmaking furnaces under Baseline
Time of determination/monitoring	Monthly according to the monitoring plan
Source of data (to be) used	Calculated parameter
Value of data (for ex ante calculations/determinations)	2008: 652 037; 2009: 677 723; 2010: 677 723; 2011: 677 723; 2012: 677 723
Justification of the choice of data or description of measurement methods and procedures (to be) applied	Calculated by the formula (1.9.3.1) of the section D.1.1.4. based on data of rolled metal production ($P_{STEEL,RP,BL,y}$) in 2008-2012 (the information about rolled metal production in 2008-2012 and they justification is provided above).
QA/QC procedures (to be) applied	Measuring instruments are calibrated in compliance with state regulations, internal standards of AMW and approved methodologies. The forecast of rolled metal production is made by Planning and Economic Department of the JCS AMW.
Any comment	-

Data / parameter	**$SMC_{SP,BL,y}$**
Data unit	t/t (steel)
Description	Specific molds consumption for steel production according to the baseline
Time of determination/monitoring	Fixed parameter
Source of data (to be) used	Calculated
Value of data (for ex ante calculations/determinations)	0.024
Justification of the choice of data or description of measurement methods and procedures (to be) applied	Specific molds consumption for steel production according to the baseline ($SMC_{SP,BL,y}$) is calculated by the formula (1.5.1.1 of section D1.1.4 PDD) based on actual data for the period 2006-2007
QA/QC procedures (to be) applied	Measuring instruments are calibrated in compliance with state regulations, internal standards of AMW and approved methodologies
Any comment	-

Data / parameter	**$SEC_{MP,BL,y}$**
Data unit	MWh/t
Description	Specific electric power consumption for the production process in the foundry plant according to the baseline
Time of determination/monitoring	Fixed parameter
Source of data (to be) used	Calculated
Value of data (for ex ante calculations/determinations)	0.060
Justification of the choice of data or description of measurement methods and procedures (to be) applied	Specific electric power consumption for the production process in the foundry shop according to the baseline ($SEC_{MP,BL,y}$) is calculated by the formula (1.5.2.2 of section D1.1.4 PDD) based on actual data for the period 2006-2007
QA/QC procedures (to be) applied	Measuring instruments are calibrated in compliance with state regulations, internal standards of AMW and approved methodologies
Any comment	**-**

Data / parameter	**$SCAC_{MP,BL,y}$**
Data unit	thous.m^3/t
Description	Specific compressed air consumption for the production process in the foundry plant according to the baseline
Time of determination/monitoring	Fixed parameter
Source of data (to be) used	Calculated
Value of data (for ex ante calculations/determinations)	0.147
Justification of the choice of data or description of measurement methods and procedures (to be) applied	Specific compressed air consumption for the production process in the foundry shop according to the baseline ($SCAC_{MP,BL,y}$) is calculated by the formula (1.5.2.4 of section D1.1.4 PDD) based on actual data for the period 2006-2007.
QA/QC procedures (to be) applied	Measuring instruments are calibrated in compliance with state regulations, internal standards of AMW and approved methodologies
Any comment	**-**

Data / parameter	$EF_{CO2,MP,TECH,BL,y}$
Data unit	tCO_2 /t
Description	Process emission factor for molds production according to the baseline
Time of determination/monitoring	Fixed parameter
Source of data (to be) used	Calculated
Value of data (for ex ante calculations/determinations)	0.511
Justification of the choice of data or description of measurement methods and procedures (to be) applied	Process emission factor for ingot molds production according to the baseline ($EF_{CO2,MP,TECH,BL,y}$) is calculated by the formula (1.8.5) based on actual data for the period 2006-2007.
QA/QC procedures (to be) applied	Measuring instruments are calibrated in compliance with state regulations, internal standards of AMW and approved methodologies
Any comment	-

Data / parameter	$P_{STEEL,RP,BL,max,y}$
Data unit	t/year
Description	Maximum rolled products manufacture in the rolling plant according to the baseline
Time of determination/monitoring	Fixed parameter
Source of data (to be) used	Estimated
Value of data (for ex ante calculations/determinations)	500,000
Justification of the choice of data or description of measurement methods and procedures (to be) applied	Assessment is made on the basis of technical specifications of the equipment provided by specialists from AMW
QA/QC procedures (to be) applied	-
Any comment	-

Data / parameter	**$SSC_{RP,BL}$**
Data unit	t(steel) / t(rolled products)
Description	Specific steel consumption for rolled metal production according to the baseline
Time of determination/monitoring	Fixed parameter
Source of data (to be) used	Calculated
Value of data (for ex ante calculations/determinations)	1.355
Justification of the choice of data or description of measurement methods and procedures (to be) applied	Specific steel consumption for rolled products manufacture according to the baseline ($SSC_{RP,BL,y}$) is calculated by the formula (1.9.2.2) based on actual data for the period 2006-2007.
QA/QC procedures (to be) applied	Measuring instruments are calibrated in compliance with state regulations, internal standards of AMW and approved methodologies
Any comment	-

Data / parameter	**$SRMC_{i,SP,BL,y}$**
Data unit	t/t
Description	specific carbonaceous raw material (i) consumption in steelmaking furnaces under Baseline
Time of determination/monitoring	Monthly according to the monitoring plan till EAF commissioning. Further will be fixed (see table D.1-2.).
Source of data (to be) used	Calculated
Value of data (for ex ante calculations/determinations)	$SRMC_{iron,SP,BL,y}$ = 0.038 $SRMC_{scrapiron,SP,BL,y}$ = 0.078 $SRMC_{scrap,SP,BL,y}$ = 1.064 $SRMC_{limestone,SP,BL,y}$ = 0.006 $SRMC_{dolomite,SP,BL,y}$ = 0.038 $SRMC_{carb.mater,SP,BL,y}$ = 0.001 $SRMC_{lime,SP,BL,y}$ = 0.045
Justification of the choice of data or description of measurement methods and procedures (to be) applied	Calculated by the formula (1.1.1.2) of the section D.1.1.4. based on actual data for the period 11/2007 – 12/2008.
QA/QC procedures (to be) applied	Measuring instruments are calibrated in compliance with state regulations, internal standards of AMW and approved methodologies
Any comment	-

Data / parameter	$SFC_{i,SP,BL,y}$
Data unit	t/t *or* thous.m^3/t
Description	specific fuel (j) consumption in steelmaking furnaces under Baseline
Time of determination/monitoring	Monthly according to the monitoring plan till EAF commissioning. Further will be fixed (see table D.1-2.).
Source of data (to be) used	Calculated parameter
Value of data (for ex ante calculations/determinations)	$SFC_{naturalgas,SP,BL,y}$ = 0.114 $SFC_{fueloil,SP,BL,y}$ = 0.051
Justification of the choice of data or description of measurement methods and procedures (to be) applied	Calculated by the formula (1.1.1.4) of the section D.1.1.4. based on actual data for the period 11/2007 – 12/2008.
QA/QC procedures (to be) applied	Measuring instruments are calibrated in compliance with state regulations, internal standards of AMW and approved methodologies
Any comment	-

Data / parameter	$SEC_{SP,BL,y}$
Data unit	MWh/t
Description	specific electric power consumption in steelmaking furnaces under Baseline
Time of determination/monitoring	Monthly according to the monitoring plan till EAF commissioning. Further will be fixed (see table D.1-2.).
Source of data (to be) used	Calculated
Value of data (for ex ante calculations/determinations)	0.007
Justification of the choice of data or description of measurement methods and procedures (to be) applied	Calculated by the formula (1.1.2.2) of the section D.1.1.4. based on actual data for the period 11/2007 – 12/2008.
QA/QC procedures (to be) applied	Measuring instruments are calibrated in compliance with state regulations, internal standards of AMW and approved methodologies
Any comment	-

Data / parameter	**$SCAC_{SP,BL,y}$**
Data unit	thous.m^3/t
Description	specific compressed air consumption in steelmaking furnaces under Baseline
Time of determination/monitoring	Monthly according to the monitoring plan till EAF commissioning. Further will be fixed (see table D.1-2.).
Source of data (to be) used	Calculated
Value of data (for ex ante calculations/determinations)	0.220
Justification of the choice of data or description of measurement methods and procedures (to be) applied	Calculated by the formula (1.1.2.4) of the section D.1.1.4. based on actual data for the period 11/2007 – 12/2008.
QA/QC procedures (to be) applied	Measuring instruments are calibrated in compliance with state regulations, internal standards of AMW and approved methodologies
Any comment	-

Data / parameter	**$SOC_{SP,BL,y}$**
Data unit	thous.m^3/ t
Description	specific oxygen consumption in steelmaking furnaces under Baseline
Time of determination/monitoring	Monthly according to the monitoring plan till EAF commissioning. Further will be fixed (see table D.1-2.).
Source of data (to be) used	Calculated
Value of data (for ex ante calculations/determinations)	0.022
Justification of the choice of data or description of measurement methods and procedures (to be) applied	Calculated by the formula (1.1.2.6) of the section D.1.1.4. based on actual data for the period 01/2008 – 12/2008.
QA/QC procedures (to be) applied	Measuring instruments are calibrated in compliance with state regulations, internal standards of AMW and approved methodologies
Any comment	-

Data / parameter	$SSC_{LF,BL,y}$
Data unit	t/t
Description	proportion of steel processed in ladle furnace
Time of determination/monitoring	Monthly according to the monitoring plan.
Source of data (to be) used	Calculated
Value of data (for ex ante calculations/determinations)	0.979
Justification of the choice of data or description of measurement methods and procedures (to be) applied	Calculated by the formula (1.9.4.2) of the section D.1.1.4. based on actual data for the period 05/2008 – 12/2008.
QA/QC procedures (to be) applied	Measuring instruments are calibrated in compliance with state regulations, internal standards of AMW and approved methodologies
Any comment	-

Data / parameter	$SRMC_{i,LF,BL,y}$
Data unit	t/t
Description	specific carbonaceous raw material (i) consumption in ladle furnace under Baseline
Time of determination/monitoring	Monthly according to the monitoring plan.
Source of data (to be) used	Calculated
Value of data (for ex ante calculations/determinations)	$SRMC_{carb.mater,LF,BL,y} = 0.001$ $SRMC_{lime,LF,BL,y} = 0.013$
Justification of the choice of data or description of measurement methods and procedures (to be) applied	Calculated by the formula (1.2.1.2) of the section D.1.1.4. based on actual data for the period 05/2008 – 12/2008.
QA/QC procedures (to be) applied	Measuring instruments are calibrated in compliance with state regulations, internal standards of AMW and approved methodologies
Any comment	-

Data / parameter	$SFC_{i,LF,BL,y}$
Data unit	t/t

Description	specific fuel (j) consumption in ladle furnace under Baseline
Time of determination/monitoring	Monthly according to the monitoring plan.
Source of data (to be) used	Calculated
Value of data (for ex ante calculations/determinations)	$SFC_{graph.elec.,LF,BL,y}$ = 0.001
Justification of the choice of data or description of measurement methods and procedures (to be) applied	Calculated by the formula (1.2.1.4) of the section D.1.1.4. based on actual data for the period 05/2008 – 12/2008.
QA/QC procedures (to be) applied	Measuring instruments are calibrated in compliance with state regulations, internal standards of AMW and approved methodologies
Any comment	-

Data / parameter	$\mathbf{SEC_{LF,BL,y}}$
Data unit	MWh/t
Description	specific electric power consumption in ladle furnace under Baseline
Time of determination/monitoring	Monthly according to the monitoring plan.
Source of data (to be) used	Calculated
Value of data (for ex ante calculations/determinations)	0.065
Justification of the choice of data or description of measurement methods and procedures (to be) applied	Calculated by the formula (1.2.2.2) of the section D.1.1.4. based on actual data for the period 11/2007 – 12/2008.
QA/QC procedures (to be) applied	Measuring instruments are calibrated in compliance with state regulations, internal standards of AMW and approved methodologies
Any comment	-

Data / parameter	$\mathbf{SCAC_{LF,BL,y}}$
Data unit	thous.m^3/t
Description	specific compressed air consumption in ladle furnace under Baseline

Time of determination/monitoring	Monthly according to the monitoring plan.
Source of data (to be) used	Calculated
Value of data (for ex ante calculations/determinations)	0.020
Justification of the choice of data or description of measurement methods and procedures (to be) applied	Calculated by the formula (1.2.2.4) of the section D.1.1.4. based on actual data for the period 11/2007 – 12/2008.
QA/QC procedures (to be) applied	Measuring instruments are calibrated in compliance with state regulations, internal standards of AMW and approved methodologies
Any comment	-

Data / parameter	**$SFC_{i,RP,y}$**
Data unit	thous.m^3/t
Description	specific fuel (j) consumption in rolling plant
Time of determination/monitoring	Monthly according to the monitoring plan
Source of data (to be) used	Calculated
Value of data (for ex ante calculations/determinations)	0.083
Justification of the choice of data or description of measurement methods and procedures (to be) applied	Calculated by the formula (1.3.1.2) of the section D.1.1.4. based on actual data for the period 11/2007 – 08/2008.
QA/QC procedures (to be) applied	Measuring instruments are calibrated in compliance with state regulations, internal standards of AMW and approved methodologies
Any comment	-

Data / parameter	**$SEC_{RP,y}$**
Data unit	MWh/t
Description	specific electric power consumption in rolling plant
Time of determination/monitoring	Monthly according to the monitoring plan
Source of data (to be) used	Calculated

Value of data (for ex ante calculations/determinations)	0.034
Justification of the choice of data or description of measurement methods and procedures (to be) applied	Calculated by the formula (1.3.2.2) of the section D.1.1.4. based on actual data for the period 11/2007 – 08/2008.
QA/QC procedures (to be) applied	Measuring instruments are calibrated in compliance with state regulations, internal standards of AMW and approved methodologies
Any comment	-

Data / parameter	**$SCAC_{RP,y}$**
Data unit	thous.m^3/t
Description	specific compressed air consumption in rolling plant
Time of determination/monitoring	Monthly according to the monitoring plan
Source of data (to be) used	Calculated
Value of data (for ex ante calculations/determinations)	0.046
Justification of the choice of data or description of measurement methods and procedures (to be) applied	Calculated by the formula (1.3.2.4) of the section D.1.1.4. based on actual data for the period 11/2007 – 08/2008.
QA/QC procedures (to be) applied	Measuring instruments are calibrated in compliance with state regulations, internal standards of AMW and approved methodologies
Any comment	-

Data / parameter	**$EF_{CO2,LP,y}$**
Data unit	tCO_2/t
Description	CO_2 emission factor for lime production
Time of determination/monitoring	Monthly according to the monitoring plan
Source of data (to be) used	Calculated
Value of data (for ex ante calculations/determinations)	0.920

Justification of the choice of data or description of measurement methods and procedures (to be) applied	Calculated by the formula (1.8.4) of the section D.1.1.4. based on actual data for the period 11/2007 – 08/2008.
QA/QC procedures (to be) applied	Measuring instruments are calibrated in compliance with state regulations, internal standards of AMW and approved methodologies
Any comment	-

Data / parameter	**$EF_{k,CO2,ELEC,y}$**
Data unit	tCO_2/MWh
Description	CO_2 emission factor for electric power production, supplied to consumers (k)
Time of determination/monitoring	Monthly according to the monitoring plan
Source of data (to be) used	Calculated
Value of data (for ex ante calculations/determinations)	0.515
Justification of the choice of data or description of measurement methods and procedures (to be) applied	Calculated by the formula (1.8.1) of the section D.1.1.4. based on actual data for the period 11/2007 – 12/2008.
QA/QC procedures (to be) applied	Measuring instruments are calibrated in compliance with state regulations, internal standards of AMW and approved methodologies
Any comment	-

Data / parameter	**$EF_{CO2,CA,y}$**
Data unit	tCO_2/thous.m^3
Description	CO_2 emission factor for compressed air production
Time of determination/monitoring	Monthly according to the monitoring plan
Source of data (to be) used	Calculated
Value of data (for ex ante calculations/determinations)	0.045
Justification of the choice of data or description of measurement methods and	Calculated by the formula (1.8.2) of the section D.1.1.4. based on actual data for the period 11/2007 – 12/2008.

procedures (to be) applied	
QA/QC procedures (to be) applied	Measuring instruments are calibrated in compliance with state regulations, internal standards of AMW and approved methodologies
Any comment	-

Data / parameter	**$EF_{CO2,OC,y}$**
Data unit	tCO_2/thous.m^3
Description	CO_2 emission factor for oxygen production
Time of determination/monitoring	Monthly according to the monitoring plan
Source of data (to be) used	Calculated
Value of data (for ex ante calculations/determinations)	0.703
Justification of the choice of data or description of measurement methods and procedures (to be) applied	Calculated by the formula (1.8.3) of the section D.1.1.4. based on actual data for the period 01/2008 – 12/2008.
QA/QC procedures (to be) applied	Measuring instruments are calibrated in compliance with state regulations, internal standards of AMW and approved methodologies
Any comment	-

Data / parameter	**$SRMC_{i,IRON,MP,BL,y}$**
Data unit	t/t
Description	specific iron (i) consumption for molds production
Time of determination/monitoring	Fixed parameter
Source of data (to be) used	Calculated
Value of data (for ex ante calculations/determinations)	0.605 for pig iron 0.295 for foundry iron
Justification of the choice of data or description of measurement methods and procedures (to be) applied	Calculated by the formula (1.7.2.1) of the section D.1.1.4. based on actual data for the period 01/2006 – 06/2007.
QA/QC procedures (to be) applied	Measuring instruments are calibrated in compliance with state regulations, internal

	standards of AMW and approved methodologies
Any comment	-

Data / parameter	$\mathbf{W_{C,RMi}}$
Data unit	t C / t
Description	Carbon content in raw material (i)
Time of determination/monitoring	Fixed parameter
Source of data (to be) used	2006 IPCC Guidelines for National Greenhouse Gas Inventories – Volume 3. Industrial Processes and Product Use, Chapter 4. Metal Industry Emissions, Table. 4.3, p. 4.27
Value of data (for ex ante calculations/determinations)	limestone 0.12 dolomite 0.13
Justification of the choice of data or description of measurement methods and procedures (to be) applied	-
QA/QC procedures (to be) applied	-
Any comment	-

Data / parameter	$\mathbf{W_{C,Fj}}$
Data unit	t C / t
Description	carbon content in fuel (j)
Time of determination/monitoring	Fixed parameter
Source of data (to be) used	2006 IPCC Guidelines for National Greenhouse Gas Inventories – Volume 3. Industrial Processes and Product Use, Chapter 4. Metal Industry Emissions, Table. 4.3, p. 4.27
Value of data (for ex ante calculations/determinations)	graphite electrodes 0.82 coke 0.83
Justification of the choice of data or description of measurement methods and procedures (to be) applied	-

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

Data / parameter	**$W_{C,STEEL}$**
Data unit	t C / t
Description	Carbon content of steel
Time of determination/monitoring	Fixed parameter
Source of data (to be) used	National Inventory Report about GHG emissions by sources and removals by sinks for the period 1990-2007, 2009, p. 110-113
Value of data (for ex ante calculations/determinations)	0.0025
Justification of the choice of data or description of measurement methods and procedures (to be) applied	By using the average actual data of steel carbon content (0.0017tC/t steel) the results of GHG emissions reductions are chageged in rage 0.02-0.01%. This is negligible.
QA/QC procedures (to be) applied	-
Any comment	-

Data / parameter	**$W_{C,RMi}$**
Data unit	t C / t
Description	Carbon content of pig iron (scrap iron)
Time of determination/monitoring	Fixed parameter
Source of data (to be) used	National Inventory Report about GHG emissions by sources and removals by sinks for the period 1990-2007, 2009, p. 110-113
Value of data (for ex ante calculations/determinations)	0.043
Justification of the choice of data or description of measurement methods and procedures (to be) applied	-
QA/QC procedures (to be) applied	-
Any comment	-

Data / parameter	**$W_{C,RMi}$**
Data unit	t C / t
Description	Carbon content of carbonaceous materials
Time of determination/monitoring	Fixed parameter
Source of data (to be) used	TU 1971-198373-846-24-2004 http://uglerod.com/prod.php
Value of data (for ex ante calculations/determinations)	0.95
Justification of the choice of data or description of measurement methods and procedures (to be) applied	-
QA/QC procedures (to be) applied	-
Any comment	-

Data / parameter	**$W_{C,Fj}$**
Data unit	t C / thous.m^3
Description	Carbon content of natural gas
Time of determination/monitoring	Fixed parameter
Source of data (to be) used	Calculated
Value of data (for ex ante calculations/determinations)	0.514
Justification of the choice of data or description of measurement methods and procedures (to be) applied	Calculations are made based on the following formula: $W_{C,Fj} = W_{C,Fj,default} * NCV_{Fj,default} * \rho_{Fj} * 10^{-3}$; $NCV_{Fj,default}$ - net calorific value of the fuel j (default value), TJ/thous.t $W_{C,Fj,default}$ - carbon content of the fuel j (default value), kg/GJ ρ_{Fj} – density of the fuel j, kg /m^3 (factual data) *For natural gas:* $W_{C,Fj,default}$ = 15.3 kgs/GJ, $NCV_{Fj,default}$ = 48.0 TJ/thous.t *Initial data source:* 2006 IPCC Guidelines for National Greenhouse Gas Inventories – Vol.2 Energy, Chapter 1. Introduction, Table. 1.2,

	p. 1.20, Table. 1.4, p.1.25 ρ_{Fj} = 0.7 kg /m^3 *Initial data source:* Certificates of natural gas
QA/QC procedures (to be) applied	-
Any comment	-

Data / parameter	$\mathbf{W_{C,Fj}}$
Data unit	t C / t
Description	Carbon content in heavy fuel oil
Time of determination/monitoring	Fixed parameter
Source of data (to be) used	Calculated
Value of data (for ex ante calculations/determinations)	0.852
Justification of the choice of data or description of measurement methods and procedures (to be) applied	Calculations are made based on the following formula: $W_{C,Fj} = W_{C,Fj,default} * NCV_{Fj,default} * 10^{-3}$; $NCV_{Fj,default}$ - net calorific value of the fuel j (default value), TJ/thous.t $W_{C,Fj,default}$- carbon content of the fuel j (default value), kg/GJ *For heavy fuel oil:* $W_{C,Fj,default}$ = 21.1 kg/GJ, $NCV_{Fj,default}$ = 40.4 TJ/thous.t *Initial data source:* 2006 IPCC Guidelines for National Greenhouse Gas Inventories – Vol.2 Energy, Chapter 1. Introduction, Table. 1.2, p. 1.20, Table. 1.4, p.1.25
QA/QC procedures (to be) applied	-
Any comment	-

Data / parameter	**44/12**
Data unit	t CO_2 / t C
Description	Ratio of CO_2 molecular weight to C molecular weight
Time of determination/monitoring	Fixed parameter
Source of data (to be) used	2006 IPCC Guidelines for National Greenhouse Gas Inventories – Volume 3.

	Industrial Processes and Product Use, Chapter 4. Metal Industry Emissions, p. 4.48
Value of data (for ex ante calculations/determinations)	3.667
Justification of the choice of data or description of measurement methods and procedures (to be) applied	-
QA/QC procedures (to be) applied	-
Any comment	-

Data / parameter	**$EF_{CO2,ELEC,grid,y}$**
Data unit	t CO_2 / MWh
Description	CO_2 emission factor for electric power produced in the electric power system and supplied to facilities consuming electric power
Time of determination/monitoring	Fixed parameter
Source of data (to be) used	Operational Guidelines for Project Design Documents of Joint Implementation Projects. Volume 1: General guidelines. Version 2.3. - Ministry of Economic Affairs of the Netherlands, 2004, p.43
Value of data (for ex ante calculations/determinations)	2008 – 0.565 2009 – 0.557 2010 – 0.550 2011 – 0.542 2012 – 0.534
Justification of the choice of data or description of measurement methods and procedures (to be) applied	-
QA/QC procedures (to be) applied	-
Any comment	-

Data / parameter	**$EF_{CO2,IP}$**
Data unit	t CO_2 / t
Description	CO_2 emission factor for pig iron production from

	Russian metallurgical plants
Time of determination/monitoring	Fixed parameter
Source of data (to be) used	Estimated
Value of data (for ex ante calculations/determinations)	1.510
Justification of the choice of data or description of measurement methods and procedures (to be) applied	The factor is calculated according to the approach set out in the Annex 4 PDD
QA/QC procedures (to be) applied	-
Any comment	-

Data / parameter	**$EF_{CO2,SP,OUT,y}$**
Data unit	t CO_2 / t
Description	CO_2 emission factor for steel production from Russian metallurgical plants
Time of determination/monitoring	Fixed parameter
Source of data (to be) used	Estimated
Value of data (for ex ante calculations/determinations)	1.766
Justification of the choice of data or description of measurement methods and procedures (to be) applied	The factor is calculated according to the approach set out in Annex 4 PDD
QA/QC procedures (to be) applied	-
Any comment	-

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

JI specific approach is used for demonstration of additionality of the project in accordance with the paragraph 2(a) of the Annex I to the “Guidance on criteria for baseline setting and monitoring”, (Version 02).[34] The approved CDM methodologies and tools are not used for demonstration of additionality.

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

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

1. Indication and description of the approach applied
2. Application of the approach chosen
3. Provision of additionality proofs

Step 1. Indication and description of the approach applied

A JI-specific approach is chosen for justification of additionality. JISC' guidance on criteria for baseline setting and monitoring prescribes in this case to provide traceable and transparent information showing that the baseline was identified on the basis of conservative assumptions, that the project scenario is not part of the identified baseline scenario and that the project will lead to reductions of anthropogenic emissions by sources.

Step 2. Application of the approach chosen

The analysis outlined in the section B.1. clearly demonstrates that the baseline scenario is: Future scenario 2. The continuation of the current situation. The production of steel in the open-hearth furnaces, processing of steel in the ladle furnace, casting of steel into moulds, rolling of steel billets at the rolling plant #1.

The project is not a part of the baseline scenario, which can be shown by analyzing the key factors that affect the implementation of the project scenarios. The results of the key factors analysis demonstrated that the project scenario is not part of the identified baseline scenario are provided in the table B.2-1.

Table B.2-1. Impact of the barriers on the implementation of future scenarios

Future scenario	Investment barrier	Technological barriers			Financial barrier
		Lack of infrastructure	Absence of prevailing practice	Absence of trained labour	
Future scenario 1 (project scenario)	+	+	+	+	+
Future scenario 2 (baseline scenario)	–	–	–	–	–

Common practice analysis

The common practice analysis completes the analysis of the key factors that affect the implementation of the future scenarios and demonstrate additionality of the project.

The similar activities to the proposed project (Construction of electric arc furnaces and continuos casting machines) that have been implemented previously or are currently underway in the relevant geographical area (metallurgical works in Russia) include the project at the following works[35]:

- OJSC “Magnitogorsk Iron and Steel Works”
- CJSC “Management company “Metalloinvest” (OJSC "Ural steel")
- CJSC “ChTPZ Group” (OJSC “Pervouralsky novotrubny works”)
- OJSC “TMK” (OJSC “Seversky Pipe Plant”)
- OJSC “TMK” (OJSC “Taganrog Metallurgical Works”)
- CJSC “Management company “ESTAR” (OJSC “Zlatoust Metallurgical Works”)

There are essential distinctions between the proposed project activity and similar activities:

- The proposed project activity is the «first of its kind» as the project’s equipment (EAF with a CONSTEEL conveyor that allows the furnace charge loading by conveyor instead of vertical bath) and technologies (the operation of open-hearth furnaces with CCM) are not defused in the relevant geographical area. That is demonstrated by the barrier analysis (Absence of prevailing practice) based on state regulations and relevant studies (section B.1.).
- The similar projects are implemented by the largest metallurgical holding companies of Russia. But JSC “Ashinskiy Metallurgical Works” does not belong to a large holding company. Therefore the similar projects have not most probably the investment barrier for them implementation in contrast to the proposed project as demonstrated by the analysis of investment barrier (section B.1.).

[35] The similar projects are determined in accordance with: “Basic investment projects in russian mettalurgical works” provided in the Strategy of the development of metallurgy in the Russian Federation up to 2020, approved by Order of Minpromtorg # 150 dated on 18.03.2009, p.100-108; PDD “Implementation of arc-furnace steelmaking at Magnitogorsk Iron and Steel Works”, source: http://ji.unfccc.int/JI_Projects/DeterAndVerif/Verification/PDD/index.html

- By analysis of common practice can be likely excluded the similar projects that are implemented in accordance with JI mechanism[36]. All the above similar projects are implemented under JI mechanism[37] (excluded the project at OJSC "Taganrog Metallurgical Works"[38]).

Therefore the projects for electric arc furnaces and continuous casting machines construction with equipment and technology proposed by JSC "AMW" implemented by small metallurgical companies and without JI mechanism are not common practice in Russia.

The analysis of the the key factors affected future scenarios implementation and analysis of the common practice shows that the project activity is not the baseline scenario. Therefore the reduction of emissions obtained in the course of project implementation is additional to the baseline scenario.

Explanation of how registration of the Project as a JI (Joint Implementation) project will reduce the effect of the barriers that prevent the Project being implemented in the absence of the use of the JI mechanism.

The analysis of the barriers showed the presence of investment, financial and thehnological barriers for the project, including those related to expenditures for their overcoming. Therefore, registering the project as a JI Project and attracting investments by selling emission reduction units (ERU) will assist in overcoming the above barriers and increase the viability of the project.

The economical efficiency analysis[39] of the project with and without the sale of ERU, showed that selling ERU would provide to increase of economical efficiency of the project.

JSC "Ashinskiy Metallurgical Works" does not have sufficient funds for completing the project. The additional income from selling of ERU allows attracting the necessary funding for completing of the project: with the carbon financing the project is more economically effective and the income from ERU sale can be guarantee timely repayment of credit and retirement of bonds.

The income from ERU sale can alleviate the financial risks because of technological barriers (lack of infrastructure for implementation of the project; absence of prevailing practice; absence of skilled and/or properly trained labour).

This shows that registering the project according to JI mechanisms will assist overcoming the above determined barriers.

Step 3. Provision of additionality proofs

The proofs to support above information are contained in the following documents:

- Protocols of decision of project implementation and other relevant documentation from project participants;

[36] Based on a provision for common practice analysis of Methodological tool "Combined tool to identify the baseline scenario and demonstrate additionality" (Version 02.2), p. 9. Source:http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-02-v2.2.pdf

[37] Source: http://ji.unfccc.int/JI_Projects/DeterAndVerif/Verification/PDD/index.html, http://www.global-carbon.com/ru/projects/ruprojects/zlatoust-metallurgical-plant.html, http://www.sbrf.ru/tula/ru/concurs/2010/index.php?from114=1&id114=11002977

[38] There are no information like about implementation stage of the project in the company internet site (http://www.tmkgroup.ru/) such as whether the project is implemented as JI project or is not. Taking into account that OJSC "TMK" are implementing a similar project at OJSC "Seversky Pipe Plant" it is possible that the project at OJSC "Taganrog Metallurgical Works" is also implemented as JI project.

[39] Economical efficiency analysis of the project is attached to PDD in excel format.

- Investment analysis of the project;
- Relevant studies;
- Lows of Russia for metallurgy development and JI projects implementation.

This documentation can be provided on request.

Explanations on how GHG emission reductions are achieved

The reduction of GHG emission will be achieved due to decrease in raw material and fuel consumption for steel and rolled metal production. The expected reduction of GHG emissions over the crediting period (2008-2012) will be about 2,000 th. tonnes of CO_2 or in average 400 th. tonnes of CO_2 per year.

The detailed description of the CO_2 emissions in the baseline and the project scenario is given in the section E of the PDD.

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

The project boundary covers **all facilities** where greenhouse gas emissions occur as a result of the project implementation:

- Facilities of Ashinskiy Metallurgical Works:
  - Steel plant:
    - Open-hearth furnaces;
    - Electric arc furnace;
    - Ladle furnace;
    - Continuous-casting machine (CCM).
  - Rolling plant #1[40]:
    - Continuous furnaces;
    - Rolling mill.
  - Combined heat and power station (CHP) and power equipment plant:
    - Steam boilers;
    - Generators;
    - Compressors;
    - Air separation unit.
  - Foundry plant
  - Lime calcining furnace
- Facilities located outside the Ashinskiy Metallurgical Works:
  - Electric power system - grid;
  - Pig iron production;
  - Steel production.

[40] The rolling plant #1 includes the rolling mill # 2850. The rolling mill #1500, mill #1400, mill #720 is excluded from the consideration as the project has not influence on they operation.

The sources of greenhouse gas emissions as well greenhouse gases themselves that are included in the assessment of emission reductions as per baseline and project scenario as shown in Table B.3-1. The project and baseline boundaries are shown on the figures in the section D.

Table B.3-1. Sources of greenhouse gas emissions included in the Project boundaries

№	Source of Emissions	Gas[41]	Included / Excluded	Description
Baseline scenario				
1	Steel furnaces	CO_2	*included*	Emissions from fossil fuel combustion and use of carbonaceous materials for steelmaking
		CH_4	*excluded*[42]	Excluded for simplification. Conservative approach.
		N_2O	*excluded*[43]	Excluded for simplification. Conservative approach.
2	Ladle furnace	CO_2	*included*	Emissions from use of carbonaceous materials during processing of steel.
		CH_4	*excluded*	Excluded for simplification. Conservative approach.
		N_2O	*excluded*	Excluded for simplification. Conservative approach.
3	Rolling plant #1	CO_2	*included*	Emissions from fossil fuel combustion for heating of steel billets.
		CH_4	*excluded*	Excluded for simplification. Conservative approach.
		N_2O	*excluded*	Excluded for simplification. Conservative approach.
4	Combined heat and power station (CHP) and power equipment plant	CO_2	*included*	Emissions from fossil fuel combustion for production of power and other energy carriers.
		CH_4	*excluded*	Excluded for simplification. Conservative approach.
		N_2O	*excluded*	Excluded for simplification. Conservative approach.
5	Foundry plant	CO_2	*included*	Emissions from fossil fuel combustion and use of carbonaceous materials for mould production.
		CH_4	*excluded*	Excluded for simplification. Conservative approach.
		N_2O	*excluded*	Excluded for simplification. Conservative approach.
6	Lime calcining furnace	CO_2	*included*	Emissions from fossil fuel combustion and use of carbonaceous materials for lime production.
		CH_4	*excluded*	Excluded for simplification. Conservative

[41] According to Guidance on criteria for baseline setting and monitoring (Version 02) the project must consider all the greenhouse gases included in Annex A of the Kyoto Protocol. However, fuel combustion and oxidation of carbonaceous materials only produces emissions of CO_2, CH_4 and N_2O and therefore emissions of SF_6, PCFs, HFCs are not considered. Source of data: 2006 IPCC Guidelines for National Greenhouse Gas Inventories – Volume 3. Industrial Processes and Product Use, Chapter 4. Metal Industry Emissions, p. 4.9

[42] See comments in Table B.3.-2

[43] See comments in Table B.3.-2

№	Source of Emissions	Gas[41]	Included / Excluded	Description
				approach.
		N_2O	*excluded*	Excluded for simplification. Conservative approach.
7	Electric power system (the grid)	CO_2	*included*	Emissions from fossil fuel combustion for production of electricity.
		CH_4	*excluded*	Excluded for simplification. Conservative approach.
		N_2O	*excluded*	Excluded for simplification. Conservative approach.
8	Pig iron production (outside Ashinskiy Metallurgical Works)	CO_2	*included*	Emissions from fossil fuel combustion and use of carbonaceous materials in melting pig iron.
		CH_4	*excluded*	Excluded for simplification. Conservative approach.
		N_2O	*excluded*	Excluded for simplification. Conservative approach.
9	Steel production (outside Ashinskiy Metallurgical Works)	CO_2	*included*	Emissions from fossil fuel combustion and use of carbonaceous materials for steelmaking.
		CH_4	*excluded*	Excluded for simplification. Conservative approach.
		N_2O	*excluded*	Excluded for simplification. Conservative approach.
Project scenario				
1	Steel furnaces	CO_2	*included*	Emissions from fossil fuel combustion and use of carbonaceous materials for steelmaking.
		CH_4	*excluded*	Excluded for simplification. Conservative approach.
		N_2O	*excluded*	Excluded for simplification. Conservative approach.
2	Ladle furnace	CO_2	*included*	Emissions from use of carbonaceous materials during steel processing.
		CH_4	*excluded*	Excluded for simplification. Conservative approach.
		N_2O	*excluded*	Excluded for simplification. Conservative approach.
3	Continuous-casting machine	CO_2	*included*	Emissions from fossil fuel combustion.
		CH_4	*excluded*	Excluded for simplification. Conservative approach.
		N_2O	*excluded*	Excluded for simplification. Conservative approach.
4	Rolling plant #1	CO_2	*included*	Emissions from fossil fuel combustion for heating of steel billets .
		CH_4	*excluded*	Excluded for simplification. Conservative approach.
		N_2O	*excluded*	Excluded for simplification. Conservative approach.
5	Combined heat and power station (CHP) and power equipment plant	CO_2	*included*	Emissions from fossil fuel combustion for production of electricity.
		CH_4	*excluded*	Excluded for simplification. Conservative approach.

№	Source of Emissions	Gas[41]	Included / Excluded	Description
		N_2O	*excluded*	Excluded for simplification. Conservative approach.
6	Foundry plant	CO_2	*included*	Emissions from fossil fuel combustion and use of carbonaceous materials for mould production.
		CH_4	*excluded*	Excluded for simplification. Conservative approach.
		N_2O	*excluded*	Excluded for simplification. Conservative approach.
7	Lime calcining furnace	CO_2	*included*	Emissions from fossil fuel combustion and use of carbonaceous materials for lime production.
		CH_4	*excluded*	Excluded for simplification. Conservative approach.
		N_2O	*excluded*	Excluded for simplification. Conservative approach.
8	Electric power system (the grid)	CO_2	*included*	Emissions from fossil fuel combustion for production of power.
		CH_4	*excluded*	Excluded for simplification. Conservative approach.
		N_2O	*excluded*	Excluded for simplification. Conservative approach.
9	Pig iron production (outside Ashinskiy Metallurgical Works)	CO_2	*included*	Emissions from fossil fuel combustion and use of carbonaceous materials in melting pig iron.
		CH_4	*excluded*	Excluded for simplification. Conservative approach.
		N_2O	*excluded*	Excluded for simplification. Conservative approach.

The specified sources of emissions are determined according to the requirements of the "Guidance on criteria for baseline setting and monitoring", (Version 02)[44] (Table B.3-2.)

The project does not provide to the leakage.

In accordance with "Guidance on criteria for baseline setting and monitoring", (Version 02) the leakage is determined as "the net change of anthropogenic emissions by sources and/or removals by sinks of GHGs which occurs outside the project boundary, and that can be measured and is directly attributable to the JI project."

The main emissions potentially giving rise to leakage in the context of the project are emissions arising from fossil fuel use (e.g. extraction, processing, transport) for electricity production in the grid and in the CHP of the JSC "AMW", for transport of row materials and for steel production and processing.

In case the potential leakage is determined the project participants must undertake an assessment of the potential leakage of the proposed JI project and explain which sources of leakage are to be calculated, and which can be neglected.[45]

The project provides to the increase of electricity consumption including supply from the grid as a result of EAF operation, therefore the potential leakage from fossil fuel use (e.g. extraction, processing,

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

[45] In accordance with the paragraph 18 of the Guidance on criteria for baseline setting and monitoring (Version 02).

transport) for electricity production in the grid and in the own CHP will be also increase. But the leakage arising from fossil fuel use (e.g. extraction, processing, transport) for electricity generation can be assessed as negligible based on analysis of methodology for electricity project[46] and provided calculation[47].

Because of the project provides to the more efficiency use of row materials and fuel by steel production and processing in comparison to the baseline scenario (table A.4.3-1.) the project implementation brings to the reduction of row materials and fuel consumption and accordingly to reduction of the leakage arising from row materials and fuel use (e.g. extraction, processing, transport). Therefore, the leakage is negligible and can be not taken into account with relation to the conservative estimation of emission reductions.

Table B.3-2. Criteria for definition of the project components

№	Criterion for definition of the project boundary	Comments
1.	*Under the control of the project participants*	The sources of emissions (open-hearth furnaces, electric arc furnace, rolling plant, combined heat and power station (CHP) and power equipment plant, foundry plant, lime calcining furnace) are under the control of Ashinskiy Metallurgical Works because they are the property of the Company and under its direct responsibility. The sources of emissions (power system (grid), pig iron production, steel production) are under the control of Ashinskiy Metallurgical Works because greenhouse gas emissions occur in these sources as a result of the activity of Ashinskiy Metallurgical Works: as a result from the use of fossil fuel and raw materials for production products that are consumed at Ashinskiy Metallurgical Works (electric power and pig iron) and for steel production that were produced at other steel plants in the absence of the project. Thereby, the implementation of the project produces changes to greenhouse gas emissions in the power system (increase of emissions), in production of iron (emission reductions), in production of steel (emission reductions).
2.	*Reasonably attributable to the project*	The sources of greenhouse gas emissions defined in Table B.3.-1 are directly related to the steel plant of Ashinskiy Metallurgical Works, therefore the reconstruction of the steel plant (construction of EAF and CCM) influences greenhouse gas emissions in these sources. Therefore, the defined sources of greenhouse gas emissions are "reasonably" attributable to the project.

[46] "The main emissions potentially giving rise to leakage in the context of electric sector projects are emissions arising due to activities such as power plant construction and upstream emissions from fossil fuel use (e.g. extraction, processing, transport). These emissions sources are neglected." Source: Approved consolidated baseline and monitoring methodology ACM0002 "Consolidated baseline methodology for grid-connected electricity generation from renewable sources" (Version 11), p. 11, http://cdm.unfccc.int/UserManagement/FileStorage/HGY3TLRFPQVM016WA4I7XCZD92KE5S

[47] The assessed value of potential leakage is less than 1% of GHG emission. The calculation is attached in excel file.

3.	*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*	Emissions from the sources under review are significant – more than 1% and exceed the level of 2,000 tonnes of CO_2 equivalent (see section E.) Emissions of CH_4 and N_2O from fuel combustion[48] and leakage are not considered within the project boundary because their average per year over the crediting period emissions are not significant (less than 1%) as per project and baseline scenarios.

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

Date of baseline setting: 05/05/2010

The baseline has been developed by:

CJSC "National Carbon Sequestration Foundation" (Moscow);

Contact person: Mr. Roman Kazakov, principal specialist;

Tel.: +7 499 788 78 35 ext. 113

Fax: +7 499 788 78 35 ext. 107

E-mail: KazakovRA@ncsf.ru

CJSC "National Carbon Sequestration Foundation" is not a project participant.

[48] The calculation of CH_4 and N_2O emmission from fuel combustion is attached to the PDD in excel file.

SECTION C. Duration of the project / crediting period

C.1. Starting date of the project:

25/01/2006

The starting data of the project is determined as the data on which the first construction work of the project is implemented.[49]

C.2. Expected operational lifetime of the project:

15 years (180 months)

The expected operational lifetime of the project is determined as lifetime of the main projects equipment (electric arc furnace and continuous casting machine) in accordance with Russian regulations.[50]

C.3. Length of the crediting period:

Length of the crediting period is 01/01/2008 – 31/12/2020 (13 years, 156 months), including:

- First commitment period: 01/01/2008 – 31/12/2012 (5 years, 60 months);
- Period after the first commitment period: 01/01/2013 – 31/12/2020 (8 years, 96 months).

[49] The starting data is determined in accordance with “Guidelines for users of the Joint implementation project design document form. Version 04”. The supporting documentation is attached (Act of construction work dated on 25/01/2006).

[50] Russian Government Decree #1 dated on 01/01/2002 About fixed assets included in depreciation groups (edit. by Decrees of Russian Government # 415 on 09.07.2003, #476 on 08.08.2003, # 697 on 18.11.2006, #676 on 12.09.2008)

SECTION D. Monitoring plan

D.1. Description of monitoring plan chosen:

The monitoring plan is elaborated using the following step-wise approach[51]:

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

Step 2. Application of the approach chosen

The description of the above approach is shown below.

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

A JI specific approach is chosen for monitoring plan setting in accordance with paragraph 9 (a) of Guidance on criteria for baseline setting and monitoring (Version 02)[52]. The approved CDM baseline and monitoring methodologies and each elements are not used for monitoring.

The chosen JI specific approach is based on paragraph 30 of Guidance on criteria for baseline setting and monitoring (Version 02). The approach chosen includes the following procedures:

- The collection and archiving of all relevant data necessary for estimating or measuring anthropogenic emissions by sources of GHGs occurring within the project boundary during the crediting period;
- The collection and archiving of all relevant data necessary for determining the baseline of anthropogenic emissions by sources of GHGs within the project boundary during the crediting period;
- The identification of all potential sources of, and the collection and archiving of data on increased anthropogenic emissions by sources of GHGs outside the project boundary that are significant and reasonably attributable to the project during the crediting period;

[51] In accordance with Guidelines for users of the joint implementation project design documentation form Version 04. Source: http://ji.unfccc.int/Ref/Documents/Guidelines.pdf

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

- The collection and archiving of information on environmental impacts, in accordance with procedures as required by the host Party;
- Quality assurance and control procedures for the monitoring process;
- Procedures for the periodic calculation of the reductions of anthropogenic emissions by sources by the proposed JI project, and for leakage effects.

The application of the above described approach is provided below and in the following section D.1.1.-D.4.

Step 2. Application of the approach chosen

Project scenario is construction of a continuous-casting machine (CCM) and an electric arc furnace (EAF) with each commissioning in two stages: first CCM in 2007, second EAF in 2010. Production of steel in the open-hearth furnaces, processing of steel in the ladle furnace, casting of steel into slabs in CCM or into moulds, rolling of steel billets at the rolling plant #1 since 2008 till middle 2010. Production of steel in EAF, processing of steel in the ladle furnace, casting of steel into slabs in CCM, rolling of steel slabs at the rolling plant #1 since middle 2010.

Baseline scenario is continuation of the current situation. The production of steel in the open-hearth furnaces, processing of steel in the ladle furnace, casting of steel into moulds, rolling of steel billets at the rolling plant #1.

The monitoring plan applies the following approaches to determining greenhouse gas emissions as per project scenario and baseline (the project and baseline boundaries are presented in the Fig. D.1-1. - Fig. D.1-3. below):

1. Calculation of CO_2 emissions made on the basis of production material balance (according to IPCC, 2006[53]). It is used for determining emissions as per project scenario and baseline for steel-melting furnaces, ladle furnace, foundry plant, lime calcining furnaces.

According to this approach, the following data are used to calculate CO_2 emissions:

- Carbonaceous raw materials and fuel consumption;
- Carbon content in carbonaceous raw materials and fuel.

2. Calculation of CO_2 emissions from fuel combustion (according to IPCC, 2006)

According to this approach, the following data are used to calculate CO_2 emissions:

[53] 2006 IPCC Guidelines for National Greenhouse Gas Inventories – Volume 3. Industrial Processes and Product Use, Chapter 4. Metal Industry Emissions, p. 4.22-4.23

- Fuel consumption;
- Carbon content in fuel.

3. Calculation of CO_2 emissions by the production of electricity supplied by the power system is made based on the following data:

- Electric power consumed from electric power system (grid);
- CO_2 emission factor for electric power produced in the electric power system and supplied to facilities consuming electric power.

4. Calculation of CO_2 emissions from pig iron and steel production at other metallurgical plants as per project activity are made on the basis of the following data:

- Pig iron and steel production at other metallurgical plants as per project activity;
- CO_2 emission factors for iron and steel production at other metallurgical plants.

5. Calculation of the specific consumption of fuel, carbonaceous raw materials, electric power, compressed air and oxygen is provided by division of the consumed fuel (etc.) into value of basic product production by sources. The specific consumption is to be calculated monthly based on actual data for continuously monitored parameters or once for constants based on historical data as described below. The following data are used for specific consumption calculation:

- Consumption of fuel, carbonaceous raw materials, electric power, compressed air, oxygen by sources;
- Production of basic product by sources.

Parameters necessary for greenhouse gas emissions calculating in accordance with the above-mentioned approaches are as follows:

1. Parameters which are continuously monitored during the crediting period:

- Consumption of fuel, carbonaceous raw materials, electric power and other energy sources as per project scenario for all emission sources is determined on the basis of actual monitoring data.

- Specific consumption of fuel, carbonaceous raw materials, electric power and other energy sources in the baseline for open-hearth furnaces, ladle furnace, lime production, rolled metal production, are calculated on the basis of actual data for fuel, raw materials, electric power and other energy sources consumption as well as product manufacturing data.

2. Parameters which are determined once and are taken as constants for the whole monitoring period:

- Specific steel consumption (steel billets) for rolled metal according to the baseline is calculated on the basis of factual data on the consumption of steel billets and rolled metal production in 2006-2007.
- Specific raw materials and fuel consumption for molds production is calculated on the basis of factual data on the consumption of fuel and raw materials in the foundry plant and molds production in 2006-2007.
- Carbon content of pig iron, steel, heavy fuel oil, natural gas, carbonaceous raw materials is defined according to reference data (IPCC, 2006; National Inventory Report, 2009).
- CO_2 emission factors from production of electric power supplied from outside, are defined according to reference data (Operational Guidelines for Project Design Documents of Joint Implementation Project. Volume 1: General guidelines, Ministry of Economic Affairs of the Netherlands, 2004).
- CO_2 emission factors from pig iron and steel production at other metallurgical plants as per project activity are calculated on the basis of data provided by the National Inventory Report, 2009.

The above parameters are available at the stage of determination and provided in the table D.1-1.

Table D.1-1. Parameters which are determined once and are taken as constants for the whole monitoring period

№	Description	Parameter	Unit	Value	Source of data
1.	Carbon content of limestone	$W_{C,RMi}$	t C / t	0.12	2006 IPCC Guidelines for National Greenhouse Gas Inventories – Volume 3. Industrial Processes and Product Use, Chapter 4. Metal Industry Emissions, Table. 4.3, p. 4.29
2.	Carbon content of dolomite	$W_{C,RMi}$	t C / t	0.13	
3.	Carbon content of graphite electrodes	$W_{C,Fj}$	t C / t	0.82	

4.	Carbon content of steel	$W_{C,STEEL}$	t C / t	0.0025	National Inventory Report, 2009 (p. 110-113)
5.	Carbon content of pig iron (scrap iron)	$W_{C,RMi}$	t C / t	0.043	
6.	Carbon content of carbonaceous materials	$W_{C,RMi}$	t C / t	0.95	TU 1971-198373-846-24-2004 http://uglerod.com/prod.php
7.	Carbon content of natural gas	$W_{C,Fj}$	t C / thous.m^3	0.514	Calculations are made based on the following formula: $W_{C,Fj} = W_{C,Fj,default} * NCV_{Fj,default} * \rho_{Fj} * 10^{-3}$; $NCV_{Fj,default}$ - net calorific value of the fuel j (default value), TJ/thous.t $W_{C,Fj,default}$ - carbon content of the fuel j (default value), kg/GJ ρ_{Fj} – density of the fuel j, kg /m^3 (factual data) *For natural gas:* $W_{C,Fj,default}$ = 15.3 kgs/GJ, $NCV_{Fj,default}$ = 48.0 TJ/thous.t *Initial data source:* 2006 IPCC Guidelines for National Greenhouse Gas Inventories – Vol.2 Energy, Chapter 1. Introduction, Table. 1.2, p. 1.20, Table. 1.4, p.1.25 ρ_{Fj} = 0.7 kg /m^3 *Initial data source:*

					Certificates of natural gas
8.	Carbon content in heavy fuel oil	$W_{C,Fj}$	t C / t	0.852	Calculations are made based on the following formula: $W_{C,Fj} = W_{C,Fj,default} * NCV_{Fj,default} * 10^{-3}$; $NCV_{Fj,default}$ - net calorific value of the fuel j (default value), TJ/thous.t $W_{C,Fj,default}$- carbon content of the fuel j (default value), kg/GJ *For heavy fuel oil:* $W_{C,Fj,default}$ = 21.1 kg/GJ, $NCV_{Fj,default}$ = 40.4 TJ/thous.t *Initial data source:* 2006 IPCC Guidelines for National Greenhouse Gas Inventories – Vol.2 Energy, Chapter 1. Introduction, Table. 1.2, p. 1.20, Table. 1.4, p.1.25
9.	Ratio of CO_2 molecular weight to C molecular weight	44/12	t CO_2 / t C	3.667	2006 IPCC Guidelines for National Greenhouse Gas Inventories – Volume 3. Industrial Processes and Product Use, Chapter 4. Metal Industry Emissions, p. 4.48
10.	CO_2 emission factor for electric power produced in	$EF_{CO2,ELEC,grid,y}$	t CO_2 / MWh	2008 – 0.565 2009 – 0.557	Operational Guidelines for Project Design Documents

	the electric power system and supplied to facilities consuming electric power			2010 – 0.550 2011 – 0.542 2012 – 0.534	of Joint Implementation Projects. Volume 1: General guidelines. Version 2.3. - Ministry of Economic Affairs of the Netherlands, 2004, p.43
11.	CO_2 emission factor for pig iron production from Russian metallurgical plants	$EF_{CO2,IP}$	t CO_2 / t	1.510	The factor is calculated according to the approach set out in Annex 4 PDD
12.	CO_2 emission factor for steel production from Russian metallurgical plants	$EF_{CO2,SP,OUT,y}$	t CO_2 / t	1.766	The factor is calculated according to the approach set out in Annex 4 PDD
13.	Specific molds consumption for steel production according to the baseline	$SMC_{SP,BL,y}$	t/t (steel)	0.026	Specific molds consumption for steel production according to the baseline ($SMC_{SP,BL,y}$) is calculated by the formula (1.5.1.1 of section D1.1.4 PDD) for the period 2006-2007.
14.	Specific electric power consumption for the production process in the foundry plant according to the baseline	$SEC_{MP,BL,y}$	MWh/t	0.060	Specific electric power consumption for the production process in the foundry shop according to the baseline ($SEC_{MP,BL,y}$) is calculated by the formula (1.5.2.2 of section D1.1.4 PDD) for the period 2006-2007.

15.	Specific compressed air consumption for the production process in the foundry plant according to the baseline	$SCAC_{MP,BL,y}$	thous.m^3/t	0.147	Specific compressed air consumption for the production process in the foundry shop according to the baseline ($SCAC_{MP,BL,y}$) is calculated by the formula (1.5.2.4 of section D1.1.4 PDD) for the period 2006-2007.
16.	Process emission factor for molds production according to the baseline	$EF_{CO2,MP,TECH,BL,y}$	tCO_2 /t	0.511	Process emission factor for ingot molds production according to the baseline ($EF_{CO2,MP,TECH,BL,y}$) is calculated by the formula (1.8.5) for the period 2006-2007.
17.	Maximum rolled products manufacture in the rolling plant according to the baseline	$P_{STEEL,RP,BL,max,y}$	t/year	500,000	Assessment is made on the basis of technical specifications of the equipment provided by specialists from AMW
18.	Specific steel consumption for rolled metal production according to the baseline	$SSC_{RP,BL}$	t(steel) / t(rolled products)	1.355	Specific steel consumption for rolled products manufacture according to the baseline ($SSC_{RP,BL,y}$) is calculated by the formula (1.9.2.2) for the period 2006-2007.

3. Parameters which are determined once and are taken as constants during monitoring but are not available at the stage of determination:

Table D.1-2. Parameters which are determined once and are taken as constants during monitoring but are not available at the stage of determination

№	Description	Parameter	Unit	Value	Source of data
1.	Specific carbonaceous raw material (i) consumption in steelmaking furnaces under Baseline	$SRMC_{i,SP,BL,y}$	t/t	Will be determined and fixed after the EAF commissioning. Till the EAF commissioning will be calculated monthly based on actual data in accordance with monitoring plan.	Specific carbonaceous raw material (limestone, dolomite, carbonaceous materials, iron, scrap iron and steel) consumption will be calculated by the formula (1.1.1.2) as an average value $SRMC_{i,SP,BL,y}$ for the operation period of the steel plant since the commissioning of the ladle furnace till the commissioning of the EAF (2010).
2.	Specific fuel (j) consumption in steelmaking furnaces under Baseline	$SFC_{i,SP,BL,y}$	t/t or thous.m3/t	Will be determined and fixed after the EAF commissioning. Till the EAF commissioning will be calculated monthly based on actual data in accordance with monitoring plan.	Specific fuel (natural gas, heavy fuel oil) consumption will be calculated by the formula (1.1.1.4) as an average value $SFC_{i,SP,BL,y}$ for the operation period of the steel plant since the commissioning of the ladle furnace till the commissioning of the EAF.

3.	Specific electric power consumption in steelmaking furnaces under Baseline	$SEC_{SP,BL,y}$	MWh/t	Will be determined and fixed after the EAF commissioning. Till the EAF commissioning will be calculated monthly based on actual data in accordance with monitoring plan.	Specific electric power consumption will be calculated by the formula (1.1.2.2) as an average value $SEC_{SP,BL,y}$ for the operation period of the steel plant since the commissioning of the ladle furnace till the commissioning of the EAF.
4.	Specific compressed air consumption in steelmaking furnaces under Baseline	$SCAC_{SP,BL,y}$	thous.m^3/t	Will be determined and fixed after the EAF commissioning. Till the EAF commissioning will be calculated monthly based on actual data in accordance with monitoring plan.	Specific compressed air consumption will be calculated by the formula (1.1.2.4) as an average value $SCAC_{SP,BL,y}$ for the operation period of the steel plant since the commissioning of the ladle furnace till the commissioning of the EAF.
5.	Specific oxygen consumption in steelmaking furnaces under Baseline	$SOC_{SP,BL,y}$	thous.m^3/ t	Will be determined and fixed after the EAF commissioning. Till the EAF commissioning will be calculated monthly based on actual data in accordance with monitoring plan.	Specific oxygen consumption will be calculated by the formula (1.1.2.6) as an average value $SOC_{SP,BL,y}$ for the operation period of the steelmaking shop since the commissioning of the ladle furnace till the commissioning of the EAF.

Fig. D.1-1. Baseline boundary

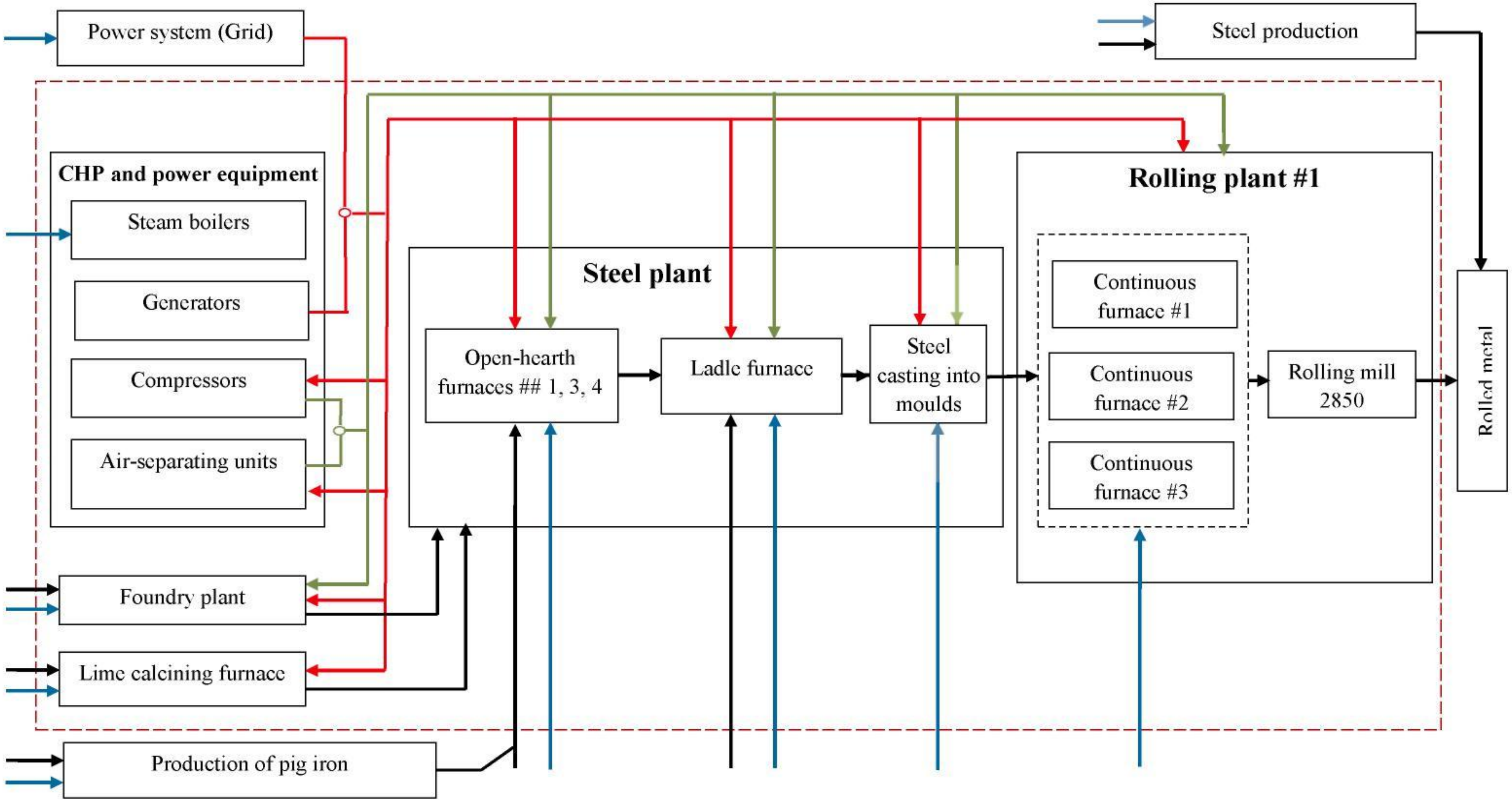


Fig D.1-2. Project boundary after CCM commissioning till EAF commissioning

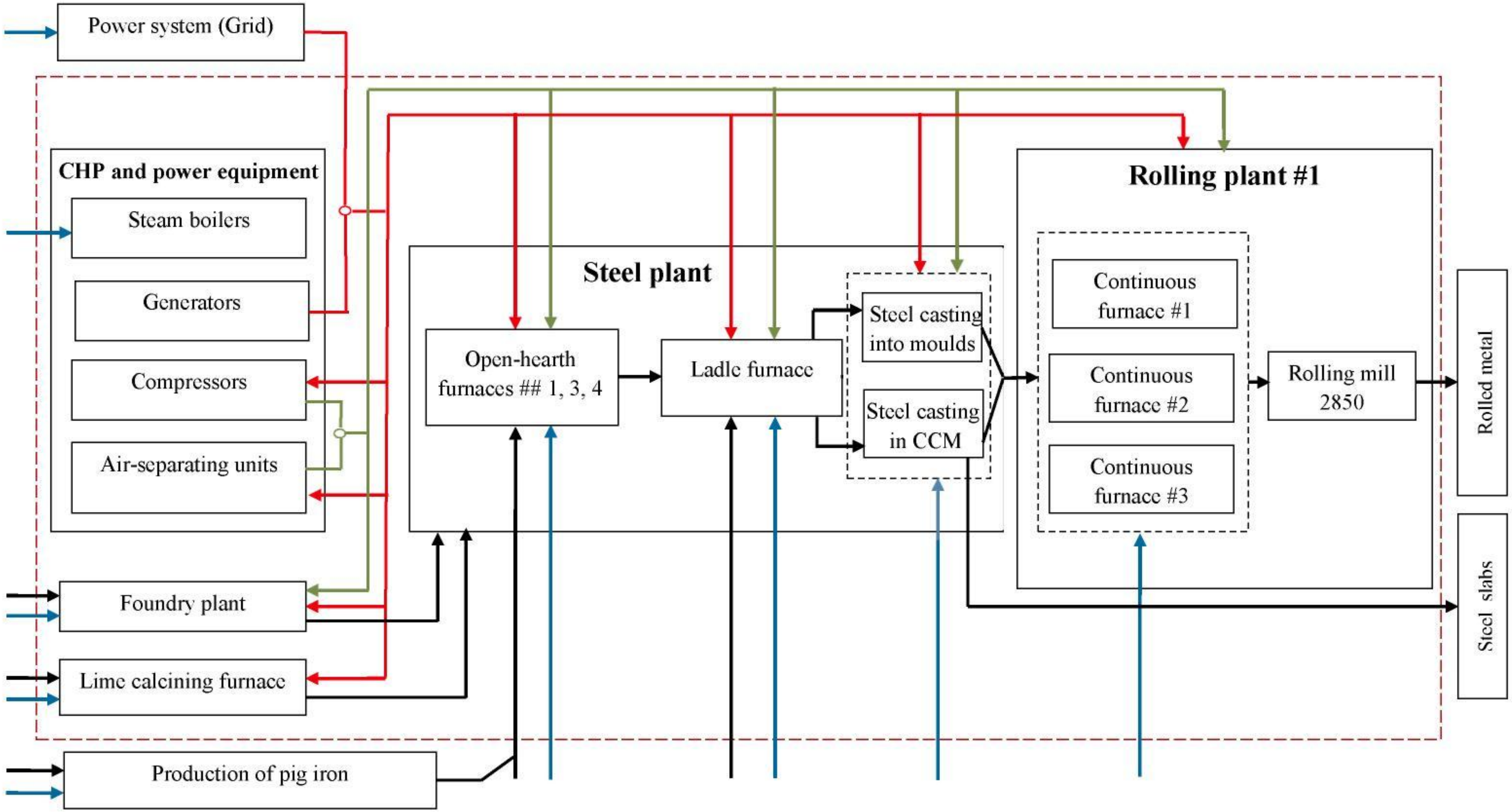
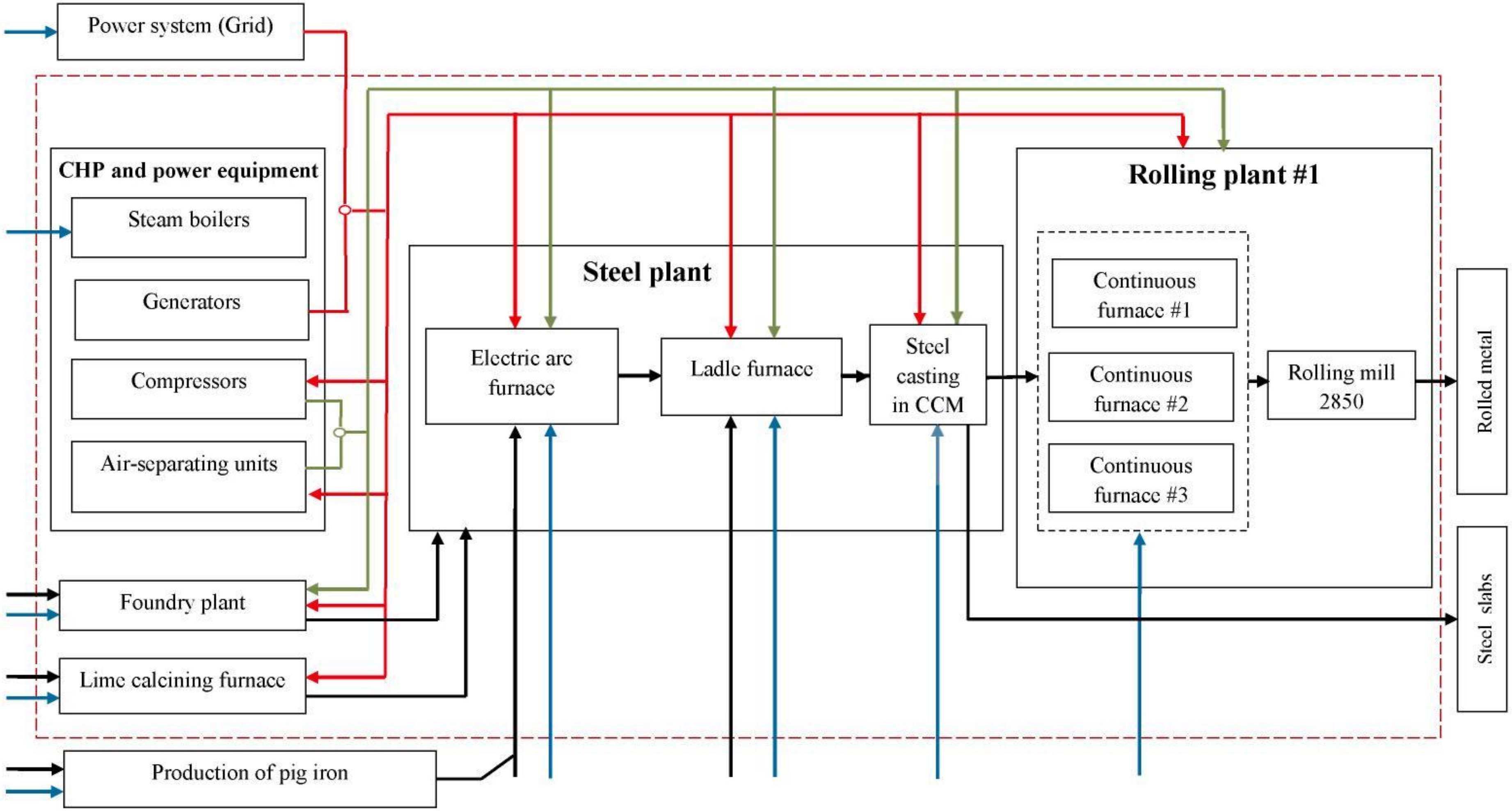


Fig D.1-3. Project boundary after EAF commissioning



Legend to the figures D.1-1. - D.1-3.

	Electric power
	Fuel resources (natural gas, fuel oil)
	Compressed air / process gases (oxygen, nitrogen, argon)
	Boundary of Ashinskiy Metallurgical Works
	Product flows – raw materials/products/auxiliary materials

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
ID-1: $RMC_{i,SP,PJ,y}$	Carbonaceous raw material (i) consumption in steelmaking furnaces under Project	Company's technical reports	t	m	Monthly	100 %	Electronic and paper	Consumption of limestone, dolomite, carbonaceous materials, iron, scrap iron and scrap steel. Primary archiving should be made by a shift foreman

								from steelmaking shop
ID-2: $FC_{j,SP,PJ,y}$	Fuel consumption (j) in steelmaking furnaces under Project	Company's technical reports	thous.m^3 *or* t	m	Monthly	100 %	Electronic and paper	Consumption of natural gas, heavy fuel oil, graphite electrodes. Primary archiving should be made by Instrumentation & Control Engineer
ID-3: $P_{STEEL,SP,PJ,y}$	steel production in steelmaking furnaces under Project	Company's technical reports	t	m	Monthly	100 %	Electronic and paper	Primary archiving should be made by a shift foreman from steelmaking shop
ID-4: $EC_{SP,PJ,y}$	Electric power consumption in steelmaking furnaces under Project	Company's technical reports	MWh	m	Monthly	100 %	Electronic and paper	Primary archiving should be made by an electrical engineer on duty from Power Engineering Department
ID-5: $CAC_{SP,PJ,y}$	Compressed air consumption in steelmaking furnaces under Project	Company's technical reports	thous.m^3	m	Monthly	100 %	Electronic and paper	Primary archiving should be made by Instrumentation & Control Engineer

ID-6: $OC_{SP,PJ,y}$	Oxygen consumption in steelmaking furnaces under Project	Company's technical reports	thous.m^3	m	Monthly	100 %	Electronic and paper	Primary archiving should be made by Instrumentation & Control Engineer
ID-7: $RMC_{i,LF,PJ,y}$	Carbonaceous raw material (i) consumption in ladle furnace under Project	Company's technical reports	t	m	Monthly	100 %	Electronic and paper	Carbonaceous materials consumption. Primary archiving should be made by a shift foreman from steelmaking shop
ID-8: $FC_{j,LF,PJ,y}$	Fuel consumption (j) in ladle furnace under Project	Company's technical reports	thous.m^3 *or* t	m	Monthly	100 %	Electronic and paper	Consumption graphite electrodes. Primary archiving should be made by a shift foreman fromsteelmaking shop
ID-9: $EC_{LF,PJ,y}$	Electric power consumption in ladle furnace under Project	Company's technical reports	MWh	m	Monthly	100 %	Electronic and paper	Primary archiving should be made by an electrical engineer on duty at Power Engineering Department
ID-10: $CAC_{LF,PJ,y}$	Compressed air consumption in	Company's technical reports	thous.m^3	m	Monthly	100 %	Electronic and paper	Primary archiving should

	ladle furnace under Project							be made by Instrumentation & Control Engineer
ID-11: $OC_{LF,PJ,y}$	Oxygen consumption in ladle furnace under Project	Company's technical reports	thous.m^3	m	Monthly	100 %	Electronic and paper	Primary archiving should be made by Instrumentation & Control Engineer
ID-12: $FC_{j,SC,PJ,y}$	Fuel consumption (j) in continuous casting machine (CCM) under Project	Company's technical reports	thous.m^3 *or* t	m	Monthly	100 %	Electronic and paper	Consumption of natural gas. Primary archiving should be made by Instrumentation & Control Engineer
ID-13: $EC_{SC,PJ,y}$	Electric power consumption in continuous casting machine (CCM) under Project	Company's technical reports	MWh	m	Monthly	100 %	Electronic and paper	Primary archiving should be made by an electrical engineer on duty from Power Engineering Department
ID-14: $CAC_{SC,PJ,y}$	Compressed air consumption in continuous casting machine (CCM) under Project	Company's technical reports	thous.m^3	m	Monthly	100 %	Electronic and paper	Primary archiving should be made by Instrumentation & Control Engineer
ID-15: $OC_{SC,PJ,y}$	Oxygen consumption in continuous	Company's technical reports	thous.m^3	m	Monthly	100 %	Electronic and paper	Primary archiving should be made by

	casting machine (CCM) under Project							Instrumentation & Control Engineer
ID-16: $FC_{j,RP,PJ,y}$	Fuel consumption (j) in rolling plant under Project	Company's technical reports	thous.m^3 *or* t	m	Monthly	100 %	Electronic and paper	Consumption of natural gas.Primary archiving should be made by Instrumentation & Control Engineer
ID-17: $EC_{RP,PJ,y}$	Electric power consumption in rolling plant under Project	Company's technical reports	MWh	m	Monthly	100 %	Electronic and paper	Primary archiving should be made by an electrical engineer on duty from Power Engineering Department
ID-18: $CAC_{RP,PJ,y}$	Compressed air consumption in rolling plant under Project	Company's technical reports	thous.m^3	m	Monthly	100 %	Electronic and paper	Primary archiving should be made by Instrumentation & Control Engineer
ID-19: $C_{LIME,SP,PJ,y}$	Lime consumption in steelmaking furnaces under Project	Company's technical reports	t	m	Monthly	100 %	Electronic and paper	Primary archiving should be made by a shift foreman from steelmaking shop
ID-20: $C_{LIME,LF,PJ,y}$	Lime consumption in ladle furnace	Company's technical reports	t	m	Monthly	100 %	Electronic and paper	Primary archiving should be made by a

	under Project							shift foreman from steelmaking shop
ID-21: $MC_{SP,PJ,y}$	Molds consumption for steel production under Project	Company's technical reports	t	m	Monthly	100 %	Electronic and paper	Primary archiving should be made by a shift foreman from steelmaking shop
ID-22: $RMC_{IRON,SP,PJ,y}$	Pig iron consumption for steel production under Project	Company's technical reports	t	m	Monthly	100 %	Electronic and paper	Primary archiving should be made by a shift foreman of steelmaking shop
ID-23: $RMC_{IRON,MP,PJ,y}$	Pig iron consumption for molds production under Project	Company's technical reports	t	m	Monthly	100 %	Electronic and paper	Primary archiving should be made by a shift foreman from foundry shop
ID-24: $EC_{grid,PJ,y}$	Electric power consumption from the grid under Project	Company's technical reports	MWh	m	Monthly	100 %	Electronic and paper	Primary archiving should be made by an electrical engineer on duty from Power Engineering Department
ID-25: $P_{ELEC,PJ,y}$	Electric power generated by own CHP under Project	Company's technical reports	MWh	m	Monthly	100 %	Electronic and paper	Primary archiving should be made by an electrical

								engineer on duty from Power Engineering Department
ID-26: $FC_{j,EP,PJ,y}$	Fuel consumption (j) for electric power production by own CHP under Project	Company's technical reports	thous.m^3 *or* t	m	Monthly	100 %	Electronic and paper	Consumption of natural gas and heavy fuel oil. Primary archiving should be made by Instrumentation & Control Engineer
ID-27: $EC_{CA,PJ,y}$	Electric power consumption for compressed air production under Project	Company's technical reports	MWh	m	Monthly	100 %	Electronic and paper	Primary archiving should be made by an electrical engineer on duty from Power Engineering Department
ID-28: $P_{CA,PJ,y}$	Compressed air production under Project	Company's technical reports	thous.m^3	m	Monthly	100 %	Electronic and paper	Primary archiving should be made by Instrumentation & Control Engineer
ID-29: $EC_{OP,PJ,y}$	Electric power consumption for technical gases production under Project	Company's technical reports	MWh	m	Monthly	100 %	Electronic and paper	Primary archiving should be made by an electrical engineer on duty from Power Engineering Department

ID-30: $P_{OXYGEN,PJ,y}$	Oxygen production under Project	Company's technical reports	thous.m^3	m	Monthly	100 %	Electronic and paper	Primary archiving should be made by Instrumentation & Control Engineer
ID-31: $P_{LIME,PJ,y}$	Lime production under Project	Company's technical reports	t	m	Monthly	100 %	Electronic and paper	Primary archiving should be made by a shift foreman from steelmaking shop
ID-32: $RMC_{i,LP,PJ,y}$	Carbonaceous raw materials (i) consumption for lime production under Project	Company's technical reports	t	m	Monthly	100 %	Electronic and paper	Consumption of limestone. Primary archiving should be made by a shift foreman from steelmaking shop
ID-33: $FC_{j,LP,PJ,y}$	Fuel consumption (j) for lime production under Project	Company's technical reports	thous.m^3 *or* t	m	Monthly	100 %	Electronic and paper	Consumption of natural gas.Primary archiving should be made by Instrumentation & Control Engineer
ID-34: $EC_{LP,PJ,y}$	Electric power consumption for lime production under Project	Company's technical reports	MWh	m	Monthly	100 %	Electronic and paper	Primary archiving should be made by an electrical engineer on duty

								from Power Engineering Department
ID-35: $CAC_{LP,PJ,y}$	Compressed air consumption for lime production under Project	Company's technical reports	thous.m^3	m	Monthly	100 %	Electronic and paper	Primary archiving should be made by Instrumentation & Control Engineer
ID-36: $P_{MOULD,PJ,y}$	Molds production under Project	Company's technical reports	t	m	Monthly	100 %	Electronic and paper	Primary archiving should be made by a shift foreman from foundry shop
ID-37: $RMC_{i,MP,PJ,y}$	Carbonaceous raw materials (i) consumption for molds production under Project	Company's technical reports	t	m	Monthly	100 %	Electronic and paper	Consumption of limestone, iron, scrap iron and steel. Primary archiving should be made by a shift foreman from foundry shop
ID-38: $FC_{j,MP,PJ,y}$	Fuel consumption (j) for molds production under Project	Company's technical reports	thous.m^3 *or* t	m	Monthly	100 %	Electronic and paper	Consumption of natural gas and coke. Primary archiving should be made by Instrumentation & Control Engineer
ID-39: $EC_{MP,PJ,y}$	Electric power consumption for molds	Company's technical reports	MWh	m	Monthly	100 %	Electronic and paper	Primary archiving should be made by an

	production under Project							electrical engineer on duty from Power Engineering Department
ID-40: $CAC_{MP,PJ,y}$	Compressed air consumption for molds production under Project	Company's technical reports	thous.m^3	m	Monthly	100 %	Electronic and paper	Primary archiving should be made by Instrumentation & Control Engineer

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 Emissions:

1. $PE_y = PE_{SP,y} + PE_{LF,y} + PE_{SC,y} + PE_{RP,y} + PE_{LP,y} + PE_{MP,y} + PE_{IP,y}$

PE_y - project emissions, tCO_2

$PE_{SP,y}$ - project emissions from steelmaking furnaces, tCO_2

$PE_{LF,y}$ - project emissions from ladle furnace, tCO_2

$PE_{SC,y}$ - project emissions from continuous casting machine (CCM), tCO_2

$PE_{RP,y}$ - project emissions from rolling plant, tCO_2

$PE_{LP,y}$ - project emissions from lime production, tCO_2

$PE_{MP,y}$ - project emissions from foundry plant, tCO_2

$PE_{IP,y}$ - project emissions from pig iron production outside JSC AMW, tCO_2

1. Steelmaking Furnaces:

1.1. $PE_{SP,y} = PE_{SP,TECH,y} + PE_{SP,ENER,y}$

$PE_{SP,y}$ - project emissions from steelmaking furnaces, tCO_2

$PE_{SP,TECH,y}$ - process emissions when using carbonaceous raw materials and fuel in steelmaking furnaces, tCO_2

$PE_{SP,ENER,y}$ - emissions caused by use of electric power, compressed air and technical gases in steelmaking furnaces, tCO_2

1.1.1. $PE_{SP,TECH,y} = [\ \Sigma(RMC_{i,SP,PJ,y} * W_{C,RMi}) + \Sigma\ (FC_{j,SP,PJ,y} * W_{C,Fj}) – P_{STEEL,SP,PJ,y} * W_{C,STEEL}] * 44/12$

$PE_{SP,TECH,y}$ - process emissions when using carbonaceous raw materials and fuel in steelmaking furnaces, tCO_2

$RMC_{i,SP,PJ,y}$ - carbonaceous raw material (i) consumption in steelmaking furnaces under Project, t

$W_{C,RMi}$ - carbon content in raw material (i), t/t

$FC_{j,SP,PJ,y}$ - fuel (j) consumption in steelmaking furnaces under Project, t *or* thous.m^3

$W_{C,Fj}$ - carbon content in fuel (j), t/t *or* t/thous.m^3

$P_{STEEL,SP,PJ,y}$ - steel production in steelmaking furnaces under Project, t

$W_{C,STEEL}$ - carbon content in steel, t/t

44/12 - conversion rate for carbon to carbon dioxide, t/t

1.1.2. $PE_{SP,ENER,y} = EC_{SP,PJ,y} * EF_{k,CO2,ELEC,y} + CAC_{SP,PJ,y} * EF_{CO2,CA,y} + OC_{SP,PJ,y} * EF_{CO2,OC,y}$

$PE_{SP,ENER,y}$ - emissions caused by use of electric power, compressed air and technical gases in steelmaking furnaces, tCO_2

$EC_{SP,PJ,y}$ - electric power consumption in steelmaking furnaces under Project, MWh

$EF_{k,CO2,ELEC,y}$ - CO_2 emission factor for electric power production, supplied to consumers (k), tCO_2/MWh

$CAC_{SP,PJ,y}$ - compressed air consumption in steelmaking furnaces under Project, $thous.m^3$

$EF_{CO2,CA,y}$ - CO_2 emission factor for compressed air production, $tCO_2/thous.m^3$

$OC_{SP,PJ,y}$ - oxygen consumption in steelmaking furnaces under Project, $thous.m^3$

$EF_{CO2,OC,y}$ - CO_2 emission factor for oxygen production, $tCO_2/thous.m^3$

2. Ladle Furnace:

1.2. $PE_{LF,y} = PE_{LF,TECH,y} + PE_{LF,ENER,y}$

$PE_{LF,y}$ - project emissions from ladle furnace, tCO_2

$PE_{LF,TECH,y}$ - process emissions when using carbonaceous raw materials and fuel in ladle furnace, tCO_2

$PE_{LF,ENER,y}$ - emissions caused by use of electric power, compressed air and technical gases in ladle furnace, tCO_2

1.2.1. $PE_{LF,TECH,y} = [\ \Sigma(RMC_{i,LF,PJ,y} * W_{C,RMi}) + \Sigma\ (FC_{j,LF,PJ,y} * W_{C,Fj})\ ] * 44/12$

$PE_{LF,TECH,y}$ - process emissions when using carbonaceous raw materials and fuel in ladle furnace, tCO_2

$RMC_{i,LF,PJ,y}$ - carbonaceous raw material (i) consumption in ladle furnace under Project, t

$W_{C,RMi}$ - carbon content in raw material (i), t/t

$FC_{j,LF,PJ,y}$ - fuel (j) consumption in ladle furnace under Project, t *or* $thous.m^3$

$W_{C,Fj}$ - carbon content in fuel (j), t/t *or* t/thous.m^3

44/12 - conversion rate for carbon to carbon dioxide, t/t

1.2.2. $PE_{LF,ENER,y} = EC_{LF,PJ,y} * EF_{k,CO2,ELEC,y} + CAC_{LF,PJ,y} * EF_{CO2,CA,y} + OC_{LF,PJ,y} * EF_{CO2,OC,y}$

$PE_{LF,ENER,y}$ - emissions caused by use of electric power, compressed air and technical gases in ladle furnace, tCO_2

$EC_{LF,PJ,y}$ - electric power consumption in ladle furnace under Project, MWh

$EF_{k,CO2,ELEC,y}$ - CO_2 emission factor for electric power production, supplied to consumers (k), tCO_2/MWh

$CAC_{LF,PJ,y}$ - compressed air consumption in ladle furnace under Project, thous.m^3

$EF_{CO2,CA,y}$ - CO_2 emission factor for compressed air production, tCO_2/thous.m^3

$OC_{LF,PJ,y}$ - oxygen consumption in ladle furnace under Project, thous.m^3

$EF_{CO2,OC,y}$ - CO_2 emission factor for oxygen production, tCO_2/thous.m^3

3. Continuous Casting Machine (CCM)

1.3. $PE_{SC,y} = PE_{SC,TECH,y} + PE_{SC,ENER,y}$

$PE_{SC,y}$ - project emissions from continuous casting machine (CCM), tCO_2

$PE_{SC,TECH,y}$ - process emissions from fuel combustion in CCM, tCO_2

$PE_{SC,ENER,y}$ - emissions caused by use of electric power, compressed air and technical gases in CCM, tCO_2

1.3.1. $PE_{SC,TECH,y} = \Sigma (FC_{j,SC,PJ,y} * W_{C,Fj}) * 44/12$

$PE_{SC,TECH,y}$ - process emissions from fuel combustion in CCM, tCO_2

$FC_{j,SC,PJ,y}$ - fuel (j) consumption in CCM under Project, t *or* thous.m^3

$W_{C,Fj}$ - carbon content of the fuel (j), t/t *or* t/thous.m^3

44/12 - conversion rate for carbon to carbon dioxide, t/t

1.3.2. $PE_{SC,ENER,y} = EC_{SC,PJ,y} * EF_{k,CO2,ELEC,y} + CAC_{SC,PJ,y} * EF_{CO2,CA,y} + OC_{SC,PJ,y} * EF_{CO2,OC,y}$

$PE_{SC,ENER,y}$ - emissions caused by use of electric power, compressed air and technical gases in CCM, tCO_2

$EC_{SC,PJ,y}$ - electric power consumption in CCM under Project, MWh

$EF_{k,CO2,ELEC,y}$ - CO_2 emission factor for electric power production, supplied to consumers (k), tCO_2/MWh

$CAC_{SC,PJ,y}$ - compressed air consumption in CCM under Project, thous.m^3

$EF_{CO2,CA,y}$ - CO_2 emission factor for compressed air production, tCO_2/thous.m^3

$OC_{SC,PJ,y}$ - oxygen consumption in CCM under Project, thous.m^3

$EF_{CO2,OC,y}$ - CO_2 emission factor for oxygen production, tCO_2/thous.m^3

4. Rolling Plant

1.4. $PE_{RP,y} = PE_{RP,TECH,y} + PE_{RP,ENER,y}$

$PE_{RP,y}$ - project emissions from rolling plant, tCO_2

$PE_{RP,TECH,y}$ - process emissions from fuel combustion in rolling plant, tCO_2

$PE_{RP,ENER,y}$ - emissions caused by use of electric power and compressed air in rolling plant, tCO_2

1.4.1. $PE_{RP,TECH,y} = \Sigma (FC_{j, RP,PJ,y} * W_{C,Fj}) * 44/12$

$PE_{RP,TECH,y}$ - process emissions from fuel combustion in rolling plant, tCO_2

$FC_{j, RP,PJ,y}$ - fuel (j) consumption in rolling plant under Project, t *or* thous.m^3

$W_{C,Fj}$ - carbon content of fuel (j), t/t *or* t/thous.m^3

44/12 - conversion rate for carbon to carbon dioxide, t/t

1.4.2. $PE_{RP,ENER,y} = EC_{RP,PJ,y} * EF_{k,CO2,ELEC,y} + CAC_{RP,PJ,y} * EF_{CO2,CA,y}$

$PE_{RP,ENER,y}$ - emissions caused by use of electric power and compressed air in rolling plant, tCO_2

$EC_{RP,PJ,y}$ - electric power consumption in rolling plant under Project, MWh

$EF_{k,CO2,ELEC,y}$ - CO_2 emission factor for electric power production, supplied to consumers (k), tCO_2/MWh

$CAC_{RP,PJ,y}$ - compressed air consumption in rolling plant under Project, thous.m^3

$EF_{CO2,CA,y}$ - CO_2 emission factor for compressed air production, tCO_2/thous.m^3

5. Lime Calcining Furnace

1.5. $PE_{LP,y} = (C_{LIME,SP,PJ,y} + C_{LIME,LF,PJ,y}) * EF_{CO2,LP,y}$

$PE_{LP,y}$ - project emissions from lime production, tCO_2

$C_{LIME,SP,PJ,y}$ - lime consumption during production in steelmaking furnaces under Project, t

$C_{LIME,LF,PJ,y}$ - lime consumption during production in ladle furnace under Project, t

$EF_{CO2,LP,y}$ - emission factor for lime production, tCO_2/t

6. Foundry Shop

1.6. $PE_{MP,y} = MC_{SP,PJ,y} * EF_{CO2,MP,y}$

$PE_{MP,y}$ - project emissions from foundry plant, tCO_2

$MC_{SP,PJ,y}$ - molds consumption for steel production under Project, t

$EF_{CO2,MP,y}$ - emission factor for molds production under Project, tCO_2/t

7. Iron Production

1.7. $PE_{IP,y} = RMC_{IRON,PJ,y} * EF_{CO2,IP,y}$

$PE_{IP,y}$ - project emissions from pig iron production outside JSC AMW, tCO_2

$RMC_{IRON,PJ,y}$ - pig iron consumption for steel and molds production under Project, t

$EF_{CO2,IP,y}$ - emission factor for iron production from Russian ferrous industry , tCO_2/t

1.7.1. $RMC_{IRON,PJ,y} = RMC_{IRON,SP,PJ,y} + RMC_{IRON,MP,PJ,y}$

$RMC_{IRON,PJ,y}$ - pig iron consumption for steel and molds production under Project, t

$RMC_{IRON,SP,PJ,y}$ - pig iron consumption for steel production under Project, t

$RMC_{IRON,MP,PJ,y}$ - pig iron consumption for molds production under Project, t

8. Emission Factors

8.1. CO_2 emission factor for electric power production

1.8.1. $EF_{k,CO2,ELEC,y} = ((EC_{grid,PJ,y} - EC_{SP,PJ,y}) * EF_{CO2,grid,y} + P_{ELEC,PJ,y} * EF_{CO2,EP,y}) / (EC_{grid,PJ,y} + P_{ELEC,PJ,y})$

$EF_{k,CO2,ELEC,y}$ - CO_2 emission factor for electric power production, supplied to consumers (k), tCO_2/MWh

$EC_{grid,PJ,y}$ - electric power consumption from grid under Project, MWh

$EC_{SP,PJ,y}$ - electric power consumption in EAF under Project, MWh

$EF_{CO2,grid,y}$ - emission factor for electric power produced in the electric power system and supplied to facilities consuming electric power, tCO_2/MWh

$P_{ELEC,PJ,y}$ - electric power generated by the own CHP under Project, MWh

$EF_{CO2,EP,y}$ - emission factor for electric power generated by the own CHP, tCO_2/MWh

k - all consumers of electric power in Project boundary with the exception of EAF

1.8.1.1. $EF_{CO2,EP,y} = \Sigma (FC_{j,EP,PJ,y} * W_{C,Fj}) * 44/12 / P_{ELEC,PJ,y}$

$EF_{CO2,EP,y}$ - emission factor for electric power generated by the own CHP, tCO_2/MWh

$FC_{j,EP,y}$ - fuel (j) consumption for electric power produced in own CHP under Project, t *or* thous.m^3

$W_{C,Fj}$ - carbon content in fuel (j), t/t *or* t/thous.m^3

44/12 - conversion rate for carbon to carbon dioxide, t/t

$P_{ELEC,PJ,y}$ - electric electric power generated by the own CHP under Project, MWh

Foolowing the lauch of the EAF, electricity for EAF will be supplied only from the grid, therefore CO_2 emission factor for electric power production, supplied to EAF ($EF_{k,CO2,ELEC,y}$) will be assessed as emission factor for electric power produced in the electric power system and supplied to facilities consuming electric power ($EF_{CO2,grid,y}$).

1.8.1.2. $EF_{k,CO2,ELEC,y} = EF_{CO2,grid,y}$

$EF_{k,CO2,ELEC,y}$ - CO_2 emission factor for electric power production, supplied to consumers (k), tCO_2/MWh

$EF_{CO2,grid,y}$ - emission factor for electric power produced in the electric power system and supplied to facilities consuming electric power, tCO_2/MWh

k - EAF

8.2. CO_2 emission factor for compressed air production

1.8.2. $EF_{CO2,CA,y} = (EC_{CA,PJ,y} * EF_{k,CO2,ELEC,y}) / P_{CA,PJ,y}$

$EF_{CO2,CA,y}$ - CO_2 emission factor for compressed air production, tCO_2/thous.m^3

$EC_{CA,PJ,y}$ - electric power consumption for compressed air production under Project, MWh

$EF_{k,CO2,ELEC,y}$ - CO_2 emission factor for electric power production, supplied to consumers (k), tCO_2/MWh

$P_{CA,PJ,y}$ - compressed air production under Project, thous.m^3

8.3. CO_2 emission factor for technical gases production

1.8.3. $EF_{CO2,OC,y} = (EC_{OP,PJ,y} * EF_{k,CO2,ELEC,y}) / P_{OXYGEN,PJ,y}$

$EF_{CO2,OC,y}$ - CO_2 emission factor for oxygen production, $tCO_2/thous.m^3$

$EC_{OP,PJ,y}$ - electric power consumption for technical gases production under Project, MWh

$EF_{k,CO2,ELEC,y}$ - CO_2 emission factor for electric power production, supplied to consumers (k), tCO_2/MWh

$P_{OXYGEN,PJ,y}$ - oxygen production under Project, thous.m^3

8.4. CO_2 emission factor for lime production

1.8.4. $EF_{CO2,LP,y} = (PE_{LP,TECH,y} + PE_{LP,ENER,y}) / P_{LIME,PJ,y}$

$EF_{CO2,LP,y}$ - CO_2 emission factor for lime production, tCO_2/t

$PE_{LP,TECH,y}$ - process emissions when using carbonaceous raw materials and fuel for lime production, tCO_2

$PE_{LP,ENER,y}$ - emissions caused by use of electric power and compressed air for lime production, tCO_2

$P_{LIME,PJ,y}$ - lime production under Project, t

1.8.4.1. $PE_{LP,TECH,y} = [\ \Sigma(RMC_{i,LP,PJ,y} * W_{C,RMi}) + \Sigma\ (FC_{j,LP,PJ,y} * W_{C,Fj})\ ] * 44/12$

$PE_{LP,TECH,y}$ - process emissions when using carbonaceous raw materials and fuel for lime production, tCO_2

$RMC_{i,LP,PJ,y}$ - carbonaceous raw material (i) consumption for lime production under Project, t

$W_{C,RMi}$ - carbon content in raw material (i), t/t

$FC_{j,LP,PJ,y}$ - fuel (j) consumption for lime production under Project, t *or* thous.m^3

$W_{C,Fj}$ - carbon content of the fuel j, t/t *or* t/thous.m^3

44/12 - conversion rate for carbon to carbon dioxide, t/t

1.8.4.2. $PE_{LP,ENER,y} = EC_{LP,PJ,y} * EF_{k,CO2,ELEC,y} + CAC_{LP,PJ,y} * EF_{CO2,CA,y}$

$PE_{LP,ENER,y}$ - emissions caused by use of electric power and compressed air for lime production, tCO_2

$EC_{LP,PJ,y}$ - electric power consumption for lime production under Project, MWh

$EF_{k,CO2,ELEC,y}$ - CO_2 emission factor for electric power production, supplied to consumers (k), tCO_2/MWh

$CAC_{LP,PJ,y}$ - compressed air consumption for lime production under Project, thous.m^3

$EF_{CO2,CA,y}$ - CO_2 emission factor for compressed air production, tCO_2/thous.m^3

8.5. CO_2 emission factor for ingot molds production

1.8.5. $EF_{CO2,MP,y} = (PE_{MP,TECH,y} + PE_{MP,ENER,y}) / P_{MOULD,PJ,y}$

$EF_{CO2,MP,y}$ - CO_2 emission factor for molds production, tCO_2/t

$PE_{MP,TECH,y}$ - process emissions when using carbonaceous raw materials and fuel for molds production, tCO_2

$PE_{MP,ENER,y}$ - emissions caused by use of electric power and compressed air for molds production, tCO_2

$P_{MOULD,PJ,y}$ - molds production under Project, t

1.8.5.1. $PE_{MP,TECH,y} = [\ \Sigma(RMC_{i,MP,PJ,y} * W_{C,RMi}) + \Sigma\ (FC_{j,MP,PJ,y} * W_{C,Fj})\ ] * 44/12$

$PE_{MP,TECH,y}$ - process emissions when using carbonaceous raw materials and fuel for molds production,tCO_2

$RMC_{i,MP,PJ,y}$ - carbonaceous raw materials (i) consumption for molds production under Project, t

$W_{C,RMi}$ - carbon content in raw materials (i), t/t

$FC_{j,MP,PJ,y}$ - fuel (j) consumption for molds production under Project, t *or* thous.m^3

$W_{C,Fj}$ - carbon content in fuel (j), t/t *or* t/thous.m^3

44/12 - conversion rate for carbon to carbon dioxide, t/t

1.8.5.2. $PE_{MP,ENER,y} = EC_{MP,PJ,y} * EF_{k,CO2,ELEC,y} + CAC_{MP,PJ,y} * EF_{CO2,CA,y}$

$PE_{MP,ENER,y}$ - emissions caused by use of electric power and compressed air for molds production, tCO_2

$EC_{MP,PJ,y}$ - electric power consumption for molds production under Project, MWh

$EF_{k,CO2,ELEC,y}$ - CO_2 emission factor for electric power production, supplied to consumers (k), tCO_2/MWh

$CAC_{MP,PJ,y}$ - compressed air consumption for molds production under Project, thous.m^3

$EF_{CO2,CA,y}$ - CO_2 emission factor for compressed air production, tCO_2/thous.m^3

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
ID-41: $RMC_{i,SP,BL,y}$	Carbonaceous raw material (i) consumption in steelmaking furnaces under Baseline	Calculated by formula 1.1.1.1	t	c	Monthly	100 %	Electronic	Consumption of limestone, dolomite, carbonaceous materials, iron, scrap iron and scrap steel
ID-42: $FC_{j,SP,BL,y}$	Fuel consumption (j) in steelmaking furnaces under Baseline	Calculated by formula 1.1.1.3	thous.m^3 *or* t	c	Monthly	100 %	Electronic	Consumption of natural gas, heavy fuel oil.
ID-43: $P_{STEEL,SP,BL,y}$	steel production in steelmaking furnaces under Baseline	Calculated by formula 1.9.3.1	t	c	Monthly	100 %	Electronic	-
ID-44: $EC_{SP,BL,y}$	Electric power consumption in steelmaking furnaces under Baseline	Calculated by formula 1.1.2.1	MWh	c	Monthly	100 %	Electronic	-
ID-45: $CAC_{SP,BL,y}$	Compressed air consumption in steelmaking furnaces under Baseline	Calculated by formula 1.1.2.3	thous.m^3	c	Monthly	100 %	Electronic	-

ID-46: $OC_{SP,BL,y}$	Oxygen consumption in steelmaking furnaces under Baseline	Calculated by formula 1.1.2.5	thous.m^3	c	Monthly	100 %	Electronic	-
ID-47: $RMC_{i,LF,BL,y}$	Carbonaceous raw material (i) consumption in ladle furnace under Baseline	Calculated by formula 1.2.1.1	t	c	Monthly	100 %	Electronic	Carbonaceous materials consumption.
ID-48: $FC_{j,LF,BL,y}$	Fuel consumption (j) in ladle furnace under Baseline	Calculated by formula 1.2.1.3	t	c	Monthly	100 %	Electronic	Consumption graphite electrodes.
ID-49: $EC_{LF,BL,y}$	Electric power consumption in ladle furnace under Baseline	Calculated by formula 1.2.2.1	MWh	c	Monthly	100 %	Electronic	-
ID-50: $CAC_{LF,BL,y}$	Compressed air consumption in ladle furnace under Baseline	Calculated by formula 1.2.2.3	thous.m^3	c	Monthly	100 %	Electronic	-
ID-51: $OC_{LF,BL,y}$	Oxygen consumption in ladle furnace under Baseline	Calculated by formula 1.2.2.5	thous.m^3	c	Monthly	100 %	Electronic	-
ID-52: $FC_{j,RP,BL,y}$	Fuel consumption (j) in rolling plant under Baseline	Calculated by formula 1.3.1.1	thous.m^3	c	Monthly	100 %	Electronic	Consumption of natural gas.
ID-53: $EC_{RP,BL,y}$	Electric power consumption in rolling plant under Baseline	Calculated by formula 1.3.2.1	MWh	c	Monthly	100 %	Electronic	-

ID-54: $CAC_{RP,BL,y}$	Compressed air consumption in rolling plant under Baseline	Calculated by formula 1.3.2.3	thous.m^3	c	Monthly	100 %	Electronic	-
ID-55: $C_{LIME,SP,BL,y}$	Lime consumption in steelmaking furnaces under Baseline	Calculated by formula 1.4.1	t	c	Monthly	100 %	Electronic	-
ID-56: $C_{LIME,LF,BL,y}$	Lime consumption in ladle furnace under Baseline	Calculated by formula 1.4.3	t	c	Monthly	100 %	Electronic	-
ID-57: $P_{STEEL,LF,BL,y}$	Steel processed in ladle furnace under Baseline	Calculated by formula 1.9.4.1	t	c	Monthly	100 %	Electronic	-
ID-58: $C_{STEEL,BILLET,BL,y}$	Steel billets consumption for rolled metal production in rolling plant under Baseline	Calculated by formula 1.9.2.1	t	c	Monthly	100 %	Electronic	-
ID-59: $P_{STEEL,RP,BL,y}$	Rolled metal production in rolling plant under Baseline	Calculated by formula 1.9.1.1 – 1.9.1.2	t	c	Monthly	100 %	Electronic	-
ID-60: $P_{STEEL,OUT,BL,y}$	steel production outside JSC AMW under Baseline	Calculated by formula 1.9.5.1	t	c	Monthly	100 %	Electronic	-
ID-61: $P_{STEEL,LF,PJ,y}$	Steel processed in ladle furnace under Project	Company's technical reports	t	m	Monthly	100 %	Electronic and paper	Primary archiving should be made by a shift foreman from

								steelmaking shop
ID-62: $C_{STEEL,BILLET,PJ,y}$	Steel billets consumption for rolled metal production in rolling plant under Project	Company's technical reports	t	m	Monthly	100 %	Electronic and paper	Primary archiving should be made by a production clerk
ID-63: $P_{STEEL,RP,PJ,y}$	Rolled metal production in rolling plant under Project	Company's technical reports	t	m	Monthly	100 %	Electronic and paper	Primary archiving should be made by a production clerk

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

Baseline Emissions:

1. $BE_y = BE_{SP,y} + BE_{LF,y} + BE_{RP,y} + BE_{LP,y} + BE_{MP,y} + BE_{SP,OUT,y} + BE_{IP,y}$

BE_y - baseline emissions, tCO_2

$BE_{SP,y}$ - baseline emissions from steelmaking furnaces, tCO_2

$BE_{LF,y}$ - baseline emissions from ladle furnace, tCO_2

$BE_{RP,y}$ - baseline emissions in rolling plant, tCO_2

$BE_{LP,y}$ - baseline emissions from lime production, tCO_2

$BE_{MP,y}$ - baseline emissions from foundry plant, tCO_2

$BE_{SP,OUT,y}$ - baseline emissions from steel production outside JSC AMW, tCO_2

$BE_{IP,y}$ - baseline emissions from iron production outside JSC AMW, tCO_2

1. Steelmaking Furnaces:

1.1. $BE_{SP,y} = BE_{SP,TECH,y} + BE_{SP,ENER,y}$

$BE_{SP,y}$ - baseline emissions from steelmaking furnaces, tCO_2

$BE_{SP,TECH,y}$ - process emissions when using carbonaceous raw materials and fuel in steelmaking furnaces, tCO_2

$BE_{SP,ENER,y}$ - emissions caused by use of electric power, compressed air and technical gases in steelmaking furnaces, tCO_2

1.1.1 $BE_{SP,TECH,y} = [\ \Sigma(RMC_{i,SP,BL,y} * W_{C,RMi}) + \Sigma\ (FC_{j,SP,BL,y} * W_{C,Fj}) - P_{STEEL,SP,BL,y} * W_{C,STEEL}\ ] * 44/12$

$BE_{SP,TECH,y}$ - process emissions when using carbonaceous raw materials and fuel in steelmaking furnaces, tCO_2

$RMC_{i,SP,BL,y}$ - carbonaceous raw material (i) consumption in steelmaking furnaces under Baseline, t

$W_{C,RMi}$ - carbon content in raw material (i), t/t

$FC_{j,SP,BL,y}$ - fuel (j) consumption in steelmaking furnaces under Baseline, t *or* thous.m^3

$W_{C,Fj}$ - carbon content in fuel (j), t/t *or* t/thous.m^3

$P_{STEEL,SP,BL,y}$ - steel production in steelmaking furnaces under Baseline, t

$W_{C,STEEL}$ - carbon content in steel, t/t

44/12 - conversion rate for carbon to carbon dioxide, t/t

1.1.1.1 $RMC_{i,SP,BL,y} = P_{STEEL,SP,BL,y} * SRMC_{i,SP,BL,y}$

$RMC_{i,SP,BL,y}$ - carbonaceous raw material (i) consumption in steelmaking furnaces under Baseline, t

$P_{STEEL,SP,BL,y}$ - steel production in steelmaking furnaces under Baseline, t

$SRMC_{i,SP,BL,y}$ - specific carbonaceous raw material (i) consumption in steelmaking furnaces under Baseline, t/t

1.1.1.2 $SRMC_{i,SP,BL,y} = RMC_{i,SP,PJ,y} / P_{STEEL,SP,PJ,y}$

$SRMC_{i,SP,BL,y}$ - specific carbonaceous raw material (i) consumption in steelmaking furnaces under Baseline, t/t

$RMC_{i,SP,PJ,y}$ - carbonaceous raw material (i) consumption in steelmaking furnaces (open-hearth furnaces) under Project, t/t

$P_{STEEL,SP,PJ,y}$ - steel production in steelmaking furnaces (open-hearth furnaces) under Project, t

Following the launch of the EAF, specific carbonaceous raw material (i) consumption in steelmaking furnaces according to the baseline ($SRMC_{i,SP,BL,y}$) will be constant. Specific consumption will be calculated by the formula (1.1.1.2) as an average value $SRMC_{i,SP,BL,y}$ for the operation period of the steel plant since the commissioning of the ladle furnace till the commissioning of the EAF.

1.1.1.3 $FC_{j,SP,BL,y} = P_{STEEL,SP,BL,y} * SFC_{i,SP,BL,y}$

$FC_{j,SP,BL,y}$ - fuel (j) consumption in steelmaking furnaces under Baseline, t *or* thous.m^3

$P_{STEEL,SP,BL,y}$ - steel production in steelmaking furnaces under Baseline, t

$SFC_{i,SP,BL,y}$ - specific fuel (j) consumption in steelmaking furnaces under Baseline, t/t *or* thous.m^3/t

1.1.1.4 $SFC_{i,SP,BL,y} = FC_{j,SP,PJ,y} / P_{STEEL,SP,PJ,y}$

$SFC_{i,SP,BL,y}$ - specific fuel (j) consumption in steelmaking furnaces under Baseline, t/t *or* thous.m^3/t

$FC_{j,SP,PJ,y}$ - fuel (j) consumption in steelmaking furnaces (open-hearth furnaces) under Project, t *or* thous.m^3

$P_{STEEL,SP,PJ,y}$ - steel production in steelmaking furnaces (open-hearth furnaces) under Project, t

Foolowing the lauch of the EAF, specific fuel (j) consumption in steelmaking furnaces according to the baseline ($SFC_{i,SP,BL,y}$) will be constant. Specific consumption will be calculated by the formula (1.1.1.4) as an average value $SFC_{i,SP,BL,y}$ for the operation period of the steel plant since the commissioning of the ladle furnace till the commissioning of the EAF.

1.1.2. $BE_{SP,ENER,y} = EC_{SP,BL,y} * EF_{k,CO2,ELEC,y} + CAC_{SP,BL,y} * EF_{CO2,CA,y} + OC_{SP,BL,y} * EF_{CO2,OC,y}$

$BE_{SP,ENER,y}$ - emissions caused by use of electric power, compressed air and technical gases in steelmaking furnaces, tCO_2

$EC_{SP,BL,y}$ - electric power consumption in steelmaking furnaces under Baseline, MWh

$EF_{k,CO2,ELEC,y}$ - CO_2 emission factor for electric power production, supplied to consumers (k), tCO_2/MWh

$CAC_{SP,BL,y}$ - compressed air consumption in steelmaking furnaces under Baseline, thous.m^3

$EF_{CO2,CA,y}$ - CO_2 emission factor for compressed air production, tCO_2/thous.m^3

$OC_{SP,BL,y}$ - oxygen consumption in steelmaking furnaces under Baseline, thous.m^3

$EF_{CO2,OC,y}$ - CO_2 emission factor for oxygen production, tCO_2/thous.m^3

1.1.2.1 $EC_{SP,BL,y} = P_{STEEL,SP,BL,y} * SEC_{SP,BL,y}$

$EC_{SP,BL,y}$ - electric power consumption in steelmaking furnaces under Baseline, MWh

$P_{STEEL,SP,BL,y}$ - steel production in steelmaking furnaces under Baseline, t

$SEC_{SP,BL,y}$ - specific electric power consumption in steelmaking furnaces under Baseline, MWh/t

1.1.2.2 $SEC_{SP,BL,y} = EC_{SP,PJ,y} / P_{STEEL,SP,PJ,y}$

$SEC_{SP,BL,y}$ - specific electric power consumption in steelmaking furnaces under Baseline, MWh/t

$EC_{SP,PJ,y}$ - electric power consumption in steelmaking furnaces (open-hearth furnaces) under Project, MWh

$P_{STEEL,SP,PJ,y}$ - steel production in steelmaking furnaces (open-hearth furnaces) under Project, t

Following the launch of the EAF, specific electric power consumption in steelmaking furnaces according to the baseline ($SEC_{SP,BL,y}$) will be constant. Specific consumption will be calculated by the formula (1.1.2.2) as an average value $SEC_{SP,BL,y}$ for the operation period of the steel plant since the commissioning of the ladle furnace till the commissioning of the EAF.

1.1.2.3 $CAC_{SP,BL,y} = P_{STEEL,SP,BL,y} * SCAC_{SP,BL,y}$

$CAC_{SP,BL,y}$ - compressed air consumption in steelmaking furnaces under Baseline, thous.m^3

$P_{STEEL,SP,BL,y}$ - steel production in steelmaking furnaces under Baseline, t

$SCAC_{SP,BL,y}$ - specific compressed air consumption in steelmaking furnaces under Baseline, thous.m^3/t

1.1.2.4 $SCAC_{SP,BL,y} = CAC_{SP,PJ,y} / P_{STEEL,SP,PJ,y}$

$SCAC_{SP,BL,y}$ - specific compressed air consumption in steelmaking furnaces under Baseline, thous.m^3/t

$CAC_{SP,PJ,y}$ - compressed air consumption in steelmaking furnaces (open-hearth furnaces) under Project, thous.m^3

$P_{STEEL,SP,PJ,y}$ - steel production in steelmaking furnaces (open-hearth furnaces) under Project, t

Following the launch of the EAF, specific compressed air consumption in steelmaking furnaces according to the baseline ($SCAC_{SP,BL,y}$) will be constant. Specific consumption will be calculated by the formula (1.1.2.4) as an average value $SCAC_{SP,BL,y}$ for the operation period of the steel plant since the commissioning of the ladle furnace till the commissioning of the EAF.

1.1.2.5 $OC_{SP,BL,y} = P_{STEEL,SP,BL,y} * SOC_{SP,BL,y}$

$OC_{SP,BL,y}$ - oxygen consumption in steelmaking furnaces under Baseline, thous.m^3

$P_{STEEL,SP,BL,y}$ - steel production in steelmaking furnaces under Baseline, t

$SOC_{SP,BL,y}$ - specific oxygen consumption in steelmaking furnaces under Baseline, thous.m^3/ t

1.1.2.6 $SOC_{SP,BL,y} = OC_{SP,PJ,y} / P_{STEEL,SP,PJ,y}$

$SOC_{SP,BL,y}$ - specific oxygen consumption in steelmaking furnaces under Baseline, thous.m^3/ t

$OC_{SP,PJ,y}$ - oxygen consumption in steelmaking furnaces (open-hearth furnaces) under Project, thous.m^3

$P_{STEEL,SP,PJ,y}$ - steel production in steelmaking furnaces (open-hearth furnaces) under Project, t

Following the launch of the EAF, specific oxygen consumption in steelmaking furnaces according to the baseline ($SOC_{SP,BL,y}$) will be constant. Specific consumption will be calculated by the formula (1.1.2.6) as an average value $SOC_{SP,BL,y}$ for the operation period of the steelmaking shop since the commissioning of the ladle furnace till the commissioning of the EAF.

2. Ladle Furnace

1.2. $BE_{LF,y} = BE_{LF,TECH,y} + BE_{LF,ENER,y}$

$BE_{LF,y}$ - baseline emissions from ladle furnace, tCO_2

$BE_{LF,TECH,y}$ - process emissions when using carbonaceous raw materials and fuel in ladle furnace, tCO_2

$BE_{LF,ENER,y}$ - emissions caused by use of electric power, compressed air and technical gases in ladle furnace, tCO_2

1.2.1. $BE_{LF,TECH,y} = [\ \Sigma(RMC_{i,LF,BL,y} * W_{C,RMi}) + \Sigma\ (FC_{j,LF,BL,y} * W_{C,Fj})\ ] * 44/12$

$BE_{LF,TECH,y}$ - process emissions when using carbonaceous raw materials and fuel in ladle furnace, tCO_2

$RMC_{i,LF,BL,y}$ - carbonaceous raw material (i) consumption in ladle furnace under Baseline, t

$W_{C,RMi}$ - carbon content in raw material (i), t/t

$FC_{j,LF,BL,y}$ - fuel (j) consumption in ladle furnace under Baseline, t *or* thous.m^3

$W_{C,Fj}$ - carbon content in fuel (j), t/t *or* t/thous.m^3

44/12 - conversion rate for carbon to carbon dioxide, t/t

1.2.1.1 $RMC_{i,LF,BL,y} = P_{STEEL,LF,BL,y} * SRMC_{i,LF,BL,y}$

$RMC_{i,LF,BL,y}$ - carbonaceous raw material (i) consumption in ladle furnace under Baseline, t

$P_{STEEL,LF,BL,y}$ - steel processed in ladle furnace under Baseline, t

$SRMC_{i,LF,BL,y}$ - specific carbonaceous raw material (i) consumption in ladle furnace under Baseline, t/t

1.2.1.2 $SRMC_{i,LF,BL,y} = RMC_{i,LF,PJ,y} / P_{STEEL,LF,PJ,y}$

$SRMC_{i,LF,BL,y}$ - specific carbonaceous raw material (i) consumption in ladle furnace under Baseline, t/t

$RMC_{i,LF,PJ,y}$ - carbonaceous raw material (i) consumption in ladle furnace under Project, t

$P_{STEEL,LF,PJ,y}$ - steel processed in ladle furnace under Project, t

1.2.1.3 $FC_{j,LF,BL,y} = P_{STEEL,LF,BL,y} * SFC_{i,LF,BL,y}$

$FC_{j,LF,BL,y}$ - fuel (j) consumption in ladle furnace under Baseline, t

$P_{STEEL,LF,BL,y}$ - steel processed in ladle furnace under Baseline, t

$SFC_{i,LF,BL,y}$ - specific fuel (j) consumption in ladle furnace under Baseline, t/t

1.2.1.4 $SFC_{i,LF,BL,y} = FC_{j,LF,PJ,y} / P_{STEEL,LF,PJ,y}$

$SFC_{i,LF,BL,y}$ - specific fuel (j) consumption in ladle furnace under Baseline, t/t

$FC_{j,LF,PJ,y}$ - fuel (j) consumption in ladle furnace under Project, t

$P_{STEEL,LF,PJ,y}$ - steel processed in ladle furnace under Project, t

1.2.2. $BE_{LF,ENER,y} = EC_{LF,BL,y} * EF_{k,CO2,ELEC,y} + CAC_{LF,BL,y} * EF_{CO2,CA,y} + OC_{LF,BL,y} * EF_{CO2,OC,y}$

$BE_{LF,ENER,y}$ - emissions caused by use of electric power, compressed air and technical gases in ladle furnace, tCO_2

$EC_{LF,BL,y}$ - electric power consumption in ladle furnace under Baseline, MWh

$EF_{k,CO2,ELEC,y}$ - CO_2 emission factor for electric power production, supplied to consumers (k), tCO_2/MWh

$CAC_{LF,BL,y}$ - compressed air consumption in ladle furnace under Baseline, thous.m^3

$EF_{CO2,CA,y}$ - CO_2 emission factor for compressed air production, tCO_2/thous.m^3

$OC_{LF,BL,y}$ - oxygen consumption in ladle furnace under Baseline, thous.m^3

$EF_{CO2,OC,y}$ - CO_2 emission factor for oxygen production, tCO_2/thous.m^3

1.2.2.1 $EC_{LF,BL,y} = P_{STEEL,LF,BL,y} * SEC_{LF,BL,y}$

$EC_{LF,BL,y}$ - electric power consumption in ladle furnace under Baseline, MWh

$P_{STEEL,LF,BL,y}$ - steel processed in ladle furnace under Baseline, t

$SEC_{LF,BL,y}$ - specific electric power consumption in ladle furnace under Baseline, MWh/t

1.2.2.2 $SEC_{LF,BL,y} = EC_{LF,PJ,y} / P_{STEEL,LF,PJ,y}$

$SEC_{LF,BL,y}$ - specific electric power consumption in ladle furnace under Baseline, MWh/t

$EC_{LF,PJ,y}$ - electric power consumption in ladle furnace under Project, MWh

$P_{STEEL,LF,PJ,y}$ - steel processed in ladle furnace under Project, t

1.2.2.3 $CAC_{LF,BL,y} = P_{STEEL,LF,BL,y} * SCAC_{LF,BL,y}$

$CAC_{LF,BL,y}$ - compressed air consumption in ladle furnace under Baseline, thous.m^3

$P_{STEEL,LF,BL,y}$ - steel processed in ladle furnace under Baseline, t

$SCAC_{LF,BL,y}$ - specific compressed air consumption in ladle furnace under Baseline, thous.m^3/t

1.2.2.4 $SCAC_{LF,BL,y} = CAC_{LF,PJ,y} / P_{STEEL,LF,PJ,y}$

$SCAC_{LF,BL,y}$ - specific compressed air consumption in ladle furnace under Baseline, thous.m^3/t

$CAC_{LF,PJ,y}$ - compressed air consumption in ladle furnace under Project, thous.m^3

$P_{STEEL,LF,PJ,y}$ - steel processed in ladle furnace under Project, t

1.2.2.5 $OC_{LF,BL,y} = P_{STEEL,LF,BL,y} * SOC_{LF,BL,y}$

$OC_{LF,BL,y}$ - oxygen consumption in ladle furnace under Baseline, thous.m^3

$P_{STEEL,LF,BL,y}$ - steel processed in ladle furnace under Baseline, t

$SOC_{LF,BL,y}$ - specific oxygen consumption in ladle furnace under Baseline, thous.m^3/ t

1.2.2.6 $SOC_{LF,BL,y} = OC_{LF,PJ,y} / P_{STEEL,LF,PJ,y}$

$SOC_{LF,BL,y}$ - specific oxygen consumption in ladle furnace under Baseline, thous.m^3/ t

$OC_{LF,PJ,y}$ - oxygen consumption in ladle furnace under Project, thous.m^3

$P_{STEEL,LF,PJ,y}$ - steel processed in ladle furnace under Project, t

3. Rolling Plant

1.3. $BE_{RP,y} = BE_{RP,TECH,y} + BE_{RP,ENER,y}$

$BE_{RP,y}$ - baseline emissions in rolling plant, tCO_2

$BE_{RP,TECH,y}$ - process emissions from fuel combustion in rolling plant, tCO_2

$BE_{RP,ENER,y}$ - emissions caused by use of electric power and compressed air in rolling plant, tCO_2

1.3.1. $BE_{RP,TECH,y} = \Sigma (FC_{j, RP,BL,y} * W_{C,Fj}) * 44/12$

$BE_{RP,TECH,y}$ - process emissions from fuel combustion in rolling plant, tCO_2

$FC_{j,RP,BL,y}$ - fuel (j) consumption in rolling plant under Baseline, thous.m^3

$W_{C,Fj}$ - carbon content in fuel (j), t/thous.m^3

44/12 - conversion rate for carbon to carbon dioxide, t/t

1.3.1.1 $FC_{j,RP,BL,y} = C_{STEEL,BILLET,BL,y} * SFC_{i,RP,BL,y}$

$FC_{j, RP,BL,y}$ - fuel (j) consumption in rolling plant under Baseline, thous.m^3

$C_{STEEL,BILLET,BL,y}$ - steel billets consumption for rolled metal production in rolling plant under Baseline, t

$SFC_{i,RP,BL,y}$ - specific fuel (j) consumption in rolling plant, thous.m^3/t

1.3.1.2 $SFC_{i,RP,y} = FC_{j,RP,PJ,y} / C_{STEEL,BILLET,PJ,y}$

$SFC_{i,RP,y}$ - specific fuel (j) consumption in rolling plant, thous.m^3/t

$FC_{j,RP,PJ,y}$ - fuel (j) consumption in rolling plant under Project, thous.m^3

$C_{STEEL,BILLET,PJ,y}$ - steel billets consumption for rolled metal production in rolling plant under Project, t

1.3.2. $BE_{RP,ENER,y} = EC_{RP,BL,y} * EF_{k,CO2,ELEC,y} + CAC_{RP,BL,y} * EF_{CO2,CA,y}$

$BE_{RP,ENER,y}$ - emissions caused by use of electric power and compressed air in rolling plant, tCO_2

$EC_{RP,BL,y}$ - electric power consumption in rolling plant under Baseline, MWh

$EF_{k,CO2,ELEC,y}$ - CO_2 emission factor for electric power production, supplied to consumers (k), tCO_2/MWh

$CAC_{RP,BL,y}$ - compressed air consumption in rolling plant under Baseline, thous.m^3

$EF_{CO2,CA,y}$ - CO_2 emission factor for compressed air production, tCO_2/thous.m^3

1.3.2.1 $EC_{RP,BL,y} = C_{STEEL,BILLET,BL,y} * SEC_{RP,y}$

$EC_{RP, BL,y}$ - electric power consumption in rolling plant under Baseline, MWh

$C_{STEEL,BILLET,BL,y}$ - steel billets consumption for rolled metal production in rolling plant under Baseline, t

$SEC_{RP,y}$ - specific electric power consumption in rolling plant, MWh/t

1.3.2.2 $SEC_{RP,y} = EC_{RP,PJ,y} / C_{STEEL,BILLET,PJ,y}$

$SEC_{RP,y}$ - specific electric power consumption in rolling plant, MWh/t

$EC_{RP,PJ,y}$ - electric power consumption in rolling plant under Project, MWh

$C_{STEEL,BILLET,PJ,y}$ - steel billets consumption for rolled metal production in rolling plant under Project, t

1.3.2.3 $CAC_{RP,BL,y} = C_{STEEL,BILLET,BL,y} * SCAC_{RP,y}$

$CAC_{RP,BL,y}$ - compressed air consumption in rolling plant under Baseline, thous.m^3

$C_{STEEL,BILLET,BL,y}$ - steel billets consumption for rolled metal production in rolling plant under Baseline, t

$SCAC_{RP,y}$ - specific compressed air consumption in rolling plant, thous.m^3/t

1.3.2.4 $SCAC_{RP,y} = CAC_{RP,PJ,y} / C_{STEEL,BILLET,PJ,y}$

$SCAC_{RP,y}$ - specific compressed air consumption in rolling plant, thous.m^3/t

$CAC_{RP,PJ,y}$ - compressed air consumption in rolling plant under Project, thous.m^3

$C_{STEEL,BILLET,PJ,y}$ - steel billets consumption for rolled metal production in rolling plant under Project, t

4. Lime Calcining Furnace

1.4. $BE_{LP,y} = (C_{LIME,SP,BL,y} + C_{LIME,LF,BL,y})* EF_{CO2,LP,y}$

$BE_{LP,y}$ - baseline emissions from lime production, tCO_2

$C_{LIME,SP,BL,y}$ - lime consumption in steelmaking furnaces under Baseline, t

$C_{LIME,LF,BL,y}$ - lime consumption in ladle furnace under Baseline, t

$EF_{CO2,LP,y}$ - emission factor for lime production, tCO_2/t

1.4.1 $C_{LIME,SP,BL,y} = P_{STEEL,SP,BL,y} * SC_{LIME,SP,y}$

$C_{LIME,SP,BL,y}$ - lime consumption in steelmaking furnaces under Baseline, t

$P_{STEEL,SP,BL,y}$ - steel production in steelmaking furnaces under Baseline, t

$SC_{LIME,SP,y}$ - specific lime consumption in steelmaking furnaces, t/t

1.4.2 $SC_{LIME,SP,y} = C_{LIME,SP,PJ,y} / P_{STEEL,SP,PJ,y}$

$SC_{LIME,SP,y}$ - specific lime consumption in steelmaking furnaces, t/t

$C_{LIME,SP,PJ,y}$ - lime consumption in steelmaking furnaces under Project, t

$P_{STEEL,SP,PJ,y}$ - steel production in steelmaking furnaces under Project, t

1.4.3 $C_{LIME,LF,BL,y} = P_{STEEL,LF,BL,y} * SC_{LIME,LF,y}$

$C_{LIME,LF,BL,y}$ - lime consumption in ladle furnace under Baseline, t

$P_{STEEL,LF,BL,y}$ - steel processed in ladle furnace under Baseline, t

$SC_{LIME,LF,y}$ - specific lime consumption in the ladle furnace, t/t

1.4.4 $SC_{LIME,LF,y} = C_{LIME,LF,PJ,y} / P_{STEEL,LF,PJ,y}$

$SC_{LIME,LF,y}$ - specific lime consumption in ladle furnace, t/t

$C_{LIME,LF,PJ,y}$ - lime consumption in ladle furnace under Project, t

$P_{STEEL,LF,PJ,y}$ - steel processed in ladle furnace under Project, t

5. Foundry Plant

1.5. $BE_{MP,y} = MC_{SP,BL,y} * EF_{CO2,MP,TECH,BL,y} + BE_{MP,ENER,y}$

$BE_{MP,y}$ - baseline emissions from foundry plant, tCO_2

$MC_{SP,BL,y}$ - molds consumption for steel production under Baseline, t

$EF_{CO2,MP,TECH,BL,y}$ - process emission factor for molds production under Baseline, tCO_2/t

$BE_{MP,ENER,y}$ - emissions caused by use of electric power and compressed air for molds production, tCO_2

1.5.1 $MC_{SP,BL,y} = P_{STEEL,SP,BL,y} * SMC_{SP,BL,y}$

$MC_{SP,BL,y}$ - molds consumption for steel production under Baseline, t

$P_{STEEL,SP,BL,y}$ - steel production under Baseline, t

$SMC_{SP,BL,y}$ - specific molds consumption for steel production under Baseline, t/t (steel)

Specific molds consumption according to the baseline for steel casting ($SMC_{SP,BL,y}$) is defined on the basis of historical data taken over the period 2006-2007 according to the formula 1.5.1.1. (initial data and calculations are available on request). This value is taken as constant for all crediting period. $SMC_{SP,BL,y}$ = 0,026 t/t (steel).

1.5.1.1. $SMC_{SP,BL,y} = MC_{SP,y} / P_{STEEL,SP,y}$

$SMC_{SP,BL,y}$ *- specific molds consumption for steel production under Baseline, t/t (steel)*

$MC_{SP,y}$ *- molds consumption for steel production, t*

$P_{STEEL,SP,y}$ - steel production, t

1.5.2. $BE_{MP,ENER,y} = EC_{MP,BL,y} * EF_{k,CO2,ELEC,y} + CAC_{MP,BL,y} * EF_{CO2,CA,y}$

$BE_{MP,ENER,y}$ - emissions caused by use of electric power and compressed air for molds production, tCO_2

$EC_{MP,BL,y}$ - electric power consumption for molds production under Baseline, MWh

$EF_{k,CO2,ELEC,y}$ - CO_2 emission factor for electric power production, supplied to consumers (k), tCO_2/MWh

$CAC_{MP,BL,y}$ - compressed air consumption for molds production under Baseline, thous.m^3

$EF_{CO2,CA,y}$ - CO_2 emission factor for compressed air production, tCO_2/thous.m^3

1.5.2.1 $EC_{MP,BL,y} = MC_{SP,BL,y} * SEC_{MP,BL,y}$

$EC_{MP,BL,y}$ - electric power consumption for molds production under Baseline, MWh

$MC_{SP,BL,y}$ - molds consumption for steel production under Baseline, t

$SEC_{MP,BL,y}$ - specific electric power consumption for molds production under Baseline, MWh/t

Specific electric power consumption for molds production according to the baseline ($SEC_{MP,BL,y}$) is calculated by the formula (1.5.2.2) for the period 2006-2007. This value is taken as constant for all crediting period. $SEC_{MP,BL,y}$ = 0,060 MWh/t

1.5.2.2 $SEC_{MP,BL,y} = EC_{MP,y} / P_{MOULD,y}$

$SEC_{MP,BL,y}$ - specific electric power consumption for molds production under Baseline, MWh/t

$EC_{MP,y}$ - *electric power consumption for molds production, MWh*

$P_{MOULD,y}$ - *molds production, t*

1.5.2.3 $CAC_{MP,BL,y} = MC_{SP,BL,y} * SCAC_{MP,BL,y}$

$CAC_{MP,BL,y}$ - compressed air consumption for molds production under Baseline, thous.m^3

$MC_{SP,BL,y}$ - molds consumption for steel production under Baseline, t

$SCAC_{MP,BL,y}$ - specific compressed air consumption for molds production under Baseline, thous.m^3/t

Specific compressed air consumption for molds production according to the baseline ($CAC_{MP,BL,y}$) is calculated by the formula (1.5.2.4) for the period 2006-2007. This value is taken as constant for all crediting period. $SCAC_{MP,BL,y}$ = 0,147 thous.m^3/t

1.5.2.4 $SCAC_{MP,BL,y} = CAC_{MP,y} / P_{MOULD,y}$

$SCAC_{MP,BL,y}$ - *specific compressed air consumption for molds production under Baseline, thous.m^3/t*

$CAC_{MP,y}$ - *compressed air consumption for molds production, thous.m^3*

$P_{MOULD,y}$ - *molds production, t*

6. Steel Production Outside JSC AMW

1.6.1. $BE_{SP,OUT,y} = P_{STEEL,OUT,BL,y} * EF_{CO2,SP,OUT,y}$

$BE_{SP,OUT,y}$ - baseline emissions from steel production outside JSC AMW, tCO_2

$P_{STEEL,OUT,BL,y}$ - steel production outside JSC AMW under Baseline, t

$EF_{CO2,SP,OUT,y}$ - CO_2 emission factor for steel production from Russian ferrous industry, tCO_2/t

7. Iron Production Outside JSC AMW

1.7. $BE_{IP,y} = RMC_{IRON,BL,y} * EF_{CO2,IP,y}$

$BE_{IP,y}$ - baseline emissions from pig iron production outside JSC AMW, tCO_2

$RMC_{IRON,BL,y}$ - pig iron consumption for steel and molds production under Baseline, t

$EF_{CO2,IP,y}$ - emission factor for pig iron production from Russian ferrous industry, tCO_2/t

1.7.1. $RMC_{IRON,BL,y} = RMC_{IRON,SP,BL,y} + RMC_{IRON,MP,BL,y}$

$RMC_{IRON,BL,y}$ - pig iron consumption for steel and molds production under Baseline, t

$RMC_{IRON,SP,BL,y}$ - pig iron consumption for steel production under Baseline, t

$RMC_{IRON,MP,BL,y}$ - pig iron consumption for molds production under Baseline, t

1.7.2. $RMC_{IRON,MP,BL,y} = MC_{SP,BL,y} * \Sigma (SRMC_{i,IRON,MP,BL,y})$

$RMC_{IRON,MP,BL,y}$ - pig iron consumption for molds production under Baseline, t

$MC_{SP,BL,y}$ - molds consumption for steel production under Baseline, t

$SRMC_{i,IRON,MP,BL,y}$ - specific iron (i) consumption for molds production, t/t

Specific iron (i) consumption *according to the baseline for molds production is defined on the basis of historical data taken over the period 2006-2007 according to the formula 1.7.2.1. (initial data and calculations are available on request). This parameters are taken as constant for all crediting period.*

1.7.2.1. $SRMC_{i,IRON,MP,BL,y} = RMC_{i,IRON,MP,BL,y} / P_{IROMPROD,MP,BL,y}$

$SRMC_{i,IRON,MP,BL,y}$ - *specific iron (i) consumption for molds production, t/t*

$RMC_{i,IRON,MP,BL,y}$ - *iron (i) consumption for molds production, t*

$P_{IROMPROD,MP,BL,y}$ - *molds production, t*

8. Emission Factors

8.1. CO_2 emission factor for electric power production

1.8.1. $EF_{k,CO2,ELEC,y} = ((EC_{grid,PJ,y} - EC_{SP,PJ,y}) * EF_{CO2,grid,y} + P_{ELEC,PJ,y} * EF_{CO2,EP,y}) / (EC_{grid,PJ,y} + P_{ELEC,PJ,y})$

$EF_{k,CO2,ELEC,y}$ - CO_2 emission factor for electric power production, supplied to consumers (k), tCO_2/MWh

$EC_{grid,PJ,y}$ - electric power consumption from grid under Project, MWh

$EC_{SP,PJ,y}$ - electric power consumption in EAF under Project, MWh

$EF_{CO2,grid,y}$ - emission factor for electric power produced in the electric power system and supplied to facilities consuming electric power, tCO_2/MWh

$P_{ELEC,PJ,y}$ - electric power generated by the own CHP under Project, MWh

$EF_{CO2,EP,y}$ - emission factor for electric power generated by the own CHP, tCO_2/MWh

k - all consumers of electric power in Project boundary with the exception of EAF

1.8.1.1. $EF_{CO2,EP,y} = \Sigma (FC_{j,EP,PJ,y} * W_{C,Fj}) * 44/12 / P_{ELEC,PJ,y}$

$EF_{CO2,EP,y}$ - emission factor for electric power generated by the own CHP, tCO_2/MWh

$FC_{j,EP,y}$ - fuel (j) consumption for electric power produced in own CHP under Project, t *or* $thous.m^3$

$W_{C,Fj}$ - carbon content in fuel (j), t/t *or* $t/thous.m^3$

44/12 - conversion rate for carbon to carbon dioxide, t/t

$P_{ELEC,PJ,y}$ - electric electric power generated by the own CHP under Project, MWh

8.2. CO_2 emission factor for compressed air production

1.8.2. $EF_{CO2,CA,y} = (EC_{CA,PJ,y} * EF_{k,CO2,ELEC,y}) / P_{CA,PJ,y}$

$EF_{CO2,CA,y}$ - CO_2 emission factor for compressed air production, $tCO_2/thous.m^3$

$EC_{CA,PJ,y}$ - electric power consumption for compressed air production under Project, MWh

$EF_{k,CO2,ELEC,y}$ - CO_2 emission factor for electric power production, supplied to consumers (k), tCO_2/MWh

$P_{CA,PJ,y}$ - compressed air production under Project, $thous.m^3$

8.3. CO_2 emission factor for technical gases production

1.8.3. $EF_{CO2,OC,y} = (EC_{OP,PJ,y} * EF_{k,CO2,ELEC,y}) / P_{OXYGEN,PJ,y}$

$EF_{CO2,OC,y}$ - CO_2 emission factor for oxygen production, $tCO_2/thous.m^3$

$EC_{OP,PJ,y}$ - electric power consumption for technical gases production under Project, MWh

$EF_{k,CO2,ELEC,y}$ - CO_2 emission factor for electric power production, supplied to consumers (k), tCO_2/MWh

$P_{OXYGEN,PJ,y}$ - oxygen production under Project, thous.m^3

8.4. CO_2 emission factor for lime production

1.8.4. $EF_{CO2,LP,y} = (PE_{LP,TECH,y} + PE_{LP,ENER,y}) / P_{LIME,PJ,y}$

$EF_{CO2,LP,y}$ - CO_2 emission factor for lime production, tCO_2/t

$PE_{LP,TECH,y}$ - process emissions when using carbonaceous raw materials and fuel for lime production, tCO_2

$PE_{LP,ENER,y}$ - emissions caused by use of electric power and compressed air for lime production, tCO_2

$P_{LIME,PJ,y}$ - lime production under Project, t

1.8.4.1. $PE_{LP,TECH,y} = [\ \Sigma(RMC_{i,LP,PJ,y} * W_{C,RMi}) + \Sigma\ (FC_{j,LP,PJ,y} * W_{C,Fj})\ ] * 44/12$

$PE_{LP,TECH,y}$ - process emissions when using carbonaceous raw materials and fuel for lime production, tCO_2

$RMC_{i,LP,PJ,y}$ - carbonaceous raw material (i) consumption for lime production under Project, t

$W_{C,RMi}$ - carbon content in raw material (i), t/t

$FC_{j,LP,PJ,y}$ - fuel (j) consumption for lime production under Project, t *or* thous.m^3

$W_{C,Fj}$ - carbon content of the fuel j, t/t *or* t/thous.m^3

44/12 - conversion rate for carbon to carbon dioxide, t/t

1.8.4.2. $PE_{LP,ENER,y} = EC_{LP,PJ,y} * EF_{k,CO2,ELEC,y} + CAC_{LP,PJ,y} * EF_{CO2,CA,y}$

$PE_{LP,ENER,y}$ - emissions caused by use of electric power and compressed air for lime production, tCO_2

$EC_{LP,PJ,y}$ - electric power consumption for lime production under Project, MWh

$EF_{k,CO2,ELEC,y}$ - CO_2 emission factor for electric power production, supplied to consumers (k), tCO_2/MWh

$CAC_{LP,PJ,y}$ - compressed air consumption for lime production under Project, thous.m^3

$EF_{CO2,CA,y}$ - CO_2 emission factor for compressed air production, tCO_2/thous.m^3

8.5. CO_2 emission factor for molds production

Process emission factor for molds production according to the baseline ($EF_{CO2,MP,TECH,BL,y}$) is calculated by the formula (1.8.5) for the period 2006-2007. This value is taken as constant for all crediting period. $EF_{CO2,MP,TECH,BL,y}$ = 0,556 tCO_2/t

1.8.5. $EF_{CO2,MP,TECH,BL,y} = BE_{MP,TECH,y} / P_{MOULD,y}$

$EF_{CO2,MP,TECH,BL,y}$ - *process emission factor for ingot molds production under Baseline, tCO_2/t*

$BE_{MP,TECH,y}$ - *process emissions when using carbonaceous raw materials and fuel for molds production, tCO_2*

$P_{MOULD,y}$ - *molds production, m*

1.8.5.1. $BE_{MP,TECH,y} = [\, \Sigma(RMC_{i,MP,y} * W_{C,RMi}) + \Sigma (FC_{j,MP,y} * W_{C,Fj})\,] * 44/12$

$BE_{MP,TECH,y}$ - *process emissions when using carbonaceous raw materials and fuel for molds production, tCO_2*

$RMC_{i,MP,y}$ - *carbonaceous raw material (i) consumption for molds production, t*

$W_{C,RMi}$	- *carbon content in raw material (i), t/t*
$FC_{j,MP,y}$	- *fuel (j) consumption for molds production, t or thous.m*^{3}
$W_{C,Fj}$	- *carbon content of the fuel j, t/t or t/thous.m*^{3}
44/12	- *conversion rate for carbon to carbon dioxide, t/t*

9. Rolled Metal And Steel Production According to the Baseline

9.1. Rolled metal production in rolling plant according to the baseline

The actual rolled metal production according to the baseline ($P_{STEEL,RP,BL,y}$) will be calculated by the formulas (1.9.1.1. and 1.9.1.2.) depending on the actual rolled metal production as per Project scenario ($P_{STEEL,RP,PJ,y}$).

If $P_{STEEL,RP,PJ,y} <= P_{STEEL,RP,BL,max,y}$ rolled metal production in rolling plant ($P_{STEEL,RP,BL,y}$) will be calculated by the formula 1.9.1.1. If $P_{STEEL,RP,PJ,y} > P_{STEEL,RP,BL,max,y}$ rolled metal production in rolling plant ($P_{STEEL,RP,BL,y}$) will be calculated by the formula 1.9.1.2. Maximum rolled metal production according to the baseline in rolling plant ($P_{STEEL,RP,BL,max,y}$) totals 500,000 tonnes/year.

1.9.1.1. $P_{STEEL,RP,BL,y} = P_{STEEL,RP,PJ,y}$

$P_{STEEL,RP,BL,y}$	- rolled metal production in rolling plant under Baseline, t
$P_{STEEL,RP,PJ,y}$	- rolled metal production in rolling plant under Project, t

1.9.1.2. $P_{STEEL,RP,BL,y} = P_{STEEL,RP,BL,max,y}$

$P_{STEEL,RP,BL,y}$	- rolled metal production in rolling plant under Baseline, t
$P_{STEEL,RP,BL,max,y}$	- maximum rolled metal production in rolling plant under Baseline, t

9.2. Steel billets consumption for rolled metal production in rolling plant according to the baseline

1.9.2.1. $C_{STEEL,BILLET,BL,y} = P_{STEEL,RP,BL,y} * SSC_{RP,BL}$

$C_{STEEL,BILLET,BL,y}$ - steel billets consumption for rolled metal production in rolling plant under Baseline, t

$P_{STEEL,RP,BL,y}$ - rolled metal production in rolling plant under Baseline, t

$SSC_{RP,BL}$ - specific steel billets consumption for rolled metal production in rolling plant under Baseline, t(steel)/t(rolled metal)

Specific steel billets consumption for rolled metal production *($SSC_{RP,BL}$) is calculated by the formula (1.9.2.2.) for the period 2006-2007 . This value is constant during all crediting period. $SSC_{RP,BL}$ = 1,355 tonnes (steel)/tonnes (rolled metal).*

1.9.2.2. $SSC_{RP,BL} = C_{STEEL,BILLET,y} / P_{STEEL,RP,y}$

$SSC_{RP,BL}$ - *specific steel consumption for rolled metal production under Baseline, t(steel)/t(rolled products)*

$C_{STEEL,BILLET,y}$ - *steel billets consumption for rolled metal production in rolling plant, t*

$P_{STEEL,RP,y}$ - *rolled metal production in rolling plant, t*

9.3. Steel production in steelmaking furnaces according to the baseline

Steel production according to the baseline ($P_{STEEL,SP,BL,y}$) is taken equal to steel billets consumption for rolled metal production in rolling plant according to the baseline ($C_{STEEL,BILLET,BL,y}$)

1.9.3.1. $P_{STEEL,SP,BL,y} = C_{STEEL,BILLET,BL,y}$

$P_{STEEL,SP,BL,y}$ - steel production in steelmaking furnaces under Baseline, t

$C_{STEEL,BILLET,BL,y}$ - steel billets consumption for rolled metal production in rolling plant under Baseline, t

9.4. Steel processed in ladle furnace according to the baseline

1.9.4.1. $P_{STEEL,LF,BL,y} = P_{STEEL,SP,BL,y} * SSC_{LF,BL,y}$

$P_{STEEL,LF,BL,y}$ - steel processed in ladle furnace under Baseline, t

$P_{STEEL,SP,BL,y}$ - steel production in steelmaking furnaces under Baseline, t

$SSC_{LF,BL,y}$ - proportion of steel processed in ladle furnace, t/t

1.9.4.2. $SSC_{LF,BL,y} = P_{STEEL,LF,PJ,y} / P_{STEEL,SP,PJ,y}$

$SSC_{LF,BL,y}$ - proportion of steel processed in ladle furnace, t/t

$P_{STEEL,SP,PJ,y}$ - steel production in steelmaking furnaces under Project, t

$P_{STEEL,LF,PJ,y}$ - steel treated in ladle furnace under Project, t

9.5. Steel production outside JSC AMW

The actual steel production according to the baseline outside JSC AMW ($P_{STEEL,OUT,BL,y}$) will be calculated by the formulas (1.9.5.1. and 1.9.5.2.).

1.9.5.1. $P_{STEEL,OUT,BL,y} = P_{SLABS,OUT,PJ,y} + (P_{STEEL,RP,PJ,y} - P_{STEEL,RP,BL,y}) * SSC_{RP,OUT,y}$

$P_{STEEL,OUT,BL,y}$ - steel production outside JSC AMW under Baseline, t

$P_{SLABS,OUT,PJ,y}$ - slabs production sold as finished product under Project, t

$P_{STEEL,RP,PJ,y}$ - rolled metal production in rolling plant under Project, t

$P_{STEEL,RP,BL,y}$ - rolled metal production in rolling plant under Baseline, t

$SSC_{RP,OUT,y}$ - specific steel consumption for rolled metal production outside JSC AMW, t(steel)/t(rolled metal)

Specific steel consumption for rolled metal production outside JSC AMW is assumed as 1 (or 100%). This is conservative.

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

Not Applicable.

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:

The leakage is negligible. See the section B.3. of the PDD.

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

Not Applicable.

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

Not Applicable.

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

D 3. $ER_y = BE_y – PE_y$

ER_y - emission reductions, tCO_2

BE_y - baseline emissions, tCO_2

PE_y - project emissions, 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 environmental impacts' monitoring of the project is determined by the following basic host party legislation:

- Federal Low dated on 10.01.2002 #7-FL (red. of 27.12.2009) "About Environment Protection" (approved on 20.12.2001)

- Federal Low dated on 04.05.1999 # 96-FL (red. of 27.12.2009) "About Atmospheric Air Protection" (approved on 02.04.1999)
- Federal Low dated on 24.06.1998 # 89-FL (red. of 30.12.2008) "About Wastes of Production and Consumption" (approved on 22.05.1998)

The assessment of the environmental impact will be carried out by the Environment Protection Department of JSC "Ashinskiy Metallurgical Works" in compliance with current monitoring regulations for environmental impact of production activities. Ecological monitoring includes the quantative determination of the environmental impact of production activities for the current period. Ecological monitoring includes the documentation of pollutant emissions to the atmosphere, waste water discharge and waste management. Data documentation of the environmental impact of project activities will be conducted on the basis of instrumental measurements and approved calculation methods. The information on the environmental impact of project activities is to be stored within the Company. Besides, it should be provided as statistical report forms to executive power bodies of the Russia: Federal Service for State Statistics and Federal Service for Ecological, Technical and Atomic Supervision.

D.2. Quality control (QC) and quality assurance (QA) procedures undertaken for data monitored:		
Data *(Indicate table and ID number)*	Uncertainty level of data (high/medium/low)	Explain QA/QC procedures planned for these data, or why such procedures are not necessary.
Table D.1.1.1 ID-1: $RMC_{i,SP,PJ,y}$	*Low*	*Measuring instruments are calibrated in compliance with state regulations, internal standards of AMW and approved methodologies*
Table D.1.1.1 ID-2: $FC_{j,SP,PJ,y}$	*Low*	*Measuring instruments are calibrated in compliance with state regulations, internal standards of AMW and approved methodologies*
Table D.1.1.1 ID-3: $P_{STEEL,SP,PJ,y}$	*Low*	*Determined in accordance with state regulations and approved methodologies*
Table D.1.1.1 ID-4: $EC_{SP,PJ,y}$	*Low*	*Measuring instruments are calibrated in compliance with state regulations, internal standards of AMW and approved methodologies*
Table D.1.1.1 ID-5: $CAC_{SP,PJ,y}$	*Low*	*Measuring instruments are calibrated in compliance with state regulations, internal standards of AMW and approved methodologies*
Table D.1.1.1 ID-6: $OC_{SP,PJ,y}$	*Low*	*Measuring instruments are calibrated in compliance with state regulations, internal standards of AMW and approved methodologies*
Table D.1.1.1 ID-7: $RMC_{i,LF,PJ,y}$	*Low*	*Measuring instruments are calibrated in compliance with state regulations, internal standards of AMW and approved methodologies*
Table D.1.1.1 ID-8: $FC_{j,LF,PJ,y}$	*Low*	*Measuring instruments are calibrated in compliance with state regulations, internal standards of AMW and approved methodologies*

Table D.1.1.1 ID-9: $EC_{LF,PJ,y}$	*Low*	*Measuring instruments are calibrated in compliance with state regulations, internal standards of AMW and approved methodologies*
Table D.1.1.1 ID-10: $CAC_{LF,PJ,y}$	*Low*	*Measuring instruments are calibrated in compliance with state regulations, internal standards of AMW and approved methodologies*
Table D.1.1.1 ID-11: $OC_{LF,PJ,y}$	*Low*	*Measuring instruments are calibrated in compliance with state regulations, internal standards of AMW and approved methodologies*
Table D.1.1.1 ID-12: $FC_{j,SC,PJ,y}$	*Low*	*Measuring instruments are calibrated in compliance with state regulations, internal standards of AMW and approved methodologies*
Table D.1.1.1 ID-13: $EC_{SC,PJ,y}$	*Low*	*Measuring instruments are calibrated in compliance with state regulations, internal standards of AMW and approved methodologies*
Table D.1.1.1 ID-14: $CAC_{SC,PJ,y}$	*Low*	*Measuring instruments are calibrated in compliance with state regulations, internal standards of AMW and approved methodologies*
Table D.1.1.1 ID-15: $OC_{SC,PJ,y}$	*Low*	*Measuring instruments are calibrated in compliance with state regulations, internal standards of AMW and approved methodologies*
Table D.1.1.1 ID-16: $FC_{j,RP,PJ,y}$	*Low*	*Measuring instruments are calibrated in compliance with state regulations, internal standards of AMW and approved methodologies*
Table D.1.1.1 ID-17: $EC_{RP,PJ,y}$	*Low*	*Measuring instruments are calibrated in compliance with state regulations, internal standards of AMW and approved methodologies*
Table D.1.1.1 ID-18: $CAC_{RP,PJ,y}$	*Low*	*Measuring instruments are calibrated in compliance with state regulations, internal standards of AMW and approved methodologies*
Table D.1.1.1 ID-19: $C_{LIME,SP,PJ,y}$	*Low*	*Measuring instruments are calibrated in compliance with state regulations, internal standards of AMW and approved methodologies*
Table D.1.1.1 ID-20: $C_{LIME,LF,PJ,y}$	*Low*	*Measuring instruments are calibrated in compliance with state regulations, internal standards of AMW and approved methodologies*
Table D.1.1.1 ID-21: $MC_{SP,PJ,y}$	*Low*	*Measuring instruments are calibrated in compliance with state regulations, internal standards of AMW and approved methodologies*
Table D.1.1.1 ID-22: $RMC_{IRON,SP,PJ,y}$	*Low*	*Measuring instruments are calibrated in compliance with state regulations, internal standards of AMW and approved methodologies*
Table D.1.1.1 ID-23: $MC_{IRON,MP,PJ,y}$	*Low*	*Measuring instruments are calibrated in compliance with state regulations, internal standards of AMW and approved methodologies*
Table D.1.1.1 ID-24: $EC_{grid,PJ,y}$	*Low*	*Measuring instruments are verified in compliance with state regulations, internal standards of AMW and approved methodologies*

Table D.1.1.1 ID-25: $P_{ELEC,PJ,y}$	*Low*	*Measuring instruments are calibrated in compliance with state regulations, internal standards of AMW and approved methodologies*
Table D.1.1.1 ID-26: $FC_{j,EP,PJ,y}$	*Low*	*Measuring instruments are calibrated in compliance with state regulations, internal standards of AMW and approved methodologies*
Table D.1.1.1 ID-27: $EC_{CA,PJ,y}$	*Low*	*Measuring instruments are calibrated in compliance with state regulations, internal standards of AMW and approved methodologies*
Table D.1.1.1 ID-28: $P_{CA,PJ,y}$	*Low*	*Measuring instruments are calibrated in compliance with state regulations, internal standards of AMW and approved methodologies*
Table D.1.1.1 ID-29: $EC_{OP,PJ,y}$	*Low*	*Measuring instruments are calibrated in compliance with state regulations, internal standards of AMW and approved methodologies*
Table D.1.1.1 ID-30: $P_{OXYGEN,PJ,y}$	*Low*	*Measuring instruments are calibrated in compliance with state regulations, internal standards of AMW and approved methodologies*
Table D.1.1.1 ID-31: $P_{LIME,PJ,y}$	*Low*	*Measuring instruments are calibrated in compliance with state regulations, internal standards of AMW and approved methodologies*
Table D.1.1.1 ID-32: $RMC_{i,LP,PJ,y}$	*Low*	*Measuring instruments are calibrated in compliance with state regulations, internal standards of AMW and approved methodologies*
Table D.1.1.1 ID-33: $FC_{j,LP,PJ,y}$	*Low*	*Measuring instruments are calibrated in compliance with state regulations, internal standards of AMW and approved methodologies*
Table D.1.1.1 ID-34: $EC_{LP,PJ,y}$	*Low*	*Measuring instruments are calibrated in compliance with state regulations, internal standards of AMW and approved methodologies*
Table D.1.1.1 ID-35: $CAC_{LP,PJ,y}$	*Low*	*Measuring instruments are calibrated in compliance with state regulations, internal standards of AMW and approved methodologies*
Table D.1.1.1 ID-36: $P_{MOULD,PJ,y}$	*Low*	*Measuring instruments are calibrated in compliance with state regulations, internal standards of AMW and approved methodologies*
Table D.1.1.1 ID-37: $RMC_{i,MP,PJ,y}$	*Low*	*Measuring instruments are calibrated in compliance with state regulations, internal standards of AMW and approved methodologies*
Table D.1.1.1 ID-38: $FC_{j,MP,PJ,y}$	*Low*	*Measuring instruments are calibrated in compliance with state regulations, internal standards of AMW and approved methodologies*
Table D.1.1.1 ID-39: $EC_{MP,PJ,y}$	*Low*	*Measuring instruments are calibrated in compliance with state regulations, internal standards of AMW and approved methodologies*
Table D.1.1.1 ID-40: $CAC_{MP,PJ,y}$	*Low*	*Measuring instruments are calibrated in compliance with state regulations, internal standards of AMW and approved methodologies*

Table D.1.1.3 ID-41: $RMC_{i,SP,BL,y}$	*Low*	*Calculated based on actual and historical data in accordance with formulas provided in the section D.1.1.4. Initial data are determined from the measuring instruments that are calibrated in compliance with state regulations, internal standards of AMW and approved methodologies*
Table D.1.1.3 ID-42: $FC_{j,SP,BL,y}$	*Low*	*Calculated based on actual and historical data in accordance with formulas provided in the section D.1.1.4. Initial data are determined from the measuring instruments that are calibrated in compliance with state regulations, internal standards of AMW and approved methodologies*
Table D.1.1.3 ID-43: $P_{STEEL,SP,BL,y}$	*Low*	*Calculated based on actual and historical data in accordance with formulas provided in the section D.1.1.4. Initial data are determined from the measuring instruments that are calibrated in compliance with state regulations, internal standards of AMW and approved methodologies*
Table D.1.1.3 ID-44: $EC_{SP,BL,y}$	*Low*	*Calculated based on actual and historical data in accordance with formulas provided in the section D.1.1.4. Initial data are determined from the measuring instruments that are calibrated in compliance with state regulations, internal standards of AMW and approved methodologies*
Table D.1.1.3 ID-45: $CAC_{SP,BL,y}$	*Low*	*Calculated based on actual and historical data in accordance with formulas provided in the section D.1.1.4. Initial data are determined from the measuring instruments that are calibrated in compliance with state regulations, internal standards of AMW and approved methodologies*
Table D.1.1.3 ID-46: $OC_{SP,BL,y}$	*Low*	*Calculated based on actual and historical data in accordance with formulas provided in the section D.1.1.4. Initial data are determined from the measuring instruments that are calibrated in compliance with state regulations, internal standards of AMW and approved methodologies*
Table D.1.1.3 ID-47: $RMC_{i,LF,BL,y}$	*Low*	*Calculated based on actual and historical data in accordance with formulas provided in the section D.1.1.4. Initial data are determined from the measuring instruments that are calibrated in compliance with state regulations, internal standards of AMW and approved methodologies*
Table D.1.1.3 ID-48: $FC_{j,LF,BL,y}$	*Low*	*Calculated based on actual and historical data in accordance with formulas provided in the section D.1.1.4. Initial data are determined from the measuring instruments that are calibrated in compliance with state regulations, internal standards of AMW and approved methodologies*
Table D.1.1.3 ID-49: $EC_{LF,BL,y}$	*Low*	*Calculated based on actual and historical data in accordance with formulas provided in the section D.1.1.4. Initial data are determined from the measuring instruments that are calibrated in compliance with state regulations, internal standards of AMW and approved methodologies*
Table D.1.1.3 ID-50: $CAC_{LF,BL,y}$	*Low*	*Calculated based on actual and historical data in accordance with formulas provided in the section D.1.1.4. Initial data are determined from the measuring instruments that are calibrated in compliance with state regulations, internal standards of AMW and approved methodologies*
Table D.1.1.3 ID-51: $OC_{LF,BL,y}$	*Low*	*Calculated based on actual and historical data in accordance with formulas provided in the section D.1.1.4. Initial data are determined from the measuring instruments that are calibrated in compliance with state regulations, internal standards of AMW and approved methodologies*

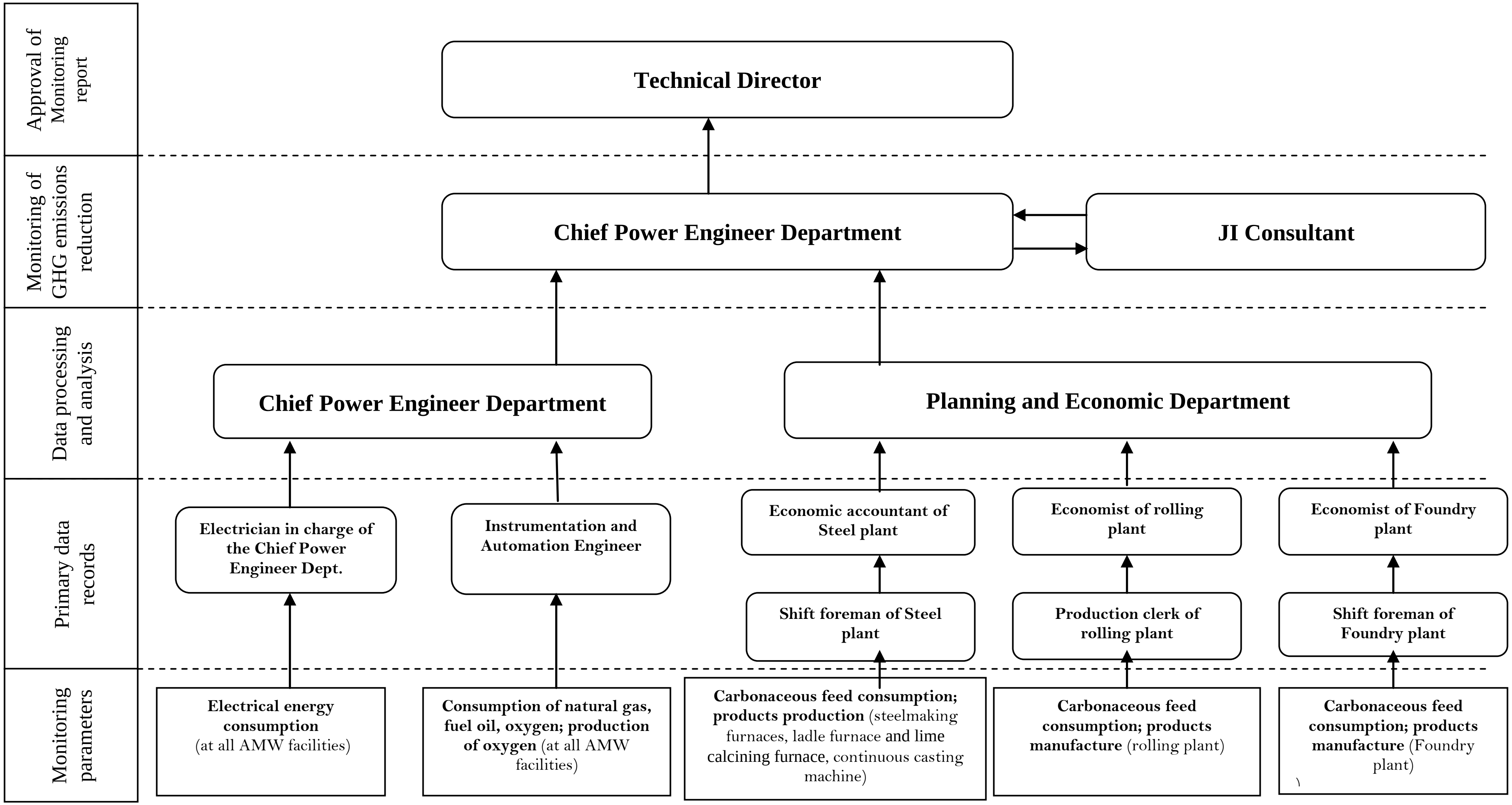
Table D.1.1.3 ID-52: $FC_{j,RP,BL,y}$	*Low*	*Calculated based on actual and historical data in accordance with formulas provided in the section D.1.1.4. Initial data are determined from the measuring instruments that are calibrated in compliance with state regulations, internal standards of AMW and approved methodologies*
Table D.1.1.3 ID-53: $EC_{RP,BL,y}$	*Low*	*Calculated based on actual and historical data in accordance with formulas provided in the section D.1.1.4. Initial data are determined from the measuring instruments that are calibrated in compliance with state regulations, internal standards of AMW and approved methodologies*
Table D.1.1.3 ID-54: $CAC_{RP,BL,y}$	*Low*	*Calculated based on actual and historical data in accordance with formulas provided in the section D.1.1.4. Initial data are determined from the measuring instruments that are calibrated in compliance with state regulations, internal standards of AMW and approved methodologies*
Table D.1.1.3 ID-55: $C_{LIME,SP,BL,y}$	*Low*	*Calculated based on actual and historical data in accordance with formulas provided in the section D.1.1.4. Initial data are determined from the measuring instruments that are calibrated in compliance with state regulations, internal standards of AMW and approved methodologies*
Table D.1.1.3 ID-56: $C_{LIME,LF,BL,y}$	*Low*	*Calculated based on actual and historical data in accordance with formulas provided in the section D.1.1.4. Initial data are determined from the measuring instruments that are calibrated in compliance with state regulations, internal standards of AMW and approved methodologies*
Table D.1.1.3 ID-57: $P_{STEEL,LF,BL,y}$	*Low*	*Calculated based on actual and historical data in accordance with formulas provided in the section D.1.1.4. Initial data are determined from the measuring instruments that are calibrated in compliance with state regulations, internal standards of AMW and approved methodologies*
Table D.1.1.3 ID-58: $C_{STEEL,BILLET,BL,y}$	*Low*	*Calculated based on actual and historical data in accordance with formulas provided in the section D.1.1.4. Initial data are determined from the measuring instruments that are calibrated in compliance with state regulations, internal standards of AMW and approved methodologies*
Table D.1.1.3 ID-59: $P_{STEEL,RP,BL,y}$	*Low*	*Calculated based on actual and historical data in accordance with formulas provided in the section D.1.1.4. Initial data are determined from the measuring instruments that are calibrated in compliance with state regulations, internal standards of AMW and approved methodologies*
Table D.1.1.3 ID-60: $P_{STEEL,OUT,BL,y}$	*Low*	*Calculated based on actual and historical data in accordance with formulas provided in the section D.1.1.4. Initial data are determined from the measuring instruments that are calibrated in compliance with state regulations, internal standards of AMW and approved methodologies*
Table D.1.1.3 ID-61: $P_{STEEL,LF,PJ,y}$	*Low*	*Determined in accordance with state regulations and approved methodologies*
Table D.1.1.3 ID-62: $C_{STEEL,BILLET,PJ,y}$	*Low*	*Determined in accordance with state regulations and approved methodologies*
Table D.1.1.3 ID-63: $P_{STEEL,RP,PJ,y}$	*Low*	*Determined in accordance with state regulations and approved methodologies*

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

Initial data necessary for monitoring greenhouse gas emission reductions are documented, treated and stored as reporting forms referring the plant operation in compliance with current regulations (standards) of the Company concerning the assessment of consumed fuel, feed, energy resources and products output. AMW is in possession of the certificate of compliance to quality management system (QMS) according to the GOST R ISO 9001-2001 (ISO 9001:2000).

Procedures of collection, transfer and treatment of the data necessary for GHG reductions monitoring according to the monitoring plan are determined by the elaborated Standard of JSC "AMW": Industry standard #058-51-2009 "Monitoring of GHG Emission Reductions", approved by Technical director on 18.11.2009. Initial data necessary for calculating greenhouse gases emission reductions and calculation results will be stored in electronic and paper formats during all of the crediting period and two years following the crediting period. The principle structure of the monitoring plan implementing is shown below on the fig. D.3-1.

Fig. D.3-1. The principle structure of the monitoring plan implementing



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

The monitoring plan has been developed by:

CJSC "National Carbon Sequestration Foundation" (Moscow);

Contact person: Mr. Roman Kazakov, principal specialist;

Tel.: +7 499 788 78 35 ext. 113

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E-mail: KazakovRA@ncsf.ru

CJSC "National Carbon Sequestration Foundation" is not a project participant.

SECTION E. Estimation of greenhouse gas emission reductions

Estimation of greenhouse gas emission reductions is provided in accordance with formulas shown in section D. *The calculation of emission reductions is available on request.* Sections E.1.-E.2. show the results of estimation of emissions by sources determined in section B.3.

E.1. Estimated project emissions:

Table E.1-1. Estimated project emissions during the first commitment period (t of CO_2 equivalent)

№	Emission source	Year				
		2008	2009	2010	2011	2012
1	Steel furnaces	269,767	254,411	191,011	110,841	110,841
2	Ladle furnace	3,938	3,713	4,990	6,115	6,115
3	Continuous-casting machine	11,987	11,305	16,250	21,213	21,213
4	Rolling plant #1	89,319	95,933	107,785	108,471	108,471
5	Combined heat and power station (CHP) and power equipment	33,842	32,703	84,373	56,822	56,822
6	Foundary plant	1,058	998	670	-	-
7	Lime calcining furnace	34,003	32,068	43,090	52,806	52,806
8	Electric power system (the grid)	28,828	27,858	97,486	251,654	248,654
9	Pig iron production (outside JSC AMW)	38,459	36,270	29,327	19,634	19,634
10	Total	511,201	495,259	574,982	627,557	624,557

E.2. Estimated leakage:

The leakage is negligible. See the section B.3. of the PDD.

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

Table E.3-1. Estimated project emissions and leakage during the first commitment period (t CO_2 equivalent)

№	Emission source	Year				
		2008	2009	2010	2011	2012
1	Project scenario	511,201	495,259	574,982	627,557	624,557
2	Leakage	-	-	-	-	-
2	Total	511,201	495,259	574,982	627,557	624,557

E.4. Estimated baseline emissions:

Table E.4-1. Estimated baseline emissions during the first commitment period (t CO_2 equivalent)

№	Emission source	Year				
		2008	2009	2010	2011	2012
1	Steel furnaces	273,166	283,927	283,927	283,927	283,927
2	Ladle furnace	3,987	4,144	4,144	4,144	4,144
3	Rolling plant #1	102,276	106,305	106,305	106,305	106,305
4	Combined heat and power station (CHP) and power equipment	29,722	30,893	30,893	30,893	30,893
5	Foundary plant	7,746	8,051	8,051	8,051	8,051
6	Lime calcining furnace	34,432	35,788	35,788	35,788	35,788
7	Electric power system (the grid)	25,319	26,316	26,316	26,316	26,316
8	Pig iron production (outside JSC AMW)	58,787	61,103	61,103	61,103	61,103
9	Steel production (outside JSC AMW)	159,325	69,862	392,696	712,769	712,769
10	Total	694,760	626,389	949,224	1,269,296	1,269,296

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

Table E.5-1. Estimated emission reductions during the first commitment period (t CO_2 equivalent)

№	Parameter	Year				
		2008	2009	2010	2011	2012
1	Difference between E.4. and E.3. representing the emission reductions of the project	183,559	131,130	374,242	641,739	644,739

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

Table E.6-1. Table containing results of emission reductions estimation during the first commitment 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)
2008	511,201	-	694,760	183,559
2009	495,259	-	626,389	131,130
2010	574,982	-	949,224	374,242
2011	627,557	-	1,269,296	641,739
2012	624,557	-	1,269,296	644,739
Total (tonnes of CO_2 equivalent)	2,833,556	-	4,808,965	1,975,409

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:

Environmental impact assessment was made at the stage of preparation of the project documentation for reconstruction the steel plant of JSC "Ashinskiy Metallurgical Works" according to the requirements of the current legislation of the Russian Federation (section F.2.).

According to the results of the environmental impact assessment of the project, it was determined that if the project requirements are met, the results will be as follows:

- the impact of the project implementation on the environment shall not lead to irreversible changes in the natural environment,

- the project implementation will not contribute to the decline of human health,

- the project implementation is not related to the output of environmentally dangerous products,

- the project shall not significantly affect the environmental situation in the project's neighboring areas.

The information materials regarding the assessment of the environmental impact have been elaborated in accordance with the requirements of the nature conservation legislation of the Russian Federation and are included in the project documentation. *This documentation is available on request.*

JSC "AMW" has necessary permissions in area of environmental impact of the project activity:

- Permission # Ч-2066 for air pollutant emissions for a period 15.09.2009 – 15.09.2010, given by Federal Service for Ecological, Technical and Atomic Supervision on 06.10.2009.
- Permission # Ч-376 for wastewater for a period 22.12.2009 – 22.12.2014, given by Federal Service for Ecological, Technical and Atomic Supervision on 21.01.2009.
- Permission # Ч-8324 for waste generation and they placement for a period 17.07.2009 – 10.06.2014, given by Federal Service for Ecological, Technical and Atomic Supervision on 17.07.2009.

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

The assessment of the environmental impact (references to the documentation are presented in section F.1.) is made according to the Regulation on the Assessment of the Environmental Impact of a Planned Economic and Other Activity approved by Order of the State Ecological Commitee 372 of May 16, 2000. The results of the assessment of the environmental impact are subject to governmental ecological examination (Federal Law About the Ecological Examination of November 25, 1995).

Ecological examination is used to define if the planned economic and other activities comply with the environmental requirements and if implementation of the subject of assessment is acceptable with regard to possible impacts of such an activity on the natural, social and economical environments of such an implementation.

The following are the fundamental legislative acts of the Russian Federation that regulate the environmental requirements for the planned economic activity:

-Federal law On Environmental Protection of January 10, 2002

-Federal law On Ambient Air Protection” of May 04, 1999

-Water Code of the Russian Federation of November 16, 1995

-Federal law On Production and Consumption Waste of June 24, 1998

A positive conclusion by the State Environmental Examination confirms that the project activities comply with the current Russian Legislation for environmental protection, i.e. it confirms the permissible level of the project’s environmental impact at all stages of its implementation (from construction to removal from service).

Positive conclusions by the State Environmental Examination were received for the project regarding the construction of a CCM and EAF at JSC “Ashinskiy Metallurgical Works”. *This documentation is available on request.*

SECTION G. Stakeholders' comments

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

There were no public hearings regarding the project due to the absence of uncertainty factors in the company's activities. As the project is located whithin the industrial site of the plant, the project was assessed by the technical council of the works.

Annex 1

CONTACT INFORMATION ON PROJECT PARTICIPANTS

Organisation:	JSC Ashinskiy Metallurgical Works
Street/P.O.Box:	Mira St.
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City:	Asha
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URL:	http://www.amet.ru
Represented by:	
Title:	Deputy chief of Industrial control department
Salutation:	Mr.
Last name:	Lovyagin
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CJSC "National Carbon Sequestration Foundation" is not a project participant.

Annex 2

BASELINE INFORMATION

The additional baseline information is as follows:

- Table containing the key elements of the baseline (including variables, parameters and data sources);
- Historical data of steelmaking at the JSC "AMW" in 2006-2008.

Table containing the key elements of the baseline (including variables, parameters and data sources)[54]

<table>
<tr><th>№</th><th>Parameter</th><th>Description</th><th>Value</th><th>Source</th></tr>
<tr><td>1.</td><td>$P_{STEEL,RP,BL,y}$</td><td>Rolled metal production in rolling plant under Baseline</td><td><table><tr><td>Year</td><td>t</td></tr><tr><td>2008</td><td>481 050</td></tr><tr><td>2009</td><td>500 000</td></tr><tr><td>2010</td><td>500 000</td></tr><tr><td>2011</td><td>500 000</td></tr><tr><td>2012</td><td>500 000</td></tr></table></td><td>Calculated based on actual data and forecast. See the section B.1. of the PDD.</td></tr>
<tr><td>2.</td><td>$P_{STEEL,SP,BL,y}$</td><td>Steel production in steelmaking furnaces under Baseline</td><td><table><tr><td>Year</td><td>t</td></tr><tr><td>2008</td><td>652 037</td></tr><tr><td>2009</td><td>677 723</td></tr><tr><td>2010</td><td>677 723</td></tr><tr><td>2011</td><td>677 723</td></tr><tr><td>2012</td><td>677 723</td></tr></table></td><td>Calculated based on actual data and forecast. See the section B.1. of the PDD.</td></tr>
<tr><td>3.</td><td>$SMC_{SP,BL,y}$</td><td>Specific molds consumption for steel production according to the baseline</td><td>0.024 t/t (steel)</td><td>Calculated based on actual data. See the section B.1. of the PDD.</td></tr>
<tr><td>4.</td><td>$SEC_{MP,BL,y}$</td><td>Specific electric power consumption for the production process in the</td><td>0.060 MWh/t</td><td>Calculated based on actual data. See the</td></tr>
</table>

[54] Detailed information about choice and justification of key elements is provided in the section B.1. of the PDD

		foundry plant according to the baseline		section B.1. of the PDD.
5.	$SCAC_{MP,BL,y}$	Specific compressed air consumption for the production process in the foundry plant according to the baseline	0.147 thous.m^3/t	Calculated based on actual data. See the section B.1. of the PDD.
6.	$EF_{CO2,MP,TECH,BL,y}$	Process emission factor for molds production according to the baseline	0.511 tCO_2 /t	Calculated based on actual data. See the section B.1. of the PDD.
7.	$P_{STEEL,RP,BL,max,y}$	Maximum rolled products manufacture in the rolling plant according to the baseline	500,000 t/year	Estimated. See the section B.1. of the PDD.
8.	$SSC_{RP,BL}$	Specific steel consumption for rolled metal production according to the baseline	1.355 t(steel) / t(rolled products)	Calculated based on actual data. See the section B.1. of the PDD.
9.	$SRMC_{i,SP,BL,y}$	Specific carbonaceous raw material (i) consumption in steelmaking furnaces under Baseline	$SRMC_{iron,SP,BL,y}$ = 0.038 t/t $SRMC_{scrapiron,SP,BL,y}$ = 0.078 t/t $SRMC_{scrap,SP,BL,y}$ = 1.064 t/t $SRMC_{limestone,SP,BL,y}$ = 0.006 t/t $SRMC_{dolomite,SP,BL,y}$ = 0.038 t/t $SRMC_{carb.mater,SP,BL,y}$ = 0.001 t/t $SRMC_{lime,SP,BL,y}$ = 0.045 t/t	Calculated based on actual data. See the section B.1. of the PDD.
10.	$SFC_{i,SP,BL,y}$	Specific fuel (j) consumption in steelmaking furnaces under Baseline	$SFC_{naturalgas,SP,BL,y}$ = 0.114 thous.m^3/t $SFC_{fueloil,SP,BL,y}$ = 0.051 t/t	Calculated based on actual data. See the section B.1. of the PDD.
11.	$SEC_{SP,BL,y}$	Specific electric power consumption in steelmaking furnaces under Baseline	0.007 MWh/t	Calculated based on actual data. See the section B.1. of the PDD.
12.	$SCAC_{SP,BL,y}$	Specific compressed air consumption in steelmaking	0.220 thous.m^3/t	Calculated based on actual

		furnaces under Baseline		data. See the section B.1. of the PDD.
13.	$SOC_{SP,BL,y}$	Specific oxygen consumption in steelmaking furnaces under Baseline	0.022 thous.m^3/t	Calculated based on actual data. See the section B.1. of the PDD.
14.	$SSC_{LF,BL,y}$	Proportion of steel processed in ladle furnace	0.979 t/t	Calculated based on actual data. See the section B.1. of the PDD.
15.	$SRMC_{i,LF,BL,y}$	Specific carbonaceous raw material (i) consumption in ladle furnace under Baseline	$SRMC_{carb.mater,LF,BL,y}$ = 0.001 t/t $SRMC_{lime,LF,BL,y}$ = 0.013 t/t	Calculated based on actual data. See the section B.1. of the PDD.
16.	$SFC_{i,LF,BL,y}$	Specific fuel (j) consumption in ladle furnace under Baseline	$SFC_{graph.elec.,LF,BL,y}$ = 0.001 t/t	Calculated based on actual data. See the section B.1. of the PDD.
17.	$SEC_{LF,BL,y}$	Specific electric power consumption in ladle furnace under Baseline	0.065 MWh/t	Calculated based on actual data. See the section B.1. of the PDD.
18.	$SCAC_{LF,BL,y}$	Specific compressed air consumption in ladle furnace under Baseline	0.020 thous.m^3/t	Calculated based on actual data. See the section B.1. of the PDD.
19.	$SFC_{i,RP,y}$	Specific fuel (j) consumption in rolling plant	0.083 thous.m^3/t	Calculated based on actual data. See the section B.1. of the PDD.
20.	$SEC_{RP,y}$	Specific electric power consumption in rolling plant	0.034 MWh/t	Calculated based on actual data. See the section B.1. of the PDD.

21.	$SCAC_{RP,y}$	Specific compressed air consumption in rolling plant	0.046 thous.m^3/t	Calculated based on actual data. See the section B.1. of the PDD.
22.	$EF_{CO2,LP,y}$	CO_2 emission factor for lime production	0.920 tCO_2/t	Calculated based on actual data. See the section B.1. of the PDD.
23.	$EF_{k,CO2,ELEC,y}$	CO_2 emission factor for electric power production, supplied to consumers (k)	0.515 tCO_2/MWh	Calculated based on actual data. See the section B.1. of the PDD.
24.	$EF_{CO2,CA,y}$	CO_2 emission factor for compressed air production	0.045 tCO_2/thous.m^3	Calculated based on actual data. See the section B.1. of the PDD.
25.	$EF_{CO2,OC,y}$	CO_2 emission factor for oxygen production	0.703 tCO_2/thous.m^3	Calculated based on actual data. See the section B.1. of the PDD.
26.	$SRMC_{i,IRON,MP,BL,y}$	Specific iron (i) consumption for molds production	0.605 t/t for pig iron 0.295 t/t for foundry iron	Calculated based on actual data. See the section B.1. of the PDD.
27.	$W_{C,RMi}$	Carbon content in raw material (i)	limestone 0.12 t C / t dolomite 0.13 t C / t	2006 IPCC Guidelines for National Greenhouse Gas Inventories – Volume 3. Industrial Processes and Product Use, Chapter 4. Metal Industry Emissions, Table. 4.3, p. 4.27

28.	$W_{C,Fj}$	Carbon content in fuel (j)	graphite electrodes 0.82 tC/t coke 0.83 t C / t	2006 IPCC Guidelines for National Greenhouse Gas Inventories – Volume 3. Industrial Processes and Product Use, Chapter 4. Metal Industry Emissions, Table. 4.3, p. 4.27
29.	$W_{C,STEEL}$	Carbon content of steel	0.0025 t C / t	National Inventory Report about GHG emissions by sources and removals by sinks for the period 1990-2007, 2009, p. 110-113
30.	$W_{C,RMi}$	Carbon content of pig iron (scrap iron)	0.043 t C / t	National Inventory Report about GHG emissions by sources and removals by sinks for the period 1990-2007, 2009, p. 110-113
31.	$W_{C,RMi}$	Carbon content of carbonaceous materials	0.95 t C / t	TU 1971-198373-846-24-2004
32.	$W_{C,Fj}$	Carbon content of natural gas	0.514 t C / thous.m^3	Calculated. See the section B.1. of the PDD.
33.	$W_{C,Fj}$	Carbon content in heavy fuel oil	0.852 t C / t	Calculated. See the section B.1. of the PDD.

34.	44/12	Ratio of CO_2 molecular weight to C molecular weight	3.667 t CO_2 / t C	2006 IPCC Guidelines for National Greenhouse Gas Inventories – Volume 3. Industrial Processes and Product Use, Chapter 4. Metal Industry Emissions, p. 4.48
35.	$EF_{CO2,ELEC,grid,y}$	CO_2 emission factor for electric power produced in the electric power system and supplied to facilities consuming electric power	2008: 0.565 t CO_2 / MWh 2009: 0.557 t CO_2 / MWh 2010: 0.550 t CO_2 / MWh 2011: 0.542 t CO_2 / MWh 2012: 0.534 t CO_2 / MWh	Operational Guidelines for Project Design Documents of Joint Implementation Projects. Volume 1: General guidelines. Version 2.3. - Ministry of Economic Affairs of the Netherlands, 2004, p.43
36.	$EF_{CO2,IP}$	CO_2 emission factor for pig iron production from Russian metallurgical plants	1.510 t CO_2 / t	Calculated. See the section B.1. of the PDD.
37.	$EF_{CO2,SP,OUT,y}$	CO_2 emission factor for steel production from Russian metallurgical plants	1.766 t CO_2 / t	Calculated. See the section B.1. of the PDD.

Historical data of steelmaking at the JSC "AMW" in 2006-2008

1. Open-hearth furnaces

№	Parameter	Unit	2006	2007	2008
1	Steel production	t	643,662.3	652,183.2	649,523.7
1.1	inc. Ingots	t	643,662.3	564,019.2	79,515.3
1.2	Slabs	t	-	88,164.0	570,008.4
2	Iron consumption	t	42,114.1	42,410.7	25,117.3
3	Scrap iron consumption	t	73,392.9	75,582.2	47,342.9
4	Scrap metal consumption	t	561,967.9	642,533.1	698,309.6
5	Limestone consumption	t	6,159.2	4,763.4	3,726.6
6	Lime consumption	t	39,475.4	39,275.6	33,167.8
7	Dolomite consumption	t	27,223.8	28,123.9	25,094.4
8	Carbonaceous materials consumption	t	309.0	722.5	1,033.8
9	Natural gas consumption	t	75,953.0	77,666.0	72,366.0
10	Fuel oil consumption	t	36,828.0	35,600.0	31,930.0
11	Electric power consumption	MWh	5,846.5	5,750.6	4,349.6
12	Compressed air consumption	th. m3	146,844.2	161,381.0	136,908.0
13	Oxygen consumption	th. m3	-	-	12,956.2
14	Moulds consumption	t	15,768.5	13,709.6	2,157.5

2. Ladle furnace

№	Parameter	Unit	2006	2007	2008
1	Steel processed in ladle furnace	t	205,527.5	435,052.7	638,755.2
2	Graphite electrodes consumption	t	99.5	258.0	471.3
3	Electric power consumption	MWh	12,607.3	30,266.7	41,165.2
4	Compressed air consumption	th. m3	4,160.4	13,775.6	12,118.0

3. CCM

№	Parameter	Unit	2006	2007	2008
1	Slabs	t	-	65,617.4	485,397.8
2	Natural gas consumption	th. m3	-	1,683.0	4,057.0
3	Electric power consumption	MWh	-	1,686.5	12,391.1
4	Compressed air consumption	th. m3	-	4,033.0	39,262.0

4. Rolling plant #1

№	Parameter	Unit	2006	2007	2008
1	Billets consumption	t	637,242.8	654,467.3	571,350.2

1.1	inc. Ingots	t	-	81,267.6	485,397.8
1.2	Slabs	t	637,242.8	573,199.7	85,952.4
2	Rolled metal	t	469,059.8	493,041.3	485,100.7
2.1	inc. out of Ingots	t	-	70,297.1	418,977.7
2.2	out of Slabs	t	469,059.8	422,744.2	66,123.0
3	Natural gas consumption	t	53,865.0	55,409.7	53,212.0
4	Electric power consumption	MWh	22,861.5	23,142.6	19,888.8
5	Compressed air consumption	th. m3	22,455.0	32,317.6	26,664.0

5. Foundry plant

№	Parameter	Unit	2006	2007	2008
1	Mouldings production	t	21,511.6	13,834.1	3,696.7
2	Foundry iron	t	4,929.7	4,717.8	821.6
3	Pig iron	t	11,902.0	5,754.8	1,906.2
4	Scrap iron consumption	t	2,903.8	1,940.6	589.4
5	Scrap metal consumption	t	195.0	307.7	28.7
6	Limestone consumption	t	285.1	230.1	106.5
7	Natural gas consumption	th. m3	1,488.0	1,145.2	532.6
8	Coke consumption	t	2,027.8	1,208.8	311.2
9	Electric power consumption	MWh	1,749.6	1,881.6	660.7
10	Compressed air consumption	th. m3	2,481.0	2,172.7	857.5

6. Lime calcining furnace

№	Parameter	Unit	2006	2007	2008
1	Lime production	t	39,521.2	39,313.5	38,483.7
2	Limestone consumption	t	54,530.8	49,216.1	43,798.4
3	Dolomite consumption	t	-	-	-
4	Natural gas consumption	th. m3	7,427.0	7,890.4	8,098.3
5	Electric power consumption	MWh	925.6	908.4	1,372.4

7. CHP and power equipment

7.1. Electric power production and consumption

№	Parameter	Unit	2006	2007	2008
1	Electric power consumption	MWh	170,202.8	202,926.2	226,878.9
2	Electric power supplied from the grid	MWh	46,831.8	79,689.4	104,149.0
3	Electric power produced in the CHPP	MWh	123,371.1	123,236.8	122,729.9
4	Natural gas consumption in the CHPP	th. m3	24,903.0	27,179.0	30,508.0
5	Fuel oil consumption in the CHPP	t	178.0	37.0	-

7.2. Compressed air production

№	Parameter	Unit	2006	2007	2008
1	Compressed air production	th. m3	205,514.0	246,192.0	236,517.0
2	Electric power consumption	MWh	20,345.1	22,504.9	20,619.8

7.3. Technical gases production

№	Parameter	Unit	2006	2007	2008
1	Oxygen	m3	2,536,316.0	6,503,973.0	14,373,192.0
2	Azot	m3	3,295,367.0	7,769,443.0	28,245,533.0
3	Argon	m3	-	3,746,676.0	258,407.0
4	Electric power consumption	MWh	6,405.7	11,579.7	19,401.5

Annex 3

MONITORING PLAN

The essential information is provided in the section D of the PDD.

Annex 4

Calculation of CO_2 emission factors from steel and iron production at Russian ferrous industry

The calculation of greenhouse gas emission factors from steel and iron production at ferrous industry in Russia is necessary for joint implementation projects leading to expansion of steel output (added-on output), as compared to the baseline and using pig iron for steel production. For projects of this type, it is assumed that under the "without-project" situation, the added manufacture of products would take place at other enterprises of the sector, i.e. in the absence of the project, greenhouse gas emissions related to the manufacturing of these products would take place at other enterprises. To calculate greenhouse gas emissions which would take place in the absence of the project, it is necessary to define the added output and calculate the average greenhouse gas emission factor when manufacturing this product throughout the sector.

The main requirements for calculating emission factors from pig iron and steel production are as follows:

1. Define all enterprises in Russia fabricating pig iron and steel (boundary of calculation);
2. Define total greenhouse gas emissions that take place at the principal stages of the production cycle at all enterprises manufacturing these products;
3. Define the production of steel and pig iron at all enterprises manufacturing these products.

Compliance with requirements:

1. The data for the whole ferrous industry is used as initial data for the calculation of the emission factor in steelmaking, i.e. all iron and steel industry enterprises in Russia are included in the calculation of emission factors.
2. Steelmaking includes several stages: from preparation and concentration of crude product (iron ore, iron-ore concentrate, coal, coke, etc.) up to the actual steelmaking in furnaces. Estimation of greenhouse gas emissions at all steelmaking stages appears to be impossible for the moment, as the required thoroughly elaborated statistical data are not available, so for the calculation of the emission factor in steelmaking we shall restrict our considerations only to the production of pig iron for steelmaking and proper steel production. When estimating the greenhouse gas emission factor in steelmaking, it is reasonable to restrict our consideration to CO_2 emissions only because other greenhouse gas emissions which are subject to Kyoto Protocol requirements, are not typical for ferrous industry sector or are insignificant.
3. Necessary data for the calculation of the CO_2 emission factor in steelmaking (steel and pig iron production, coke and fuel consumption for production of pig iron and steel) are determined on the basis of data from the National Inventory Report of anthropogenic emissions by sources and removals by sinks of greenhouse gases not controlled by the Montreal Protocol and the IPCC guidelines.

Approach for the Emission Factor Calculation

The calculation of the CO_2 emission factor by steel production ($EF_{STEEL,y}$) at ferrous industry in Russia is made by the formulas (1-6):

(1) $$EF_{STEEL,y} = (E_{CO2,STEEL,TECH,y} + E_{CO2,IRON,TECH,y} + E_{CO2,STEEL,IRON,ENER,y}) / P_{STEEL,y}$$

$EF_{STEEL,y}$ - CO_2 emission factor by steel production at ferrous industry in Russia, tCO_2/t

$E_{CO2,STEEL,TECH,y}$ - CO_2 process emissions by steel production at ferrous industry in Russia, thous.tCO_2

$E_{CO2,IRON,TECH,y}$ - CO_2 process emissions from pig iron production for steelmaking at ferrous industry in Russia, thous.tCO_2

$E_{CO2,STEEL,IRON,ENER,y}$ - CO_2 emissions as a result of fuel combustion from pig iron and steel production at ferrous industry in Russia, thous.tCO_2

$P_{STEEL,y}$ - steel production at ferrous industry in Russia, thous.t

CO_2 process emissions by steel production ($E_{CO2,STEEL,TECH,y}$) include CO_2 emissions resulting from the oxidation of carbon contained in pig iron used in steel production and oxidation of graphite electrode carbon utilized in electric steel production. CO_2 process emissions by steel production *($E_{CO2,STEEL,TECH,y}$)* are calculated by the formula (2).

CO_2 process emissions by pig iron production for steelmaking at ferrous industry in Russia ($E_{CO2,IRON,TECH,y}$) include emissions from utilization of coke as a reducing agent in ironmaking. CO_2 process emissions by pig iron production for steelmaking *($E_{CO2,IRON,TECH,y}$)* are calculated by the formula (4).

CO_2 emissions as a result of fuel combustion from pig iron and steel production at ferrous industry in Russia ($E_{CO2,STEEL,IRON,ENER,y}$) include emissions resulting from the combustion of burning gaseous, liquid, solid and other types of fuel during the production of steel and iron. The basic data on CO_2 emissions resulting from fuel combustion during the production of steel and iron at Russian ferrous industry were taken from the National Inventory Report of anthropogenic emissions by sources and removals by sinks of greenhouse gases not controlled by the Montreal Protocol (hereinafter referred to as the National Inventory Report). Sources categories 1.A.2.a Sectoral Background Data for Energy. Fuel Combustion Activities. Manufacturing Industries and Construction. Iron and Steel.[55]

Data regarding steel production at Russian ferrous industry ($P_{STEEL,y}$) were taken from the National Inventory Report, 2009 [56] (Table 4.34, p. 103).

(2) $$E_{CO2,STEEL,TECH,y} = [(C_{IRON,Psteel,y} * W_{C,IRON} - P_{STEEL,Ciron,y} * W_{C,STEEL}) * 44/12] + $$

$$+ (P_{STEEL,ELEC,y} * EF_{CO2,STEEL,ELEC})$$

$E_{CO2,STEEL,TECH,y}$ - CO_2 process emissions by steel production at ferrous industry in Russia, thous. tCO_2

$C_{IRON,Psteel,y}$ - pig iron consumption for steelmaking at Russian ferrous industry, thous. t

$W_{C,IRON}$ - carbon content in pig iron, t/t

$P_{STEEL,Ciron,y}$ - steel production from pig iron at Russian ferrous industry, thous. t

$W_{C,STEEL}$ - carbon content in steel, t/t

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[55] Source: Common reporting format to the National Inventory Report of anthropogenic emissions by sources and removals by sinks of greenhouse gases not controlled by the Montreal Protocol. within 1990-2007, 2009, Table 1.A(a)s2 within 1990-2007

[56] National Inventory Report of anthropogenic emissions by sources and removals by sinks of greenhouse gases not controlled by the Montreal Protocol. for 1990-2007, 2009, 353 p.

44/12 - conversion rate for carbon to carbon dioxide, tCO_2/tC

$\mathbf{P_{STEEL,ELEC,y}}$ - electric steel production at Russian ferrous industry, thous. t.

$\mathbf{EF_{CO2,STEEL,ELEC}}$ - emission factor from electric steel production resulting from the use of electrodes, tCO_2/t

Pig iron consumption for steelmaking at Russian ferrous industry ($\boldsymbol{C_{IRON,Psteel,y}}$) is defined taking into account export and import of pig iron in Russia by the formula (3).

Carbon content in pig iron ($\boldsymbol{W_{C,IRON}}$) is set equal to 4,3% or 0,043 tC/t pig iron (National Inventory Report, 2009, p. 112).

Steel production from pig iron at Russian ferrous industry ($\boldsymbol{P_{STEEL,Ciron,y}}$) is assumed to be equal to the amount of pig iron for steel production ($\boldsymbol{C_{IRON,Psteel,y}}$) (National Inventory Report, 2008-2009).

Carbon content in steel ($\boldsymbol{W_{C,STEEL}}$) is assumed equal to 0,25% or 0,0025 tC/t of steel (National Inventory Report, 2009, p. 112).

Data regarding electric steel production at Russian ferrous industry ($\boldsymbol{P_{STEEL,ELEC,y}}$) were taken from National Inventory Report, 2009 (Table 4.36, p. 115).

Emission factor from electric steel production resulting from the use of electrodes ($\boldsymbol{EF_{CO2,STEEL,ELEC}}$) is assumed equal to 0,00458 tCO_2/t (National Inventory Report, 2009 (p. 113); IPCC guidelines[57], 2000, p. 3.26).

(3) $$\mathbf{C_{IRON,Psteel,y} = I_{production,y} - I_{export,y} + I_{import,y}}$$

$\mathbf{C_{IRON,Psteel,y}}$ - pig iron consumption for steelmaking at Russian ferrous industry, thous.t

$\mathbf{I_{production,y}}$ - pig iron production at Russian ferrous industry, thous.t.

$\mathbf{I_{export,y}}$ - export of pig iron from Russia, thous.t.

$\mathbf{I_{import,y}}$ - import of pig iron to Russia, thous.t.

Data on pig iron production at Russian ferrous industry ($\boldsymbol{I_{production,y}}$), *export of pig iron from Russia* ($\boldsymbol{I_{export,y}}$) *and import of pig iron to Russia* ($\boldsymbol{I_{import,y}}$) were taken from the National Inventory Report, 2009 (Table 4.36, p. 115).

(4) $$\mathbf{E_{CO2,IRON,TECH,y} = C_{COKE,Piron,y} * EF_{COKE} - P_{IRON,Psteel,y} * W_{C,IRON} * 44/12}$$

$\mathbf{E_{CO2,IRON,TECH,y}}$ - CO_2 process emissions from pig iron production for steelmaking at Russian ferrous industry, thous.tCO_2

$\mathbf{C_{COKE,Piron,y}}$ - coke consumption for production of pig iron for steelmaking at Russian ferrous industry, thous.t.

$\mathbf{EF_{COKE}}$ - emission factor from coke combustion, tCO_2/t

$\mathbf{P_{IRON,Psteel,y}}$ - production of pig iron at Russian ferrous industry for steelmaking at Russian ferrous industry, thous.t.

[57] IPCC Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories, 2000 Chapter 3: Industrial processes, p. 3.26

$W_{C,IRON}$ - carbon content in pig iron, t/t

44/12 - conversion rate for carbon to carbon dioxide, tCO_2/tC

*Coke consumption for production of pig iron for steelmaking at Russian ferrous industry (**$C_{COKE,Piron,y}$**)* is defined on the basis of data on specific consumption of coke for iron production by the formula (5).

*Emission factor from coke combustion (**EF_{COKE}**)* is assumed equal to 3,1 tCO_2/t (National Inventory Report, 2009, p. 110; IPCC guidelines, 2000, Table 3.6, p. 3.30).

*Production of pig iron at Russian ferrous industry for steelmaking at Russian ferrous industry (**$P_{IRON,Psteel,y}$**)* is calculated on the basis of data on pig iron production and export of steelmaking iron by the formula (6).

(5) $$C_{COKE,Piron,y} = P_{IRON,Psteel,y} * SC_{COKE,Piron,y}$$

$C_{COKE,Piron,y}$ - coke consumption for production of pig iron for steelmaking at Russian ferrous industry, thous.t.

$P_{IRON,Psteel,y}$ - production of pig iron at Russian ferrous industry for steelmaking at Russian ferrous industry, thous.t.

$SC_{COKE,Piron,y}$ - specific consumption of coke for production of pig iron at Russian ferrous industry, t/t

*Specific consumption of coke for production of pig iron at Russian ferrous industry (**$SC_{COKE,Piron,y}$**)* is assumed to be equal to 0,538 t of coke / t of pig iron (National Inventory Report, 2009, Table 4.32, p. 112).

(6) $$P_{IRON,Psteel,y} = I_{production,y} – I_{export,y}$$

$P_{IRON,Psteel,y}$ - production of pig iron at Russian ferrous industry for steelmaking at Russian ferrous industry, thous.t.

$I_{production,y}$ - pig iron production at Russian ferrous industry, thous.t.

$I_{export,y}$ - export of pig iron from Russia, thous.t.

The calculation of the CO_2 emission factor by pig iron production ($EF_{IRON,y}$) at ferrous industry in Russia is made by the formula (7):

(7) $$EF_{IRON,y} = E_{CO2,IP,TECH,y} / P_{IRON,Psteel,y}$$

$EF_{IRON,y}$ - CO_2 emission factor by pig iron production at Russian ferrous industry, tCO_2/t

$E_{CO2,IRON,TECH,y}$ - CO_2 process emissions from pig iron production for steelmaking at Russian ferrous industry, thous.tCO_2

$P_{IRON,Psteel,y}$ - production of pig iron at Russian ferrous industry for steelmaking at Russian ferrous industry, thous.t.

The results of the CO_2 emission factor calculation by pig iron and steel production at Russian ferrous industry

The average CO_2 emission factor in steel production, that was calculated according to the formulas (1-6) for the period 1990-2007, amounts to **1,790 tCO_2/t of steel**; uncertainty based on the variation of the factor within the investigated period, is equal to ± **1,36%,** which demonstrates the stability of the defined factor within the period under consideration.

For calculation of CO_2 emissions in steel production according to the baseline, it is suggested using the value of the factor equated to the low limit of the 95% confidence interval: **1,766 tCO_2/t of steel.**

The CO_2 emission factor in the pig iron production, calculated according to the formula (7) for the period 1990-2007, is equal to **1,510 tCO_2/t of iron**.

The values of the emission factors in iron and steel production that will be applied for monitoring greenhouse gas emissions within the period of 2008-2012 are provided below.

CO_2 emission factor from steel production for projects that increase steel production

Parameter	Unit	2008	2009	2010	2011	2012
Emission factor in steel production	tCO_2 / t of steel	1,766	1,766	1,766	1,766	1,766

CO_2 emission factors from pig iron production for projects utilizing iron from another producer for steelmaking

Parameter	Unit	2008	2009	2010	2011	2012
Emission factor in steel production	tCO_2 / t of iron	1,510	1,510	1,510	1,510	1,510

Conservatism of CO_2 emission factors calculation

1) The given approach to the calculation of the CO_2 emission factor from steel production fully complies with the approach to the calculation of CO_2 emissions from the production of iron and steel provided in the National GHG Inventory Report of the Russian Federation. Hence, CO_2 emission reductions defined through the use of calculated emission factors will comply with CO_2 emission reductions set out in the GHG emissions National Inventory.

2) When calculating CO_2 emission factor from steel production, we restrict our consideration only to the manufacture of pig iron for steel production and proper steel production. Such metallurgical processes as coke production, sintering, casting, milling, pellets and direct reduction iron production are excluded. Hence, the calculated emission factor is underestimated.

3) When calculating CO_2 emission factor from steel production, according to the given approach, the emissions resulting from the use of some sorts of carbonaceous feed (e.g. limestone, dolomite, carbonaceous powders, etc.) in steel and iron production are not taken into consideration.

4) When calculating CO_2 emission factor for steel production according to the given approach, CO_2 indirect emissions are not taken into consideration, e.g. emissions resulting from the production of electrical power supplied from the electric power system (grid).

5) For calculating CO_2 emissions from steel production according to the baseline in JI projects, we use a factor value complying with the low limit of the 95% confidence interval.

6) If other CO_2 emission factors from iron and steel production are developed and approved during the implementation of the project, the emission factors (1,766 tCO_2/t of steel and 1,510 tCO_2/t of iron) may be revised.