Monitoring report of GHGs emission reduction

JI PROJECT:

«PRODUCTION OF CONTINUOUSLY CASTED SLAB STEEL BILLET BY ARC-FURNACE TECHNIQUE AT OJSC MMK»

Monitoring period: 01.01.2008 – 31.12.2010

Version 1.1. (final after verification)

Data of development of this version: 05 July 2011.

CONTENTS

A. General information on the project

A.1. Introduction

The aim of report is representation of the monitoring results and results of calculation of Emission Reduction Units (ERUs) generated by the JI project “Production of continuously casted slab steel billet by arc-furnace technique at OJSC MMK” for the period from January 01, 2008 to December 31, 2010.

Monitoring report has been developed in accordance with PDD version 1.2 of February 01, 2011 (the Bureau Veritas Certification Holding SAS has issued a positive expert opinion № RUSSIA-det/0105/2010).

The project has no approval yet in the Russian Federation as a Host Party. This is in process of receipt awaiting the announcement for submission of the project application to the Operator of carbon units (Sberbank) in accordance with procedure stipulated in the Decree #843 of 28, October 2009.

The Declaration of Approval from State of the Netherlands, acting through the Ministry of Economic Affairs, Agriculture and Innovation and its implementing agency “NL Agency”, being the Designated Focal Point for Joint Implementation (JI) in The Netherlands has been received for the project by 1st June 2011.

A.2. Brief description of the project

The proposed JI project takes into account the production of slab steel billet in the EAFP of MMK. The EAFP includes the following units: two high-capacity electric arc furnaces (EAF-180) manufactured by Austrian company “Voest-Alpine AG” with output capacity of 2 million tons of liquid steel per year each, one double-bath steelmaking unit (DBSU), ladle furnace steel processing aggregates, one slab continuous-casting machine (CCM #5) with capacity of 2 million tones/year of slab steel billet and two section continuous casting machines manufactured by Austrian company “VAI” with total capacity of 2 mln. tones/year of profiled steel billet. Thereby EAFP produces both profiled and slab steel billet. Technical implementation of the project took place in 2003-2006 in accordance with the following schedule:

Table A.2.1. Project implementation schedule

Year	**Operating capacities, phase-out and commissioning dates**
2003	Two DBSUs and three classic open hearth furnaces were in operation
2004	Demounting : three classic open hearth furnaces Commissioning: LFA #1, two section CCMs #1, 2 In operation: two DBSUs
2005	Demounting: one DBSU, chemicals preparation plant, blooming mill plant (BMP) In operation: DBSU #32, LFA #1, section CCMs #1, 2
2006	Commissioning: **two electric arc furnaces (EAF) #1, 2, LFA #2 (reconstruction of SRA #1), one slab CCM #5** In operation: DBSU #32, LFA #1, section CCMs #1, 2
2008	Commissioning: LFA #3 In operation: EAF #1, 2, DBSU #32, slab CCM #5, section CCMs #1, 2, LFA #1, LFA #2

The project "Implementation of arc-furnace steelmaking at Magnitogorsk Iron and Steel Works" was arranged as Joint Implementation project[1] and passed a determination and verification by Bureau Veritas, however in the project boundary the only profiled steel billet production was included as previously this function was performed by open-hearth furnace plant and blooming mill plant, i.e. steel billet was made at the own industrial site area.

The proposed project takes into account the greenhouse gas emissions associated with production of slab steel billet in EAFP of MMK. Output of slab steel billet is equivalent in the project and in the baseline.

In the absence of the proposed JI project the production of slab steel billet would be carried out at the existing metallurgical works of Russia (including the oxygen-converter shop of MMK) or newly introduced capacities (during the crediting period). The most common method of steelmaking at the existing metallurgical works of Russia, which are under the project boundary – smelting in oxygen converters, for instance:

- in 2008 the share of this technology accounted for 73.92 %, the share of steel melted in electric arc steel furnaces was 14.74 % and the share of steel produced by different versions of the open-hearth process: the pig-and-ore process, the scrap process and the production in double-bath steelmaking units was 11.34 %;
- in 2009 the share of smelting in oxygen converters – 78.50 %, the share of steel melted in electric arc steel furnaces – 15.78 %, the share of steel produced by different versions of the open-hearth process – 5.72 %;
- in 2010 - 80.05 %, 15.80 % and 4.15 % accordingly.

CO_2 emissions from production of one ton of steel by steel mills of Russia exceed CO_2 emissions from production of one ton of steel in EAFP of MMK, because open-hearth and oxygen-converter method of steel production are more resource-and carbon intensive in comparison with the arc-furnace process due to use of mostly pig iron as a raw material (except open-hearth scrap process).

Smelting of slab steel by arc-furnace technique followed by casting at continuous casting machine today in Russia is the most advanced technology which promotes resource saving and this is achieved by a large percentage of steel scrap in the charge of smelting furnaces in comparison with other methods of steel production.

A.3. Emission reduction during monitoring period

Current report takes into account CO_2 emission reduction generated during 2008-2010. Detailed calculations are in the section D.

The actual generation of ERUs:

for the period of 1st January 2008 to 31st December 2008 is **469 338** tonnes CO_{2eq}

for the period of 1st January 2009 to 31st December 2009 is **62 690** tonnes CO_{2eq}

for the period of 1st January 2010 to 31st December 2010 is **203 815** tonnes CO_{2eq}

In accordance with PDD, version 1.2 of February 01, 2011 the expected volume of ERUs:

for the period of 1st January 2008 to 31st December 2008 is 465 214 tonnes CO_{2eq}

---

[1] http://ji.unfccc.int/JI_Projects/DB/3YOHME3FSIKG8602M8WN9D60QNIQT7/PublicPDD/YAGHLX0KYONQCE VWW7EHHU3EW75Z32/view.html

for the period of 1st January 2009 to 31st December 2009 is 0 tonnes CO_{2eq}

for the period of 1st January 2010 to 31st December 2010 is 189 483 tonnes CO_{2eq}

Despite the fact that PDD version 1.2 of February 01, 2011 was developed using actual data for 2008 and 2009 the more accurate calculation of specific consumption of pig iron per ton of steel billet produced in EAFP (which has been made per month in the present monitoring report), has given a more precise value of ERUs for these years. The significant difference in the amount of ERUs in 2009 calculated in this report and in the PDD connects with the fact that the slab steel billet in contrast to the profiled one was not produced in 2009 during several months. Calculation of ERUs in section E of the PDD was conducted on an annualized basis and generally for EAFP, so the value of specific consumption of pig iron per ton of steel billet was overrated and incorrect with respect to the slab steel smelting.

A.4. Contact information on project participants

Contact person on project participants:

Company:	OJSC "Magnitogorsk Iron and Steel Works"
Street:	Kirova
Building:	93
City:	Magnitogorsk
State/region	-
Zip code:	455000
Country:	Russia
Phone:	+7 (3519) 24-78-98
Fax:	+7 (3519) 24-71-40
e-mail:	mit@mmk.ru
website:	www.mmk.ru
Representative:	
Position:	Manager of environmental and regional programs
Title:	Mr.
Family name:	Mitchin
Name:	Andrey Mikhailovich
Department:	Department for relations with state authorities and markets protection

Contact person on consultant of project participant and project developer and developer of monitoring report:

Company:	CTF Consulting, LLC
Street:	Baltschug
Building:	7
City:	Moscow
State/region	-
Zip code:	115035
Country:	Russia
Phone:	+7 (495) 984-59-51
Fax:	+7 (495) 984-59-52
e-mail:	konstantin.myachin@carbontradefinance.com
website:	http://www.carbontradefinance.com/
Representative:	

Position:	Carbon projects manager
Title:	
Family name:	Myachin
Name:	Konstantin Yurevich
Department:	-

B. Monitoring system of GHGs emission reduction

B.1 Information on the collection and archiving of information on the environmental impacts of the project

In accordance with requirements of Articles 14, 22 the Federal Law on environmental protection # 7-FZ OJSC "MMK" has the approved Maximum Permissible Emissions (MPE) document. This document is approved by Chelyabinsk Regional Department of Technological and Environmental Surveillance of Rostechnadzor. This decision is valid for one year. Under this decision the harmful emission permit is issued. This permit quantified impacts to atmosphere by OJSC "MMK".

For confirmation of MPE the air emissions were estimated by OJSC "Magnitogorsk GIPROMEZ" in accordance with Russian "Guidelines for calculation of industrial emissions of air pollutants" (OND-86)[2]. These estimations were based on OJSC "MMK" Emission Inventory and Emission Sources Report done by Federal State Unitary Enterprise "All-Russian Institute for Carbon Chemistry" in Yekaterinburg (2008). This report was approved according to the established procedure.

Laboratory for Control of Air Quality of OJSC "MMK" performs environmental monitoring according to the monitoring schedule.

According to the provisions of Russian environmental law (Federal Law №7-FZ of 10.01.2002 "On Environmental Protection"), environmental experts and managers of polluting enterprises must have qualifications in environmental protection and environmental safety. Functions of the Department of environmental protection are ensuring compliance with environmental quality standards, obtaining government permits for emissions and discharges of hazardous substances, disposal of waste.

In accordance with referred above Federal Law OJSC "MMK" has the approved Maximum Permissible Discharge of Sewage document (MPDS) and Permissible Norm of Producing and Placement of Wastes document (PNPPW). In these documents procedure of collecting and archiving of information on the environmental impacts is defined.

There is a monitoring plan in MPDS document, which is defined the monitoring parameters, frequency of measurement for each parameter and responsible personnel. Monitoring plan is approved by OJSC "MMK". In PNPPW document list and quantity of produced wastes, frequency of producing, places of storage and responsible personnel are defined. This document is approved by OJSC "MMK".

Considering the above we can conclude that OJSC "MMK" conduct the periodic monitoring of the environment impacts. The enterprise also has an environmental management system certified by ISO 14001.

According to the information from Environmental department of OJSC "MMK" confirmed during the visit in January 2011:

The project was fully put into operation is 2006 and environmental protection equipment designed for it (gas purification units at EAFs, etc) operates normally. The total environmental impact for the section steel production has been radically reduced in comparison with the open-hearth/ingots casting technology.

Emissions of polluting substances are normalized in the permission to emission of the polluting substances, given out by Rostehnadzor in the Chelyabinsk area. Results of inventory of emissions prepares annually.

[2] http://www.vsestroi.ru/snip_kat/ad977f56010639c6e1ba95802d182677.php

According to the valid permission the emissions of pollutant substances do not create maximum concentration above limit, except a number of substances (nitrogen (IV) a dioxide, sulfur a dioxide, hydrogen sulfide, carbon oxid, phenol) for which the temporarily permission is established.

The polluted water is treated at local treatment facilities. The enterprise has several closed loop water turnover systems. The water which is subject to the discharge is released in the river Sukhaya (inflow of the river Ural).

Placing of a waste occurs in conformity to the project of specifications of formation of a waste and limits on their placing, confirmed by Rostehnadzor in the Chelyabinsk area.

B.2 Methodological approach applied (summary from PDD, version 1.2 of February, 01 2011)

Monitoring of the baseline and project emissions during 2008-2010 has been performed in accordance to the PDD, version 1.2 of February, 01 2011 except adjustments and deviations given in the Section C.

JI specific approach is applied for the monitoring of GHGs emission in accordance with paragraph 9 (a) of the "Guidance on criteria for baseline setting and monitoring" (Version 02).

MMK is a metallurgical complex where production of coke and pig iron meets the needs not only the EAFP, but the oxygen-converter shop. EAFP produces both section slab and profiled steel billet (this is beyond the project boundary and considered in the PDD of the JI project "Implementation of arc-furnace steelmaking at Magnitogorsk Iron and Steel Works"[3], passed a determination and verification by Bureau Veritas).

To calculate CO_2 emissions the specific CO_2 emissions per ton of coke, pig iron and steel billet are determined. Then specific emissions are multiplied by the output of these products in the amount needed to production of slab steel billet.

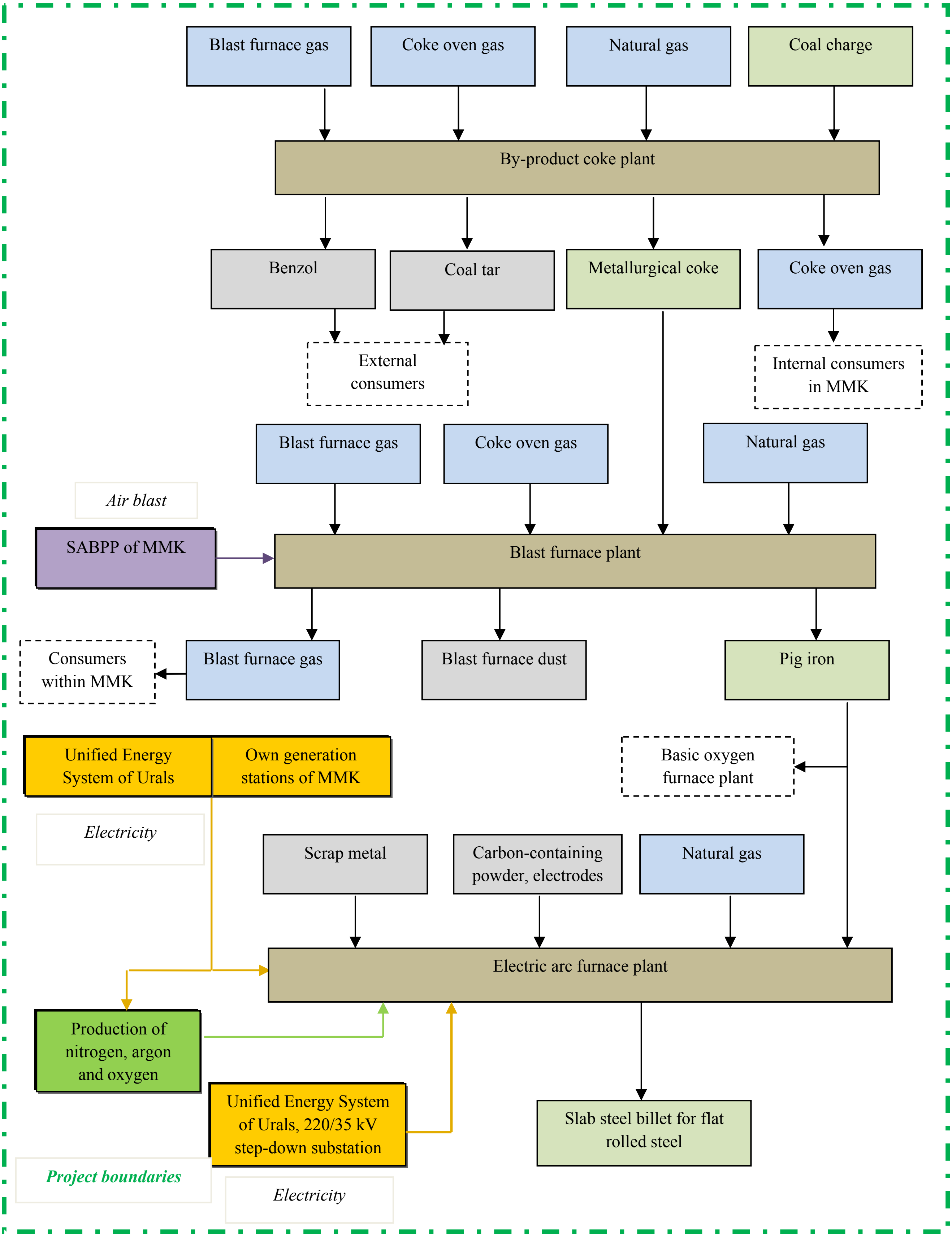
The project boundaries include:

- Metallurgical conversion stages of MMK: coking coal production in the by-product coke plant, blast-furnace plant, EAFP
- Own power generation capacities of MMK: CHPP, CPP, SABPP, turbine section in the steam plant, gas recovery section in the steam plant
- Unified Energy Systems of the Russian Federation: Center, North West, South, Middle Volga, Urals, Siberia, East.
- Existing metallurgical works or newly introduced capacities (during the crediting period) in Russia with capacity to produce slab steel billet.

---

[3] http://ji.unfccc.int/JI_Projects/DB/3YOHME3FSIKG8602M8WN9D60QNIQT7/PublicPDD/YAGHLX0KYONQCEVWW7EHHU3EW75Z32/view.html

Diagram B.2.1. Project boundaries. Project scenario



Project CO_2 emissions are calculated as follows:

1. CO_2 emissions from metallurgical conversions within the project boundaries (using carbon balance method) are estimated to determine specific CO_2 emissions per ton of coke, pig iron and steel billet produced in EAFP (profiled and slab combined).
2. Specific consumption of pig iron for production of one ton of steel billet produced in EAFP and specific consumption of metallurgical coke per one ton of pig iron is determined.
3. Project CO_2 emissions from metallurgical conversions during production of slab steel billet using defined specific values and coefficients are calculated.
4. CO_2 emission coefficients associated with generation of electricity and air blast at MMK, and project emissions from consumption of electricity in EAFP and consumption of air blast in BFP required for production of the slab steel billet are calculated.
5. Total project CO_2 emissions associated with production of slab steel billet are summarized.

The production of metallurgical coke is accompanied by the formation of by-product - coke breeze. The coke batteries in BPCP (By product coke plant) produce gross coke, which after quenching is sifted to coke breeze and metallurgical coke, then metallurgical coke is transported to BFP. Coke breeze is transported to the sintering plant where it is used as fuel for sintering machines. Excess of coke breeze is sold to other companies, where the coke breeze is used as a special high-carbon fuel or as a component of the carbon-containing powder in metallurgy. As the coke breeze completely burns to CO_2 in the process of its use, these carbon dioxide emissions are attributable to the production of raw material for BFP – metallurgical coke, which is a major end product of the BPCP. Thus the integrated emission factor is calculated for the production of metallurgical coke. In BFP the metallurgical coke is sifted once again with separation of additional coke breeze, which is formed during the transportation from BPCP to BFP. In line with conservative approach this coke breeze has not been considered in the calculation of BFP and BPCP CO_2 emissions.

Blast furnace dust and scrubber sludge are particular kinds of industrial waste generated during blast furnace process. They originate in the system of dry cleaning of blast furnace gas and contain significant amounts of carbon. These materials are transported to agglomeration plant and consumed during production of fluxed agglomerate. The carbon from blast furnace dust and scrubber sludge is fully released as CO_2. Therefore, these emissions are included in emissions during production of pig iron in blast furnace plant. A small fraction of blast furnace dust comes to the cement plant. CO_2 emissions during utilization of this dust at the cement factory are considered as leakages and fully accounted in the monitoring plan of the JI Project "Implementation of arc-furnace steelmaking at Magnitogorsk Iron and Steel Works". This PDD had been determined by independent expertise (determination) by Bureau Veritas[4]. To avoid double counting the CO_2 emissions during utilization of this dust at the cement factory are not calculated in this project.

The consumption of production inputs, raw materials, energy resources, and the output of commercial products are routinely monitored by MMK applying the system of factory monitoring and reporting. These parameters are measured in accordance with applicable standards and rules in the iron and steel industry of Russian Federation as well as international standards (OJSC "MMK" is certified by ISO 9001 standard). All required parameters are available within the factory monitoring and reporting system implemented at MMK and thus associated procedure for monitoring of CO_2 emissions does not require any additional changes or improvements in the existing system.

---

[4]http://ji.unfccc.int/JI_Projects/DB/3YOHME3FSIKG8602M8WN9D60QNIQT7/PublicPDD/YAGHLX0KYONQCEVWW7EHHU3EW75Z32/view.html

The majority of carbon content parameters included in the monitoring plan are regularly determined by direct analyses in Central Lab of MMK or calculated on the basis of chemical composition of carbon-containing substances. The samples of blast furnace gas and coke oven gas are analyzed in CEST lab and the data on chemical composition of natural gas are taken from its technical passport issued and provided by the supplier.

Table B.2.1. Values of parameters that are used in calculation formulae but fixed ex-ante as per PDD and applied only for the project emissions calculation (i.e. are relevant to OJSC "MMK" only) [5]

#	Parameter and measurement units	Variable	Value	Source of data
1.	Carbon content in crude benzol, % by mass	**$\%C_{benzol}$**	90.0	The Central Lab of MMK performs a test of chemical composition of crude benzol once a month. The carbon content in crude benzol therefore can be determined by known carbon content in each component and its % mass fraction. During development of the PDD the analysis of chemical composition of crude benzol has been taken (QMS reporting form SMK CLK (51)-22-2) and calculated carbon content of crude benzol was 87.8%. As a conservative assumption the value with a certain margin (2,2%) was applied and fixed ex-ante, i.e. 90%.
2.	Carbon content in coal tar, % by mass	**$\%C_{coal\text{-}tar}$**	86.0	During development of the PDD OJSC "MMK" provided to CTF, LLC a Memo #BPCP-C296 of 02.06.2009 (in the PDD by mistake data was mentioned as 26.06.2009), signed by Director of BPCP. It stated that by measurements the carbon content in the coal tar was 83%. By information of BPCP during site visit similar measurements in several preceding years showed the maximum value of 84%. As a conservative assumption the maximum value with a certain margin (2%) was applied and fixed ex-ante, i.e. 86%
3.	Carbon content in pig iron, % by mass	**$\%C_{pig\ iron}$**	4.70	This is an important technological indicator, which determines the end of blast furnace smelting. Final carbon content of pig iron is a technological standard and measurements of the carbon content are performed by MMK Central Lab constantly. The average value for 2002 and 2007 was 4.7 % and provided in the Letter of

[5] The data confirming the appropriateness of values of these parameters as a ground for their fixing ex-ante has been provided during determination of the PDD and available at OJSC "MMK" by request

				OJSC MMK to CTF, LLC by 16.02.2009. Due to stability of the value it was decided to fix ex-ante the carbon content in pig iron as 4.7 %.
4.	Carbon content in scrap metal, % by mass	**$\%C_{scrap}$**	0.18	Electric Arc Furnaces consume scrap metal during steel smelting. The supplied scrap metal is a subject for incoming control by MMK. The carbon content in the scrap metal varies depending on its origin but does not exceed 0,2% by measurements, however usually is less (information from specialists of EAFP). As an assumption for simplicity the carbon content of steel produced at EAFP of MMK (i.e. 0,18%) was applied for scrap metal and fixed ex-ante.
5.	Carbon content in carbon-containing powder, % by mass	**$\%C_{carbon\ powder\_EAFP}$**	95.0	In accordance with standard specification 1971-003-13303593-2006, which is confirmed by quality certification.
6.	Carbon content in electrodes, % by mass	**$\%C_{electrodes\_EAFP}$**	99.0	In accordance with standard specification 1911-109-052-2003, which is confirmed by quality certification.
7.	Carbon content in steel, % by mass	**$\%C_{steel}$**	0.18	This is an important technological indicator, which determines quality of steel and may vary only within very narrow bounds depending on type of steel. The average carbon content of steel product mix, produced by the EAFP within long period of time (one year), based on MMK Lab measurements is quite stable. For 2002 the measurements performed by MMK Lab has shown the average value of 0.19 % and for 2007 the average value of 0.18%. Due to stability of the value it was decided to fix ex-ante the carbon content in steel as 0.18 % (the least one as more conservative).
8.	Carbon content in power station coal, % by mass	**$\%C_{energy\ coal}$**	73.0	IPCC Guidelines 2006 default value has been taken as no measurements of the carbon content in power station coal are performed at OJSC "MMK".
9.	Specific electricity consumption for nitrogen production at MMK, MWh/1.000 m^3 (since July 2010)	**SEC_{N2_PJ}**	0.150	Nitrogen compressors which provide EAFP with nitrogen were switched to another current feeder in July 2010. As a result it has become impossible to separate the amount of electricity spent for compression of nitrogen.

				In August 2010 the Oxygen shop of OJSC "MMK" provided a note that in July 2010 the nitrogen compressors which provide the EAFP with gaseous nitrogen were switched. As a result it became impossible to define a quantity of electricity used for compressing of the nitrogen. In the letter # KC-1079-06 of 05.08.2010 sent by Oxygen shop to CEST it was proposed to revise an order of electricity consumption accounting for nitrogen generation and fix the value as 150 kWh/1000 m^3. The value of parameter had been monitored until July 2010. The average value for January-June 2010 is 141 kWh/1000 m^3. Therefore the fixed ex-ante value of specific electricity consumption for production of nitrogen as 150 kWh/1000 m^3 can be considered as conservative.
10.	Specific electricity consumption for production of pure nitrogen at MMK, MWh/1.000 m^3	**$SEC_{pure\_N2\_PJ}$**	0.826	Values of specific electricity consumption for production of pure nitrogen and argon are reported in the Summary of energy consumption by departments of OJSC "MMK". During the visit to the works in January 2011 it was revealed that in fact these values are not measured but determined only once because the technical ability for their instrumental measurements currently is absent. This practice takes place over the several years including the period from January 1, 2008, and in the reporting for 2008 and 2009 the mentioned values remained same. Anyhow the values are still subject of monitoring and reporting at MMK and not fixed ex-ante. The appropriate confirmation by the Technological department of MMK is provided in the e-mail from the Head of Section of regulation and analysis of fuel and energy resources consumption, date 17/03/2011 mrs. Irina Kucherova:"The consumption rates were determined in 1994, consumption of electricity for nitrogen production was calculated through the known value of consumption of electricity for oxygen production in the ratio of the melting points of nitrogen
11.	Specific electricity consumption for production of argon at MMK, MWh/1.000 m^3	**SEC_{Ar_PJ}**	0.055	

				and oxygen (at an estimated exergy). The consumption of electricity for argon production was determined as electricity consumption for purification and compressing of the crude argon (this is a by-product of oxygen production) – for that the additional equipment had been installed.
12.	CO_2 emissions factor for grid electricity produced by Unified Energy System of Urals, t CO_2/MWh	EF_{grid_Ural}	0.541	Report on GHG emission factors for Russian energy systems (2008)[6]. This report was prepared by Carbon Investments Ltd. by order of Carbon Trade & Finance SICAR S.A., and approved by Accredited Independent Entity (AIE) Bureau Veritas in October-November 2008. Official approval was received November, 10 2008.

Baseline CO_2 emissions are calculated as follows:

1. The number of metallurgical works of Russia with capacity for production of slab steel billet is identified according to data of quarterly reports "Analysis of the expenditure of materials and process fuel by production of pig iron, steel and rolled iron at ferrous metallurgy works", "Corporation CHERMET", LLC and information from public sources in the Internet (web sites of metallurgical works to insure that slab steel billet is produced);
2. General CO_2 emission factor for steel production is calculated for each metallurgical works of this group of metallurgical enterprises of Russia. General CO_2 emission factor for steel production characterizes the carbon intensity of steel production at the metallurgical works. The basis of calculation is statistic data of "Corporation CHERMET", LLC. The calculation is provided for the steel smelting at the whole enterprise without separation of slab steel production, because of such detailing is not provided in statistic data;
3. General CO_2 emission factor for steel production is calculated based on the share of each technique of steel production (converter, arc-furnace, pig-and-ore process, steel production in DBSU, scrap process) in the whole volume of steel output at the metallurgical works. In turn for each used technique the specific CO_2 emissions from production of one ton of steel are calculated separately based on statistic data of specific consumption of relevant carbon-bearing raw materials and energy sources (consumption of pig iron, natural gas, electrodes, electricity, oxygen) and fixed ex-ante CO_2 emissions factors for them;
4. Integrated CO_2 emission factor for steel production at the Russian metallurgical works with capacity for production of slab steel billet is calculated based on general CO_2 emission factor for steel production at each metallurgical works and share of each metallurgical works with capacity for production of slab steel billet in the whole volume of steel output by this group metallurgical works of Russia.
5. Taking into account the output of slab steel billet in EAFP of MMK and integrated CO_2 emission factor for steel production at the Russian metallurgical works with capacity for production of slab

[6] The Report and its results are exclusively owned by "Carbon Trade & Finance SICAR S.A." and it can be used only after written permission of the owner.

steel billet, the baseline emissions CO_2 from slab steel production at the metallurgical works of Russia are calculated.

Table B.2.2. Values of parameters that are used in calculation formulae but fixed ex-ante as per PDD and applied for the baseline emissions calculation[7]

#	Parameter and measurement units	Variable	Value	Source of data
1.	CO_2 emission factor for iron production, t CO_2/t pig iron	**EF** $_{iron}$	1.35	IPCC Guidelines 2006, Chapter 4, table 4.1.
2.	CO_2 emission factor for NG combustion, t CO_2/ 1,000 m^3 (confirmed by data of OJSC "Ashinsky metallurgical works")	**EF** $_{NG}$	1.88	Calculated on the base of data of CO_2 EF for NG combustion – 56,100 kg/TJ (IPCC Guidelines 2006, volume 2, Chapter 1, Introduction, table 1.4), data of net calorific value of NG – 48.0 TJ/Gg (IPCC Guidelines 2006, volume 2, Chapter 1, Introduction, table 1.2) and density of NG under normal conditions. Since the composition of NG is variable in different regions, we standardize this value at 0.7 kg/m^3
3.	CO_2 emission factor for electrodes consumption, t CO_2/t electrodes	**EF** $_{electrodes}$	3.007	Calculated on the base of data of carbon content in electrodes (IPCC Guidelines 2006, Chapter 4, table 4.3.). Carbon content 0.82 is multiplied by 44/12.
4.	Electricity consumption for oxygen production, MWh/ 1,000 m^3	**EC** $_{oxygen}$	0.83	The main producers and suppliers of air separation units for metallurgical works are JSC "Cryogenmash" (cryogenic plant) and "Energotechprom", LLC (absorption and membrane plants). Air separation units of JSC "Cryogenmash" are installed at MMK, NTMK, NKMK, Seversteel, Zapsib[8]. Electricity consumption for oxygen production for units KAr-30 is 0.83 MWh/ 1,000 m^3.[9] Electricity consumption for oxygen production for units K-0.25 is 1.2 MWh/ 1,000 m^3.[10] So taking account the conservativeness approach we use the lowest value of this parameter – 0.83 MWh/1,000 m^3.
5.	CO_2 emissions factor for grid electricity produced by Unified Energy System of Center, t	**EF** $_{grid\_Centre}$	0.511	Report on GHG emission factors for Russian energy systems (2008). This report was prepared by Carbon Investments Ltd. by order of Carbon

[7] The data confirming the appropriateness of values of these parameters as a ground for their fixing ex-ante has been provided during determination of the PDD and available at OJSC "MMK" by request

[8] http://www.cryogenmash.ru/

[9] http://www.arcelormittal.com.ua/index.php?id=126&p=224

[10] http://www.compressed-air.ru/odessa/ustanovka-k-025.html

	CO_2/MWh			Trade & Finance SICAR S.A., and approved by Accredited Independent Entity (AIE) Bureau Veritas in October-November 2008. Official approval was received November, 10 2008.
6.	CO_2 emissions factor for grid electricity produced by Unified Energy System of Northwest, t CO_2/MWh	**EF** $_{grid\_Northwest}$	0.548	Same as above.
7.	CO_2 emissions factor for grid electricity produced by Unified Energy System of Middle Volga, t CO_2/MWh	**EF** $_{grid\_Middle\ Volga}$	0.506	Same as above.
8.	CO_2 emissions factor for grid electricity produced by Unified Energy System of Urals, t CO_2/MWh	**EF** $_{grid\_Ural}$	0.541	Same as above.
9.	CO_2 emissions factor for grid electricity produced by Unified Energy System of South, t CO_2/MWh	**EF** $_{grid\_South}$	0.500	Same as above.
10.	CO_2 emissions factor for grid electricity produced by Unified Energy System of Siberia, t CO_2/MWh	**EF** $_{grid\_Siberia}$	0.894	Same as above.
11.	CO_2 emissions factor for grid electricity produced by Unified Energy System of East, t CO_2/MWh	**EF** $_{grid\_East}$	0,823	Same as above.

B.3 Approach for organization and implementation of monitoring, project emissions

The system of monitoring for the project has functioned during the year in accordance with internal procedure PD MMK 3-SSGO-01-2010 "Regulation on monitoring of GHG emissions reduction, created as a result of the realization of the project: "Implementation of arc-furnace steelmaking at Magnitogorsk Iron and Steel Works". Despite the fact that initially this procedure was developed for the mentioned project it perfectly suits to the considered one as the monitoring parameters are practically same and reporting forms used in the moritoring are fully identical. Therefore MMK monitored all parameters of the monitoring plan before development and determination of PDD.

Results of monitoring of 2008-2009 based on the system that existed prior to this point of time and practically identical to the developed later, with the exception of involvement the Department for relations with state authorities and markets protection in the monitoring procedure.

Hereby all relevant monitoring information was collected and stored with accordance with MMK corporate rules and regulations but was not qualified as related to JI project boundaries.

The mentioned internal Regulation MMK 3-SSGO-01-2010 has been designed to establish a clear and transparent set of authorities and responsibilities for identification of monitoring parameters, timely transfer of relevant reporting forms to MMK JI coordinator and to external consultant (CTF Consulting, LLC) and creation of provisions for secure long-term conservation of monitoring data in accordance with international requirements to JI. It is planned to up-date it following the positive determination of the considered project "Production of continuously casted slab steel billet by arc-furnace technique at OJSC MMK".

Monitoring of greenhouse gases emission reduction is carried out at OJSC "MMK" based on continuous monitoring of the monitoring parameters (Table B.3.1) specified in the PDD. Monitoring report is subject for verification.

Departments responsible for monitoring of each parameter of the JI project carry a responsibility for the treatment of primary reporting documents, processing, preparation, verification and transfer to the Department for relations with state authorities and markets protection (JI project implementation coordinator) of the reporting documents containing the information about monitored parameters. In each department of OJSC "MMK" involved in monitoring under the JI project the head of the department assigns a person responsible for provision of the reporting documents and tracking of the parameters change.

Picture B.3.1. Management structure of monitoring process

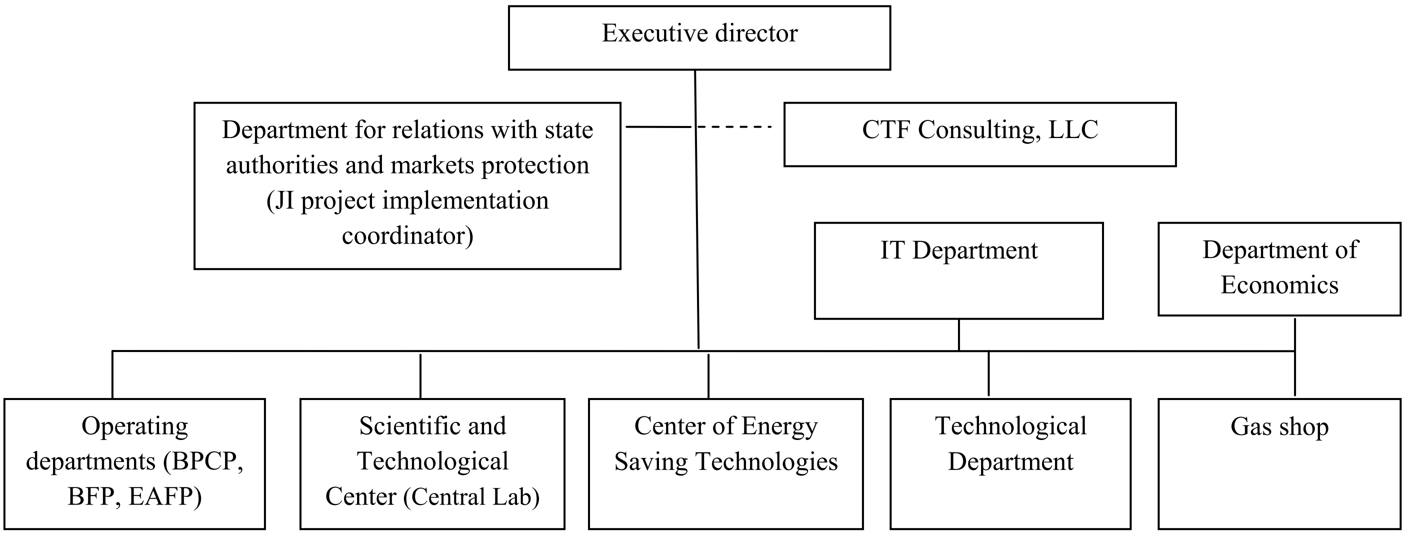


Table B.3.1. Responsibility of departments for monitoring parameters

#	Department	Monitoring parameter
1	By-product coke plant	1. Consumption of dry coal charge 2. Production of dry metallurgical coke 3. Production of crude benzol 4. Output of dry coal tar
2	Blast-furnace plant	5. Consumption of dry skip metallurgical coke 6. Production of pig iron
3	Electric arc-furnace plant	7. Consumption of pig iron in EAFP 8. Consumption of carbon-containing powder in EAFP 9. Consumption of scrap metal in EAFP 10. Consumption of electrodes in EAFP 11. Output of slab steel billet in EAFP 12. Total production of slab and profiled steel billet in EAFP

		13. Total smelting of steel in EAF-180
4	Technological department	14. Total electricity consumption by MMK 15. Electricity purchase from Unified Energy System of Urals grid 16. Total electricity consumption in EAFP 17. Consumption of grid electricity by EAF-180 18. Consumption of BFG in CPP 19. Consumption of NG in CPP 20. Consumption of NG in CHPP 21. Consumption of BFG in SABPP 22. Consumption of COG in SABPP 23. Consumption of NG in SABPP 24. Consumption of NG in turbine section of SP 25. Consumption of NG in recovery unit of SP 26. Consumption of power station coal by CHPP 27. Generation of air blast at MMK 28. Consumption of BFG in SABPP for generation of air blast 29. Consumption of COG in SABPP for generation of air blast 30. Consumption of NG in SABPP for generation of air blast 31. Output of oxygen by oxygen-compressor shop (OCS) #1 32. Output of oxygen by oxygen-compressor shop (OCS) #2 33. Specific electricity consumption for production of oxygen in OCS #1 34. Specific electricity consumption for production of oxygen in OCS #2
5	Center of Energy Saving Technologies	35. Consumption of BFG in BPCP 36. Carbon content in BFG 37. Consumption of COG in BPCP 38. Carbon content in COG 39. Consumption of NG in BPCP 40. Output of COG in BPCP 41. Consumption of COG in BFP 42. Consumption of NG in BFP 43. Consumption of BFG in BFP 44. Output of BFG in BFP 45. Consumption of NG in EAFP 46. Consumption of nitrogen in EAFP 47. Consumption of pure nitrogen in EAFP 48. Consumption of argon in EAFP 49. Consumption of oxygen in EAFP
6	Central Laboratory of Control in structure of Scientific and	50. Carbon content in dry coal charge

	Technological Center	51. Carbon content in dry metallurgical coke
7	Gas shop	52. Carbon content in NG

The period of data transfer by structural departments of OJSC “MMK” is monthly within 5 working days after their preparation and approval of paper form. Submission of the reports to Department for relations with state authorities and markets protection is performed by responsible person in electronic form.

Responsible person from department prepares documents containing information about monitoring parameters in electronic format *.doc, *.xls, *.pdf, *.jpeg (depending the type of the document, see Table B.3.2). From e-mail address assigned for each department these files are sent to the e-mail address of Department of informational technologies that is registered as a resource for the monitoring data collection. Then received files are placed on the server of OJSC “MMK”. Read access to this server is provided to users on the basis of an application for access to information resource. Editing rights of the electronic documents are restricted. Approved reported documents in paper form are stored in accordance with procedure existing in each department.

Storage of all records on monitoring for JI project (describing the period from January 1, 2008 to December 31, 2012) in electronic form is provided until January 1, 2015 by Department for relations with state authorities and markets protection.

Department for relations with state authorities and markets protection controls the completeness of the data and the term of data transfer. Every quarter all the relevant data are transferred to CTF Consulting, LLC. (consultant for the project) by e-mail. Similarly the information matrix of parameters, which were changed and other important information is sent to CTF Consulting, LLC in order that relevant definitions are made during a preparation of the monitoring report.

Table B.3.2. List of reporting documents prepared by departments of OJSC “MMK”, which are used in project monitoring

#	Organization department	Name of the reporting document in the Quality Management System (QMS)	Format of electronic copy
1	By-product coke plant	Technical report on coking Report on recovery of main products from coke oven gas	.XLS .XLS
2	Blast-furnace plant	Monthly technical report of BFP	.XLS
3	Electric arc-furnace plant	Technical report of EAFP	.XLS
4	Electric arc-furnace plant	Reference on consumption of pig iron, metallurgical scrap, carbon-containing powders, electrodes	.XLS
5	Technological department	Summary of energy consumption by departments of OJSC “MMK”	.XLS
6	Technological department	Analysis of energy resources consumption by OJSC “MMK” (form QMS (2) -32-0)	.XLS
7	Technological department	Fuel consumption by type of product of	.XLS

		power plants	
8	Central Laboratory of Control in structure of Scientific and Technological Center	Carbon content in dry coal charge and metallurgical coke of BPCP of OJSC “MMK”.	.JPEG (scan of the table with signature laboratory head)
10	Central Laboratory of Control in structure of Scientific and Technological Center	Monthly average data of agglomerates, iron-ore raw materials and flux	.XLS
11	Center of Energy Saving Technologies	Report on balance of blast furnace gas consumption in workshops	.XLS
12	Center of Energy Saving Technologies	Report on balance of coke over gas consumption in workshops	.XLS
13	Center of Energy Saving Technologies	Report on balance of natural gas consumption in workshops	.XLS
14	Center of Energy Saving Technologies	Products distribution of the oxygen plant, delivered by pipeline to consumers	.XLS
15	Center of Energy Saving Technologies	Results of analysis of coke over gas	.XLS
16	Center of Energy Saving Technologies	Results of analysis of blast furnace gas	.XLS
17	Chief powerman department, Gas shop	Natural gas quality passport (provided by supplier)	.PDF/.JPEG (scan of the passport)

CTF Consulting, LLC define the value of technological losses during transportation and distribution of grid electricity in Unified Energy System of Urals from the annual report of Urals Inter-regional company for distribution of grid electricity posted in Internet (http://www.mrsk-ural.ru/).

B.4. Approach for organization of baseline emissions and monitoring report preparation

Necessary information for monitoring baseline CO_2 emissions contains in quarterly analytic report “Analysis of the expenditure of materials and process fuel by production of pig iron, steel and rolled iron at ferrous metallurgy works” by “Corporation CHERMET”, LLC (http://www.k-chermet.ru). MMK is a regular subscriber of this report for many years. This analytic report was transferred by Department for relations with state authorities and markets protection to CTF Consulting, LLC for further processing.

Within 10 working days after receipt of the complete set of reporting forms for the project and baseline emission calculation the specialists of CTF Consulting, LLC calculate CO_2 emission reduction achieved by JI project for each quarter. The results of calculation are reported to the Department for relations with state authorities and markets protection.

CTF Consulting, LLC develops for OJSC “MMK” the annual monitoring report on CO_2 emission reduction based on quarterly reporting upon receipt of the reporting for 4th quarter. The monitoring report is sent then to Department for relations with state authorities and markets protection, which submits it for consideration of relevant departments. Department of Economics of MMK has to compare the figures contained in the monitoring report on consumption of raw materials and manufacture of products with Calculation of prime costs and confirm their compliance. Annual monitoring report is approved by Executive Director of MMK.

B.5 Technical means of measurements at MMK, used in the project and its accuracy

#	*Monitoring parameter*	*Measuring device*	*Inaccuracy of measurements,*
1	Consumption of coal charge in BPCP (on dry mass)	Consumption of coal charge is calculated based on gross coke production that is calculated as a sum of weighed amounts of metallurgical coke and coke breeze/coke nut after quenching and sifting of every shipment of the gross coke from the coke batteries. Besides humidity is measured to recalculate all material flows on dry mass.	1%
2	Production of dry metallurgical coke	Railway scales	1%
3	Production of crude benzol	Fluid level gauge	0.1%
4	Output of dry coal tar	Reverse calculation via sum of products of tar distillation measured by fluid level gauge	0.1%
5	Consumption of skip metallurgical coke in BFP	Weighting funnels with strain sensor VDD6-0.5. Besides humidity is measured to recalculate on dry mass	1%
6	Production of pig iron in BFP	Railway scales	0.3-1% depending on the scales type
7	Consumption of pig iron in EAFP	Railway scales	0.3-1% depending on the scales type
8	Consumption of scrap metal in EAFP		
9	Consumption of carbon-containing powder in EAFP	Strain-gauge weight-hopper	1%
10	Consumption of electrodes in EAFP	Visual control	-
11	Output of slab steel billet in EAFP	Calculation through geometric size of production output	-
12	Total production of slab and profiled steel billet in EAFP		
13	Total smelting of steel in EAF-180		

14	Total electricity consumption by MMK	Electricity meters	Accuracy rating 0.5; 2.0; 2.5 depending on the type of meter
15	Electricity purchase from Unified Energy System of Urals grid	Electricity meters	Accuracy rating 0.5
16	Total electricity consumption in EAFP	Electricity meters	Accuracy rating 0.5; 2.0; 2.5 depending on the type of meter
17	Consumption of grid electricity by EAF-180	Electricity meters	Accuracy rating 0.5
18	Specific electricity consumption for production of oxygen in OCS #1	CEST experts calculate these parameters on the basis of electricity consumption and amount of gas formed in OCS	-
19	Specific electricity consumption for production of oxygen in OCS #2		
20	Consumption of BFG in CPP	Pressure differential flow meters Metran-100-DD-1411, Metran-22-DD-1420 and Sapphire-22-DD-2410 measure flows of COG, BFG and NG. Then the consumption of these gases is calculated by SPG-762 calculator. Pressure differential flow meters Yokogava Eja110a measure flows of NG in BFP, CHPP, CPP, SABPP and the turbine section of the steam plant. Then the consumption of natural gas is calculated by SPG-762 calculator.	1%
21	Consumption of NG in CPP		
22	Consumption of NG in CHPP		
23	Consumption of BFG in SP		
24	Consumption of COG in SP		
25	Consumption of NG in SP		
26	Consumption of NG in turbine section of SP		
27	Consumption of NG in recovery unit of SP		
28	Consumption of BFG in BPCP		
29	Consumption of COG in BPCP		
30	Consumption of NG in BPCP		
31	Consumption of COG in BFP		
32	Consumption of BFG in BFP		
33	Consumption of BFG in SABPP for generation of air blast		

34	Consumption of COG in SABPP for generation of air blast		
35	Consumption of NG in SABPP for generation of air blast		
36	Consumption of NG in BFP		
37	Consumption of NG in EAFP		
38	Output of COG in BPCP		
39	Output of BFG in BFP		
40	Output of oxygen by OCS #1	Air flow meter	1%
41	Output of oxygen by OCS #2		
42	Generation of air blast at MMK	Air flow meter	1%
43	Consumption of pure nitrogen in EAFP	Air flow meter	1%
44	Consumption of nitrogen in EAFP		
45	Consumption of argon in EAFP		
46	Consumption of oxygen in EAFP		
47	Consumption of power station coal by CHPP	Railway scale	1%
48	Carbon content in BFG	Calculation through gas composition which is measured by VTI-2 gas analyzer	0.3%
49	Carbon content in COG		
50	Carbon content in dry coal charge	Carbon analyzer LECO SC144DR	0.25%
51	Carbon content in dry metallurgical coke		
52	Carbon content in NG	Component composition of NG is specified in technical passport by the supplier. Carbon content is then estimated on the basis of that measured composition of gas	0.5%

C. Adjustments and deviations from the monitoring plan presented in PDD

Present monitoring report contains some adjustments and deviations from the monitoring plan presented in section D of PDD, version 1.2 of February 01, 2011 (for this version of PDD the Bureau Veritas Certification Holding SAS has issued a determination report № RUSSIA-det/0105/2010 version 02 of February 08, 2011). The changes have been made to adapt a monitoring plan and represent the actually existing situation. Other monitoring parameters and calculation formulae are in compliance with PDD.

Mentioned in PDD	Implemented in practice	Explanation
Table D.1.1.1. **Parameter %C $_{coking\ coal\_CP\_PJ}$ - Carbon content in dry coal charge** Recording frequency – 2 times a day Each incoming batch of coal is analyzed. Monthly average value is used.	BPCP lab of OJSC "MMK" did not perform systematic measurements of carbon content in coal charge in 2008 and in January 2009 due to replace the old measuring device on a new one (carbon analyzer LECO SC144DR), which entailed the development and approval of new measurements methodologies and staffed training. Therefore in the calculations the value of the carbon content in dry coal charge for the period January 2008-January 2009 was taken as monthly average value of for the period February 2009-December 2009 (**80,35 % by mass.**).	A deviation in average values of carbon content in coal charge and metallurgical coke (on dry weight) was less than 1% by mass in the period from February 2009 to December 2009, which suggests a stable composition of the coal charge loaded into the coke ovens. It is achieved by pre-mixing of different types of coking coal before it is fed to the ovens. This is a common practice of the enterprise. According to the MMK data based on regular measurements in previous years, the carbon content in coal charge didn't fell below 79% by mass and in metallurgical coke didn't fell below 83% by mass[11]. Besides the recent monitoring data from MMK shows that in 2010 the average carbon content in coal charge was 80.34 % by mass and the average carbon content in metallurgical coke was 83.02 % by mass respectively what confirms that these values are fairly stable in the long-term period. In case of application of default values from 2006 IPCC Guidelines for National Greenhouse Gas Inventories Chapter 4. Table 4.3. (carbon content in
Table D.1.1.1. **Parameter %C $_{metallurgical\ coke\_PJ}$ - Carbon content in dry metallurgical coke** Recording frequency – 2 times a day Averaged over sample measurements.	BPCP lab of OJSC "MMK" did not perform systematic measurements of carbon content in dry metallurgical coke in 2008 and in January 2009 due to replace the old measuring device on a new one (carbon analyzer LECO SC144DR), which entailed the development and approval of new measurements methodologies and staffed training. Therefore in the calculations the value of the carbon content in dry metallurgical coke for the period	

[11] Letter from Head of BPCP production mr. Shashkov to CTF Consulting, LLC by 29 May 2009

	January 2008-January 2009 was taken as monthly average value of for the period February 2009-December 2009 (**83,51 % by mass.**).	coal charge is 73 % by mass and carbon content in metallurgical coke is 83 % by mass) the existing carbon balance for coke and iron production processes developed in the PDD and Monitoring report will be heavily disturbed. Applying the default values of IPCC 2006 for CO_2 emission calculations in year 2008 the total mass of carbon in the input flow for production of metallurgical coke in BPCP would be decreased by 8.4% (446.5 ths. tones C) meanwhile total mass of carbon in the output flow from production of metallurgical coke would be decreased only by 0.5 % (21.8 ths. tones C). Thereby for production of 4269.3 ths. tones of metallurgical coke in BPCP in 2008 the greater quantities of coal charge would need to be used in case of proposed lower carbon content of coal charge (73 % by mass instead of actually applied 80.35 % by mass). As soon as production data are fixed based on actual reporting for 2008 the CO_2 emissions would be estimated with great deviation from the PDD values which seems to be unreasonable as on the stage of development the PDD (April 2009) all available data of raw materials consumption and output in the project were used from actual MMK reports for 2008. Therefore the value of emission reduction in 2008 in the PDD report should coincide with the value of emission reduction in 2008 in the Monitoring report. Taking into account statements above it seems would be rather correct and acceptable approach to apply the monthly average value of carbon content in coal charge and metallurgical coke in accordance with instrumental data of February 2009-December 2009 for CO_2

		emissions calculation for the period January 2008 – January 2009 instead of using of respective IPCC default values.
Specific CO_2 emissions per ton of produced metallurgical coke **$SPE_{metallurgical\ coke} = PE_{metallurgical\ coke} / P_{metallurgical\ coke\_PJ}$ (D.1.1.2.-2)** Where: $SPE_{metallurgical\_coke}$ – Specific CO_2 emissions per ton of dry metallurgical coke produced in BPCP, ton CO_2/ton $PE_{metallurgical\_coke}$ – Project emissions from production of metallurgical coke in BPCP, thousand tons of CO_2 $P_{metallurgical\ coke\_PJ}$ – Production of dry metallurgical coke, thousand tons	The monitoring plan means that OJSC "MMK" fully meets their requirements for metallurgical coke, which was the practice in recent years. However in 2nd and 3rd quarters of 2009 OJSC "MMK" purchased a part of required metallurgical coke from other coke producers by reason of shut down of several coke batteries at the end of 2008 (due to the global economic and financial crisis). Thereby the value of specific CO_2 emissions per ton of dry metallurgical coke produced in BPCP was the same for own produced and purchased coke since other producers of coke have not lesser carbon intensity during its production.	Mentioned deviation in the calculation model have been illustrated in section E.1 of PDD and approved by Accredited Independent Entity during determination.
Tables D.1.1.1 и D.1.1.3 **Parameter C_{NG_PJ} - Carbon content in NG** Recording frequency – monthly Calculated on the basis of composition of natural gas, specified in the technical quality passport by the supplier.	Technical quality passport for July 2008 is unreadable because of bad quality of printing. The value of carbon content in NG for this month was taken as **0.49 кг C/m^3**.	According to data of the quality passports of natural gas for the other months in 2008 the carbon content of natural gas from April to December 2008 was 0.49 kg C/m^3. Therefore, this value is characteristic and arithmetic average for 2008. So mentioned deviation is a conservative assumption.
Table D.1.1.1 **CO_2 emissions from consumption of grid electricity by EAF-180 via 220/35 kV step-down substation during smelting of slab steel grades** **$PE_{EC\_grid\_slab\_steel\_EAF} = SEC_{grid\_steel\_EAF} * P_{slab\ steel\_EAFP} * \sum P_{steel\_EAF} / \sum P_{profiled\ \&slab\ steel\_EAFP} * EF$**	**In April-July and November-December 2009 the** steel was not melted in EAF-180 furnaces that have been shut down. But ancillary equipment of complex EAF-180 consumed a small amount of electricity. Therefore **for these months** the formula D.1.1.2.-14 was reduced to the form:	

$_{grid}$ * (1+TDL) (D.1.1.2.-14) Where: PE $_{EC\_grid\_slab\_steel\_EAF}$ – CO_2 emissions from consumption of grid electricity by EAF-180 via 220/35 kV step-down substation during smelting of slab steel grades, thousand tons of CO_2 SEC $_{grid\_steel\_EAF}$ – Specific consumption of grid electricity by EAF-180 via 220/35 kV step-down substation per ton of all smelted steel, MWh/ton P $_{slab\ steel\_EAFP}$ – Output of slab steel billet in EAFP, thousand tons ∑P $_{steel\_EAF}$ – Total smelting of steel in EAF-180, thousand tons ∑P $_{profiled\&slab\ steel\_EAFP}$ – Total production of slab and profiled steel billet in EAFP, thousand tons EF $_{grid}$ – CO_2 emission factor for grid electricity from Unified Energy Systems of Urals (EF $_{grid}$ = 0.541 t CO_2/MW-h) TDL – Technological losses during transportation and distribution of grid electricity in Unified Energy System of Urals, % **Specific consumption of grid electricity by EAF-180 via 220/35 kV step-down substation during smelting of slab steel grades** **SEC $_{grid\_steel\_EAF}$ = EC $_{grid\_steel\_EAF}$ / ∑P $_{steel\_EAF}$ (D.1.1.2.-15)** Where: SEC $_{grid\_steel\_EAF}$ – Specific consumption of grid electricity by EAF-180 via 220/35 kV step-down	**PE $_{EC\_grid\_slab\_steel\_EAF}$ = EC $_{grid\_steel\_EAF}$ * EF $_{grid}$ * (1+TDL)**	

substation per ton of all smelted steel, MWh/t $EC_{grid\_steel\_EAF}$ – Consumption of grid electricity by EAF-180 via 220/35 kV step-down substation, GW-h $\sum P_{steel\_EAF}$ – Total smelting of steel in EAF-180, thousand tons		
Table D.1.1.1 **EC_{import_PJ}** **Electricity purchase from Unified Energy System of Urals grid, GW-h** **$EC_{grid\_sleel\_EAF}$** **Consumption of grid electricity by EAF-180, GW-h**	According to the reports: Summary of energy consumption by departments of OJSC "MMK" and Analysis of energy resources consumption by OJSC "MMK" the import of grid electricity from the grid ("Chelyabinsk Energy" an affiliate of OJSC "Interregional distribution grid company of Urals") **in November-December 2008 and January 2009** was the value less than consumption of grid electricity by EAF-180 via 220/35 kV step-down substation registered by the meters. For correctness of the calculations the value of the import of grid electricity **for these months** has been equated in the calculation tables to the value of consumption of grid electricity by EAF-180 via 220/35 kV step-down substation.	Mentioned deviation is due to both: the specifics of the registration of electricity consumption in OJSC "MMK" and influence of the sharp setback in production in the end of 2008 – beginning 2009. As shown in Annex 3 of PDD all high-voltage power lines can work two-way including the connecting lines between MMK's substations and block-station power plants. Electricity can be transmitted to and from MMK. The volume of electricity purchased by OJSC "MMK" from grid supplier during each accounting period (usually one month) is calculated as a balance in transmission of electricity. In November-December 2008 and January 2009, MMK was actually a net exporter of electricity into the Unified Energy System of Urals grid which is reflected in the reports. Electric arc furnaces are powered by 35 kV from substation №77 (this substation is directly connected to the external grid of UES Urals) without possibility of electricity consumption from other sub-stations. Therefore the actual electricity consumption by EAF-180 cannot be less than the import of grid electricity.
CO_2 emissions from consumption of electricity TDL – Technological losses during transportation	To the moment of preparation of present Monitoring report the OJSC "MRSK of Urals" has	The value of technological losses during transportation and distribution of grid electricity in Unified Energy

and distribution of grid electricity in Unified Energy System of Urals, %	not yet published on their web-site the annual report for 2010. Therefore the value of technological losses has been defined for all the year 2010 by data of 9 months (http://www.mrsk-ural.ru/ru/440.news1434.html) as **7.24%**.	System of Urals changes over the last years within 1%. The impact of such change on ERUs is less than 1000 tonnes CO_{2eq}.
For the calculation of specific CO_2 emissions from production of one ton of steel by arc-furnace technique at the metallurgical works n in the baseline in accordance with PDD formulae D.1.1.4.-4, D.1.1.4.-5, D.1.1.4.-6, D.1.1.4.-7, D.1.1.4.-8, D.1.1.4.-9 following monitoring parameters are used: - **specific consumption of pig iron per ton of steel produced by arc-furnace technique at the metallurgical works n ($SM_{iron\ EAF\_n}$);** - **specific consumption of NG per ton of steel produced by arc-furnace technique at the metallurgical works n ($SM_{NG\ EAF\_n}$);** - **specific consumption of electrodes per ton of steel produced by arc-furnace technique at the metallurgical works n** ($SM_{electrodes\ EAF\_n}$); - **specific consumption of oxygen per ton of steel produced by arc-furnace technique at the metallurgical works n ($SM_{oxygen\ EAF\_n}$);** - **specific consumption of electricity per ton of steel produced by arc-furnace**	The data of specific consumption of carbon-bearing raw materials, fuel and energy for production one ton steel by arc-furnace technique at JSC "Amurmetal", "Metallurgical Plant "Kamasteel", LLC, "Novorossmetal", LLC and JSC "United Metallurgical Company" are absent in the reports of "Corporation CHERMET", LLC in 2008-2010. For these metallurgical works values of specific consumptions of raw materials, fuel and energy (**$SM_{iron\ EAF\_n}$, $SM_{NG\ EAF\_n}$, $SM_{electrodes\ EAF\_n}$, $SM_{oxygen\ EAF\_n}$, $SM_{electricity\ EAF\_n}$**) are taken from PDD "Production modernisation at OJSC Amurmetal, Komsomolsk-on-Amur, Khabarovsk Krai, Russian Federation".	Only total volume of steel production by arc-furnace technique is indicated for JSC "Amurmetal", "Metallurgical Plant "Kamasteel", LLC, "Novorossmetal", LLC and JSC "United Metallurgical Company" in "Analysis of the expenditure of materials and process fuel by production of pig iron, steel and rolled iron at ferrous metallurgy works" by "Corporation CHERMET", LLC in 2008-2010. JI project "Production modernisation at OJSC Amurmetal, Komsomolsk-on-Amur, Khabarovsk Krai, Russian Federation" is implemented at JSC "Amurmetal". PDD was published in UNFCCC website in 2010[12]. The value of specific consumption of carbon-bearing raw materials, fuel and energy missing for the mentioned steel smelters is taken from this PDD because the most modern equipment of steel smelting is used in OJSC Amurmetal. There are no facilities for the production of pig iron at JSC "Amurmetal". The plant consists of scrap preparing shop, EAFPs and two rolling mills. A similar situation is observed at "Metallurgical Plant "Kamasteel", LLC, "Novorossmetal", LLC and JSC "United Metallurgical Company", so the same number

[12]http://ji.unfccc.int/JI_Projects/DB/UVNZRJEB5WZQ7N9UR9YINGKVG1QXM0/PublicPDD/QL4F4O8TJVW1IVEFPUFEJRK9FRF0TM/view.html

technique at the metallurgical works n ($SM_{electricity\ EAF\ \_n}$). The monitoring plan means, that the resource of data of above-listed monitoring parameters (**$SM_{iron\ EAF\ \_n}$, $SM_{NG\ EAF\ \_n}$, $SM_{electrodes\ EAF\_n}$, $SM_{oxygen\ EAF\_n}$, $SM_{electricity\ EAF\ \_n}$**) is annual report “Analysis of the expenditure of materials and process fuel by production of pig iron, steel and rolled iron at ferrous metallurgy works” by “Corporation CHERMET”, LLC.		of raw materials, fuel and energy are used for the listed above enterprises. The share of steel production at “Metallurgical Plant “Kamasteel”, LLC, “Novorossmetal”, LLC and JSC “United Metallurgical Company” is 2.7 % in the whole volume of steel production by Russian metallurgical works with capacity for production of slab steel billet (data of 2009), so the uncertainty is insignificant when the above-described method is used. Mentioned deviation in the calculation model have been illustrated in section E.4 of PDD and approved by Accredited Independent Entity during determination.
For the calculation of specific CO_2 emissions from production of one ton of steel by scrap technique at the metallurgical works n in the baseline in accordance with PDD formulae PDD D.1.1.4.-22, D.1.1.4.-23, D.1.1.4.-24, D.1.1.4.-25 following monitoring parameters are used: - **specific consumption of pig iron per ton of steel produced by scrap technique at the metallurgical works n** ($SM_{iron\ scrap\ process\_n}$); - **specific consumption of NG per ton of steel produced by scrap technique at the metallurgical works n** ($SM_{NG\ scrap\ process\_n}$); - **specific consumption of oxygen per ton of steel produced by scrap technique at the metallurgical works n** ($SM_{oxygen\ scrap\ process\_n}$)	The data of specific consumption of carbon-bearing raw materials, fuel and energy for production one ton steel by scrap technique at OJSC "Ashinskiy metallurgical works" in 2008-2009 (not actual since 2010 due to shut down of the open-heath furnaces) and “Metallurgical Plant Petrostal” Closed JSC in 2008-2010are absent in the reports of “Corporation CHERMET”, LLC for the respective period. For these metallurgical works the value of specific CO_2 emissions from production of one ton of steel by scrap technique is equal to the value of specific CO_2 emissions from production of one ton of steel by scrap technique at JSC “Taganrog Steel Works”.	Only total volume of steel production by scrap technique is indicated for OJSC "Ashinskiy metallurgical works" and “Metallurgical Plant Petrostal” Closed JSC in “Analysis of the expenditure of materials and process fuel by production of pig iron, steel and rolled iron at ferrous metallurgy works” by “Corporation CHERMET”, LLC in 2008-2010. Scrap technique of steel production is implemented at four pipe plants, which are not considered for the determination of baseline emissions, so they are chosen as reference: JSC “Vyksa Steel Works”, JSC “Seversky Pipe Plant” (till 2010), JSC “Taganrog Steel Works”, OJSC “Chelyabinsk Tube Rolling Plant”. On basis of specific consumption of carbon-bearing raw materials, fuel and energy at these pipe plants presented in report “Analysis of the expenditure of materials and process fuel by production of pig iron, steel and rolled iron at ferrous metallurgy works” by “Corporation CHERMET”, LLC specific CO_2

<table>
<tr>
<td>The monitoring plan means, that the resource of data of above-listed monitoring parameters ($SM_{iron\ scrap\ process\_n}$, $SM_{NG\ scrap\ process\_n}$, $SM_{oxygen\ scrap\ process\_n}$) is annual report “Analysis of the expenditure of materials and process fuel by production of pig iron, steel and rolled iron at ferrous metallurgy works” by “Corporation CHERMET”, LLC.</td>
<td></td>
<td>emissions from production of one ton of steel by scrap technique at the pipe plants is calculated.

Specific CO_2 emissions from production of one ton of steel by scrap technique at the pipe plants, which are not included under the project boundary
<table>
<tr><td>#</td><td>Pipe plant</td><td>2008</td><td>2009</td><td>2010</td></tr>
<tr><td>1</td><td>JSC “Vyksa Steel Works”</td><td>0.681</td><td>0.705</td><td>0.671</td></tr>
<tr><td>2</td><td>JSC “Seversky Pipe Plant”</td><td>0.753</td><td>0.737</td><td>0.00</td></tr>
<tr><td>3</td><td>JSC “Taganrog Steel Works”</td><td>0.550</td><td>0.624</td><td>0.633</td></tr>
<tr><td>4</td><td>OJSC “Chelyabinsk Tube Rolling Plant”</td><td>0.845</td><td>0.857</td><td>0.765</td></tr>
</table>
General CO_2 emission factor for steel production by scrap technique at OJSC "Ashinskiy metallurgical works" and “Metallurgical Plant Petrostal” Closed JSC is assumed to be equal to specific CO_2 emissions from production of one ton of steel at JSC “Taganrog Steel Works”, as the lowest and therefore most conservative value (in according to IPCC Guidelines 2006, Chapter 4, table 4.1. CO_2 emission factor of steel production by Open Hearth Furnace is 1.72 t CO_2/ t steel).

The share of steel production at OJSC "Ashinskiy metallurgical works" and “Metallurgical Plant Petrostal” Closed JSC is 1.7 % in the whole volume of steel production by Russian metallurgical works with capacity for production of slab steel billet (data of</td>
</tr>
</table>

		2008-2010), so the uncertainty is insignificant when the above-described method is used. Mentioned deviation in the calculation model have been illustrated in section E.4 of PDD and approved by Accredited Independent Entity during determination.

D. Calculation of GHG emissions reduction

D.1 CO_2 emissions from metallurgical conversions calculated by carbon balance method

Production of metallurgical coke

$$PE_{metallurgical\_coke} = [(M_{coking\ coal\_PJ} * \%C_{coking\ coal\_PJ}) + (FC_{BFG\_CP\_PJ} * C_{BFG\_PJ}) + (FC_{COG\_CP\_PJ} * C_{COG\_PJ}) + (FC_{NG\_CP\_PJ} * C_{NG\_PJ}) - (P_{metallurgical\ coke\_PJ} * \%C_{metallurgical\ coke\_PJ}) - (P_{COG\_CP\_PJ} * C_{COG\_PJ}) - (P_{benzol\_PJ} * \%C_{benzol}) - (P_{coal\text{-}tar\_PJ} * \%C_{coal\text{-}tar})] * 44/12$$

(PDD formula D.1.1.2.-1)

Specific CO_2 emissions per ton of produced metallurgical coke

$$SPE_{metallurgical\ coke} = PE_{metallurgical\ coke} / P_{metallurgical\ coke\_PJ}$$

(PDD formula D.1.1.2.-2)

Symbol	Data variable	Unit	Symbol	Data variable	Unit	Symbol	Data variable	Unit
$M_{coking\ coal\_PJ}$	Consumption of coal charge in BPCP (on dry mass)	ths. tons	C_{COG_PJ}	Carbon content in COG	kg C/m^3	$P_{COG\_CP\_PJ}$	Output of COG in BPCP	mln. m^3
$\%C_{coking\ coal\_PJ}$	Carbon content in dry coal charge	% by mass	$FC_{NG\_CP\_PJ}$	Consumption of NG in BPCP	mln. m^3	P_{benzol_PJ}	Production of crude benzol	ths. tons
$FC_{BFG\_CP\_PJ}$	Consumption of BFG in BPCP	mln. m^3	C_{NG_PJ}	Carbon content in NG	kg C/m3	$P_{coal\text{-}tar\_PJ}$	Output of dry coal tar	ths. tons
C_{BFG_PJ}	Carbon content in BFG	kg C/m^3	$P_{metallurgical\ coke\_PJ}$	Production of dry metallurgical coke	ths. tons	$PE_{metallurgical\_coke}$	Project emissions from production of metallurgical coke in BPCP	ths. tons CO_2
$FC_{COG\_CP\_PJ}$	Consumption of COG in BPCP	mln. m^3	$\%C_{metallurgical\ coke\_PJ}$	Carbon content in dry metallurgical coke	% by mass	$SPE_{metallurgical\ coke}$	Specific CO_2 emissions per ton of dry metallurgical coke produced in BPCP	ton CO_2/ ton

Specific CO_2 emissions form metallurgical conversions same for project and baseline. Production of metallurgical coke

12 months of 2008

Input carbon flows

#	Data variable	Unit	Jan	Feb	March	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Total for year
1	Consumption of coal charge in BPCP (on dry mass)	ths. tons	602,5	573,9	605,6	578,4	621,1	578,6	503,1	559,8	597,0	442,0	219,7	192,8	**6074,5**
	Carbon content in dry coal charge	% by mass	80,35	80,35	80,35	80,35	80,35	80,35	80,35	80,35	80,35	80,35	80,35	80,35	**80,35**
		ths. tons C	484,1	461,2	486,6	464,7	499,0	464,9	404,2	449,8	479,7	355,2	176,5	154,9	**4880,8**
2	Consumption of COG in BPCP	mln. m3	50,8	49,6	49,8	47,3	56,0	51,8	40,8	47,5	52,8	36,9	18,1	19,3	**520,7**
	Carbon content in COG	kg C/m3	0,20	0,19	0,19	0,19	0,20	0,19	0,19	0,19	0,18	0,19	0,18	0,17	**0,19**
		ths. tons C	10,0	9,7	9,5	9,2	11,0	10,0	7,7	9,0	9,7	7,0	3,3	3,3	**99,4**
	Consumption of BFG in BPCP	mln. m3	163,2	155,0	168,8	162,4	152,2	143,8	141,7	150,7	151,7	121,5	73,6	50,9	**1635,4**
	Carbon content in BFG	kg C/m3	0,20	0,20	0,21	0,20	0,19	0,20	0,20	0,20	0,20	0,20	0,17	0,17	**0,20**
		ths. tons C	33,0	31,7	34,6	33,2	29,6	29,4	28,3	29,4	29,6	23,9	12,7	8,6	**324,0**
	Consumption of NG in BPCP	mln. m3	2,3	2,3	2,1	1,0	0,8	0,7	0,8	0,8	0,8	0,9	0,7	1,3	**14**
	Carbon content in NG	kg C/m3	0,50	0,50	0,50	0,49	0,49	0,49	0,49	0,49	0,49	0,49	0,49	0,49	**0,49**
		ths. tons C	1,1	1,1	1,0	0,5	0,4	0,4	0,4	0,4	0,4	0,5	0,3	0,6	**7,1**
3	**Total mass of carbon in the input flow for production of metallurgical coke**	**ths. tons C**	**528,2**	**503,7**	**531,8**	**507,5**	**540,0**	**504,7**	**44 0,6**	**488,6**	**519,4**	**386,5**	**192,9**	**167,5**	**5311,4**

Output carbon flows

#	Data variable	Unit	Jan	Feb	March	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Total for year
1	Production of dry metallurgical coke	ths. tons	423,0	406,0	428,5	406,0	433,4	402,5	352,1	395,3	421,3	312,8	154,0	134,4	**4269,3**
	Carbon content in dry metallurgical coke	% by mass	83,51	83,51	83,51	83,51	83,51	83,51	83,51	83,51	83,51	83,51	83,51	83,51	**83,51**
		ths. tons C	353,2	339,0	357,9	339,1	361,9	336,2	294,0	330,1	351,8	261,2	128,6	112,2	**3565,3**
2	Output of COG in BPCP	mln. m3	202,0	189,6	201,3	191,8	206,7	193,1	167,8	185,4	197,4	147,0	70,0	59,1	**2011,2**
	Carbon content in COG	kg C/m3	0,20	0,19	0,19	0,19	0,20	0,19	0,19	0,19	0,18	0,19	0,18	0,17	**0,19**
		ths. tons C	39,7	36,9	38,5	37,2	40,6	37,3	31,6	35,1	36,4	27,8	12,8	10,2	**384,3**
3	Output of dry coal tar	ths. tons	17,5	16,6	17,5	16,8	18,0	16,8	15,5	16,2	17,3	12,8	7,5	5,6	**178,2**
	Carbon content in dry coal tar	% by mass	86,00	86,00	86,00	86,00	86,00	86,00	86,00	86,00	86,00	86,00	86,00	86,00	**86,00**
		ths. tons C	15,0	14,3	15,1	14,4	15,5	14,4	13,3	14,0	14,9	11,0	6,4	4,8	**153,2**
4	Production of crude benzol	ths. tons	5,5	5,2	5,4	5,1	5,4	5,2	4,9	5,1	5,5	4,0	2,0	1,8	**55,0**

Specific CO_2 emissions form metallurgical conversions same for project and baseline. Production of metallurgical coke

#	Data variable	Unit	Jan	Feb	March	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Total for year
	Carbon content in crude benzol	%	90,00	90,00	90,00	90,00	90,00	90,00	90,00	90,00	90,00	90,00	90,00	90,00	**90,00**
		ths. tons C	4,9	4,7	4,8	4,6	4,9	4,7	4,4	4,5	4,9	3,6	1,8	2	**49,5**
5	**Total mass of carbon in the output flow from production of metallurgical coke**	**ths. tons C**	**412,9**	**395,0**	**416,3**	**395,3**	**422,9**	**392,6**	**343,3**	**383,8**	**408,1**	**303,7**	**149,7**	**128,9**	**4152,3**

CO2 emissions from production of metallurgical coke

#	Data variable	Unit	Jan	Feb	March	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Total for year
1	Burning of carbon during production of metallurgical coke	ths. tons C	115,3	108,7	115,5	112,3	117,1	112,0	97,3	104,8	111,3	82,8	43,2	38,6	**1159,0**
2	CO2 emissions from production of metallurgical coke in BPCP	ths. tons CO2	422,9	398,7	423,7	411,6	429,3	410,8	356,6	384,4	408,3	303,7	158,2	141,5	**4249,8**
3	**Specific CO2 emissions per ton of produced metallurgical coke**	**ton CO2/ton**	**1,000**	**0,982**	**0,989**	**1,014**	**0,991**	**1,020**	**1,013**	**0,972**	**0,969**	**0,971**	**1,028**	**1,053**	**0,995**

12 months of 2009

Input carbon flows

#	Data variable	Unit	Jan	Feb	March	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Total for year
1	Consumption of coal charge in BPCP (on dry mass)	ths. tons	277,3	406,8	429,5	441,4	436,6	484,4	495,3	503,3	493,3	501,0	456,6	527,0	**5452,4**
	Carbon content in dry coal charge	% by mass	80,35	80,26	80,23	79,73	79,72	80,48	80,51	80,30	80,67	80,83	80,72	80,39	**80,35**
		ths. tons C	222,8	326,5	344,6	351,9	348,1	389,8	398,7	404,1	397,9	404,9	368,6	423,7	**4381,7**
2	Consumption of COG in BPCP	mln. m3	34,1	42,9	42,6	43,4	41,6	51,4	49,9	49,4	49,5	49,4	46,4	53,4	**553,9**
	Carbon content in COG	kg C/m3	0,18	0,18	0,18	0,18	0,18	0,18	0,19	0,18	0,19	0,19	0,19	0,18	**0,18**
		ths. tons C	6,2	7,7	7,7	7,8	7,7	9,4	9,4	8,8	9,2	9,5	8,6	9,7	**101,6**
	Consumption of BFG in BPCP	mln. m3	47,5	88,0	92,5	95,2	101,4	93,0	104,6	107,7	105,5	109,7	103,6	114,0	**1162,6**
	Carbon content in BFG	kg C/m3	0,19	0,21	0,20	0,21	0,21	0,21	0,22	0,21	0,21	0,21	0,21	0,21	**0,21**
		ths. tons C	8,8	18,2	18,9	20,0	21,2	19,9	22,6	22,4	22,6	23,4	22,1	23,9	**243,9**
	Consumption of NG in BPCP	mln. m3	1,5	2,1	2,3	1,50	0,69	0,64	0,70	0,58	0,74	1,44	2,21	3,0	**17**
	Carbon content in NG	kg C/m3	0,50	0,50	0,50	0,50	0,50	0,50	0,49	0,49	0,49	0,49	0,49	0,50	**0,50**
		ths. tons C	0,7	1,0	1,1	0,7	0,3	0,3	0,3	0,3	0,4	0,7	1,1	1,5	**8,6**

3	**Total mass of carbon in the input flow for production of metallurgical coke**	**ths. tons C**	**238,5**	**353,4**	**372,3**	**380,4**	**377,3**	**419,4**	**431,1**	**435,5**	**430,1**	**438,6**	**400,5**	**458,7**	**4735,8**

Output carbon flows

#	Data variable	Unit	Jan	Feb	March	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Total for year
1	Production of dry metallurgical coke	ths. tons	193,5	282,4	301,5	309,9	308,2	342,1	350,9	353,7	347,1	352,9	322,1	372,6	**3836,9**
	Carbon content in dry metallurgical coke	% by mass	83,51	83,39	84,02	83,39	83,41	83,31	83,43	83,64	83,40	83,84	83,63	83,10	**83,51**
		ths. tons C	161,6	235,5	253,3	258,4	257,1	285,0	292,7	295,8	289,4	295,9	269,4	309,6	**3203,8**
2	Output of COG in BPCP	mln. m3	86,7	131,1	140,8	145,4	146,0	158,1	166,0	167,6	163,7	166,5	148,0	171,4	**1791,4**
	Carbon content in COG	kg C/m3	0,18	0,18	0,18	0,18	0,18	0,18	0,19	0,18	0,19	0,19	0,19	0,18	**0,18**
		ths. tons C	15,7	23,6	25,4	26,3	26,9	28,9	31,3	29,7	30,5	31,9	27,6	31,0	**328,8**
3	Output of dry coal tar	ths. tons	6,9	13,9	12,8	13,9	14,6	16,5	16,3	15,9	15,8	14,5	13,2	15,4	**169,6**
	Carbon content in dry coal tar	% by mass	86,00	86,00	86,00	86,00	86,00	86,00	86,00	86,00	86,00	86,00	86,00	86,00	**86,00**
		ths. tons C	6,0	12,0	11,0	12,0	12,5	14,2	14,0	13,6	13,6	12,5	11,4	13,2	**145,9**
4	Production of crude benzol	ths. tons	2,7	4,2	4,0	4,6	4,2	4,6	4,8	5,0	4,8	4,9	4,2	4,8	**52,9**
	Carbon content in crude benzol	%	90,00	90,00	90,00	90,00	90,00	90,00	90,00	90,00	90,00	90,00	90,00	90,00	**90,00**
		ths. tons C	2,4	3,8	3,6	4,1	3,8	4,2	4,3	4,5	4,4	4,5	3,8	4	**47,6**
5	**Total mass of carbon in the output flow from production of metallurgical coke**	**ths. tons C**	**185,7**	**274,8**	**293,4**	**300,8**	**300,3**	**332,2**	**342,3**	**343,7**	**337,9**	**344,7**	**312,1**	**358,2**	**3726,2**

CO2 emissions from production of metallurgical coke

#	Data variable	Unit	Jan	Feb	March	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Total for year
1	Burning of carbon during production of metallurgical coke	ths. tons C	52,8	78,6	79,0	79,6	77,0	87,2	88,8	91,9	92,2	93,8	88,4	100,6	**1009,7**
2	CO2 emissions from production of metallurgical coke in BPCP	ths. tons CO2	193,7	288,0	289,6	291,8	282,2	319,6	325,5	336,9	338,1	344,1	324,0	368,7	**3702,2**
3	**Specific CO2 emissions per ton of produced metallurgical coke**	**ton CO2/ton**	**1,001**	**1,020**	**0,960**	**0,942**	**0,916**	**0,934**	**0,928**	**0,952**	**0,974**	**0,975**	**1,006**	**0,990**	**0,965**

Specific CO_2 emissions form metallurgical conversions same for project and baseline. Production of metallurgical coke

12 months of 2010

Input carbon flows

#	Data variable	Unit	Jan	Feb	March	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Total for year
1	Consumption of coal charge in BPCP (on dry mass)	ths. tons	511,5	500,7	551,8	571,9	516,3	458,0	485,0	509,2	582,4	536,5	554,7	550,1	**6328,1**
	Carbon content in dry coal charge	% by mass	80,40	80,70	80,50	80,70	80,40	80,10	80,10	80,50	80,20	80,00	80,10	80,40	**80,34**
		ths. tons C	411,2	404,1	444,2	461,5	415,1	366,8	388,5	409,9	467,1	429,2	444,3	442,3	**5084,3**
2	Consumption of COG in BPCP	mln. m3	46,6	45,3	51,9	54,2	48,1	42,4	46,7	50,6	61,3	52,1	53,6	53,3	**606,0**
	Carbon content in COG	kg C/m3	0,18	0,18	0,18	0,18	0,18	0,18	0,19	0,19	0,19	0,19	0,19	0,19	**0,18**
		ths. tons C	8,6	8,2	9,3	9,6	8,5	7,5	8,7	9,5	11,4	9,9	10,0	9,9	**111,0**
	Consumption of BFG in BPCP	mln. m3	131,8	134,1	139,7	141,0	136,4	117,5	118,6	118,4	121,4	129,6	137,3	137,2	**1562,9**
	Carbon content in BFG	kg C/m3	0,21	0,21	0,21	0,21	0,21	0,21	0,21	0,21	0,21	0,22	0,22	0,22	**0,21**
		ths. tons C	27,9	28,1	29,4	29,8	28,9	25,0	25,1	25,0	25,8	27,9	30,1	30,2	**333,3**
	Consumption of NG in BPCP	mln. m3	3,3	2,9	2,7	1,9	0,8	0,7	0,8	0,7	0,8	1,1	1,6	2,4	**19**
	Carbon content in NG	kg C/m3	0,50	0,50	0,49	0,49	0,49	0,49	0,49	0,49	0,49	0,49	0,49	0,49	**0,49**
		ths. tons C	1,6	1,4	1,3	0,9	0,4	0,3	0,4	0,3	0,4	0,5	0,8	1,2	**9,6**
3	**Total mass of carbon in the input flow for production of metallurgical coke**	**ths. tons C**	**449,3**	**441,8**	**484,2**	**501,8**	**452,9**	**399,6**	**422,7**	**444,8**	**504,7**	**467,5**	**485,2**	**483,5**	**5538,2**

Output carbon flows

#	Data variable	Unit	Jan	Feb	March	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Total for year
1	Production of dry metallurgical coke	ths. tons	359,6	351,7	388,7	404,7	367,1	325,0	344,1	360,1	415,6	380,1	392,9	388,2	**4477,7**
	Carbon content in dry metallurgical coke	% by mass	83,10	82,60	83,20	83,50	83,30	83,00	83,00	82,90	82,80	82,90	82,90	83,00	**83,02**
		ths. tons C	298,8	290,5	323,4	337,9	305,8	269,7	285,6	298,5	344,1	315,1	325,7	322,2	**3717,4**
2	Output of COG in BPCP	mln. m3	165,6	161,6	181,3	188,7	168,0	144,7	154,0	165,9	189,8	180,7	189,3	189,5	**2079,0**
	Carbon content in COG	kg C/m3	0,18	0,18	0,18	0,18	0,18	0,18	0,19	0,19	0,19	0,19	0,19	0,19	**0,18**
		ths. tons C	30,4	29,2	32,4	33,3	29,7	25,6	28,8	31,2	35,4	34,2	35,4	35,1	**380,8**
3	Output of dry coal tar	ths. tons	15,5	15,1	17,9	18,3	16,4	14,1	15,4	15,3	17,5	17,7	18,6	18,3	**200,1**
	Carbon content in dry coal tar	% by mass	86,00	86,00	86,00	86,00	86,00	86,00	86,00	86,00	86,00	86,00	86,00	86,00	**86,00**
		ths. tons C	13,3	13,0	15,4	15,7	14,1	12,1	13,3	13,2	15,0	15,2	16,0	15,7	**172,1**
4	Production of crude benzol	ths. tons	4,8	4,7	5,2	5,4	4,6	4,4	4,5	4,7	4,7	5,1	5,1	5,4	**58,5**

Specific CO_2 emissions form metallurgical conversions same for project and baseline. Production of metallurgical coke

	Carbon content in crude benzol	%	90,00	90,00	90,00	90,00	90,00	90,00	90,00	90,00	90,00	90,00	90,00	90,00	**90,00**
		ths. tons C	4,3	4,2	4,7	4,9	4,1	4,0	4,0	4,2	4,2	4,5	4,6	5	**52,7**
5	**Total mass of carbon in the output flow from production of metallurgical coke**	**ths. tons C**	**346,8**	**336,9**	**376,0**	**391,9**	**353,7**	**311,4**	**331,7**	**347,1**	**398,7**	**369,1**	**381,7**	**377,9**	**4322,9**

CO2 emissions from production of metallurgical coke

#	Data variable	Unit	Jan	Feb	March	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	**Total for year**
1	Burning of carbon during production of metallurgical coke	ths. tons C	102,5	104,9	108,3	110,0	99,2	88,2	91,1	97,6	106,0	98,4	103,5	105,6	**1215,3**
2	CO2 emissions from production of metallurgical coke in BPCP	ths. tons CO2	375,9	384,8	397,0	403,2	363,7	323,4	333,9	357,9	388,6	361,0	379,5	387,1	**4456,0**
3	**Specific CO2 emissions per ton of produced metallurgical coke**	**ton CO2/ton**	**1,045**	**1,094**	**1,021**	**0,996**	**0,991**	**0,995**	**0,970**	**0,994**	**0,935**	**0,950**	**0,966**	**0,997**	**0,995**

Specific CO_2 emissions form metallurgical conversions same for project and baseline. Production of metallurgical coke

Production of pig iron

$$PE_{pig\_iron} = [(M_{skip\_metallurgical\ coke\_BF\_PJ} * \%C_{metallurgical\ coke\_PJ}) + (FC_{COG\_BF\_PJ} * C_{COG\_PJ}) + (FC_{NG\_BF\_PJ} * C_{NG\_PJ}) + (FC_{BFG\_BF\_PJ} * C_{BFG\_PJ}) - - (P_{pig\ iron\_BF\_PJ} * \%C_{pig\ iron}) - (P_{BFG\_BF\_PJ} * C_{BFG\_PJ})] * 44/12$$

(PDD formula D1.1.2.-3)

Specific CO2 emissions per ton of pig iron produced

$$SPE_{pig\ iron} = PE_{pig\_iron} / P_{pig\ iron\_BF\_PJ}$$

(PDD formula D.1.1.2.-4)

Symbol	Data variable	Unit	Symbol	Data variable	Unit
$M_{skip\ metallurgical\ coke\_BF\_PJ}$	Consumption of skip metallurgical coke in BFP	ths. tons	$P_{pig\ iron\_BF\_PJ}$	Production of pig iron in BFP	ths. tons
$FC_{COG\_BF\_PJ}$	Consumption of COG in BFP	mln. m^3	$P_{BFG\_BF\_PJ}$	Output of BFG in BFP	mln. m^3
$FC_{NG\_BF\_PJ}$	Consumption of NG in BFP	mln. m^3	C_{NG_PJ}	Carbon content in NG	kg C/m^3
$FC_{BFG\_BF\_PJ}$	Consumption of BFG in BFP	mln. m^3	C_{BFG_PJ}	Carbon content in BFG	kg C/m^3
C_{COG_PJ}	Carbon content in COG	kg C/m^3	$PE_{pig\ iron}$	Project emissions from production of pig iron in the blast furnace plant	ths. tons CO_2
$\%C_{pig\ iron}$	Carbon content in pig iron	% by mass	$SPE_{pig\ iron}$	Specific CO_2 emissions per ton of produced pig iron	ton CO_2/ton
$\%C_{metallurgical\ coke\_PJ}$	Carbon content in metallurgical coke	% by mass			

12 months of 2008

Input carbon flows

#	Data variable	Unit	Jan	Feb	March	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Total for year
1	Consumption of skip metallurgical coke in BFP	ths. tons	390,5	374,6	397,3	375,4	408,0	361,3	323,5	371,4	381,5	283,3	144,6	127,8	**3939,2**
	Carbon content in dry metallurgical coke	%by mass	83,51	83,51	83,51	83,51	83,51	83,51	83,51	83,51	83,51	83,51	83,51	83,51	**83,51**
		ths. tons C	326,1	312,8	331,8	313,5	340,7	301,7	270,2	310,1	318,6	236,6	120,8	106,7	**3289,6**
2	Consumption of COG in BFP	mln. m3	6,4	7,1	5,9	4,9	7,9	8,9	7,4	8,5	8,3	4,9	3,3	0,0	**73,7**
	Carbon content in COG	kg C/m3	0,20	0,19	0,19	0,19	0,20	0,19	0,19	0,19	0,18	0,19	0,18	0,17	**0,19**
		ths. tons C	1,26	1,39	1,13	0,96	1,55	1,73	1,39	1,61	1,54	0,93	0,61	0,00	**14,1**

Specific CO_2 emissions form metallurgical conversions same for project and baseline. Production of pig iron

	Consumption of NG in BFP	mln. m3	86,3	83,0	89,6	81,9	82,9	71,4	63,9	71,8	79,1	67,3	31,4	20,2	**828,8**
	Carbon content in NG	kg C/m3	0,50	0,50	0,50	0,49	0,49	0,49	0,49	0,49	0,49	0,49	0,49	0,49	**0,49**
		ths. tons C	42,7	41,1	44,4	40,5	41,0	35,3	31,3	35,5	39,1	33,3	15,5	10,0	**409,8**
	Consumption of BFG in BFP	mln. m3	422,3	400,8	438,9	390,4	404,0	328,9	302,7	362,5	371,6	291,6	164,2	153,76	**4031,8**
	Carbon content in BFG	kg C/m3	0,20	0,20	0,21	0,20	0,19	0,20	0,20	0,20	0,20	0,20	0,17	0,17	**0,20**
		ths. tons C	85,4	82,1	90,1	79,7	78,5	67,2	60,4	70,8	72,5	57,3	28,3	26,1	**798,4**
3	**Total mass of carbon in the input flow for production of pig iron**	**ths. tons C**	**455,5**	**437,4**	**467,4**	**434,7**	**461,7**	**405,8**	**363,3**	**418,0**	**431,8**	**328,1**	**165,2**	**142,8**	**4511,9**

Output carbon flows

#	Data variable	Unit	Jan	Feb	March	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Total for year
1	Production of pig iron in BFP	ths. tons	874,5	843,1	895,4	820,8	872,3	754,4	679,4	785,3	811,0	621,8	315,3	268,2	**8541,4**
	Carbon content in pig iron	% by mass	4,70	4,70	4,70	4,70	4,70	4,70	4,70	4,70	4,70	4,70	4,70	4,70	**4,70**
		ths. tons C	41	40	42	39	41	35	32	37	38	29	15	13	**401**
2	Output of BFG in BFP	mln. m3	1176,9	1140,2	1200,5	1107,7	1180,0	1037,6	925,1	1062,6	1103,6	835,7	392,8	312,4	**11475,0**
	Carbon content in BFG	kg C/m3	0,20	0,20	0,21	0,20	0,19	0,20	0,20	0,20	0,20	0,20	0,17	0,17	**0,20**
		ths. tons C	238,0	233,5	246,4	226,2	229,2	211,9	184,7	207,4	215,4	164,4	67,6	53,0	**2277,7**
3	**Total mass of carbon in the output flow from production of pig iron**	**ths. tons C**	**279,1**	**273,1**	**288,5**	**264,8**	**270,2**	**247,3**	**216,6**	**244,3**	**253,5**	**193,6**	**82,4**	**65,6**	**2679,1**

CO2 emissions from production of pig iron

#	Data variable	Unit	Jan	Feb	March	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Total for year
1	Carbon burning during production of pig iron	ths. tons	176,4	164,3	178,9	169,9	191,6	158,5	146,6	173,7	178,3	134,6	82,7	77,2	**1832,8**
2	CO2 emissions from production of pig iron in the blast furnace plant	ths. tons CO2	647,0	602,4	655,9	623,0	702,4	581,2	537,6	637,0	653,8	493,4	303,4	283,1	**6720,2**
3	**Specific CO2 emissions per ton of pig iron produced**	**ton CO2/ton**	**0,740**	**0,715**	**0,733**	**0,759**	**0,805**	**0,770**	**0,791**	**0,811**	**0,806**	**0,794**	**0,962**	**1,056**	**0,787**

Specific CO_2 emissions form metallurgical conversions same for project and baseline. Production of pig iron

12 months of 2009

Input carbon flows

#	Data variable	Unit	Jan	Feb	March	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Total for year
1	Consumption of skip metallurgical coke in BFP	ths. tons	183,2	247,8	280,8	291,0	279,2	305,6	337,9	336,7	336,1	341,1	298,6	334,0	**3572,2**
	Carbon content in dry metallurgical coke	%by mass	83,51	83,39	84,02	83,39	83,41	83,31	83,43	83,64	83,40	83,84	83,63	83,10	**83,51**
		ths. tons C	153,0	206,7	235,9	242,7	232,9	254,6	281,9	281,6	280,3	286,0	249,7	277,6	**2982,9**
2	Consumption of COG in BFP	mln. m3	0,27	2,69	2,43	2,18	3,67	4,19	3,94	4,37	3,59	3,09	1,95	2,11	**34,5**
	Carbon content in COG	kg C/m3	0,18	0,18	0,18	0,18	0,18	0,18	0,19	0,18	0,19	0,19	0,19	0,18	**0,18**
		ths. tons C	0,05	0,48	0,44	0,39	0,68	0,77	0,74	0,78	0,67	0,59	0,36	0,38	**6,3**
	Consumption of NG in BFP	mln. m3	86,3	83,0	89,6	81,9	82,9	71,4	63,9	71,8	79,1	67,3	31,4	20,2	**828,8**
	Carbon content in NG	kg C/m3	0,50	0,50	0,50	0,50	0,50	0,50	0,49	0,49	0,49	0,49	0,49	0,50	**0,50**
		ths. tons C	42,8	41,1	44,4	40,5	41,0	35,3	31,6	35,5	39,1	33,3	15,5	10,0	**410,3**
	Consumption of BFG in BFP	mln. m3	188,8	249,7	289,0	292,2	286,4	310,9	346,9	350,9	361,2	382,4	340,9	379,55	**3778,8**
	Carbon content in BFG	kg C/m3	0,19	0,21	0,20	0,21	0,21	0,21	0,22	0,21	0,21	0,21	0,21	0,21	**0,21**
		ths. tons C	35,0	51,6	59,2	61,3	59,9	66,4	74,8	72,9	77,2	81,7	72,8	79,6	**792,5**
3	**Total mass of carbon in the input flow for production of pig iron**	**ths. tons C**	**230,8**	**299,9**	**339,9**	**344,8**	**334,5**	**357,2**	**389,1**	**390,9**	**397,3**	**401,6**	**338,4**	**367,6**	**4192,0**

Output carbon flows

#	Data variable	Unit	Jan	Feb	March	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Total for year
1	Production of pig iron in BFP	ths. tons	400,5	551,4	639,7	668,9	640,5	696,9	777,5	775,2	773,0	788,4	685,0	766	**8162,8**
	Carbon content in pig iron	% by mass	4,70	4,70	4,70	4,70	4,70	4,70	4,70	4,70	4,70	4,70	4,70	4,70	**4,70**
		ths. tons C	19	26	30	31	30	33	37	36	36	37	32	36	**384**
2	Output of BFG in BFP	mln. m3	458,4	732,8	865,5	907,3	888,0	954,6	1077,7	1077,1	1070,0	1090,0	964,0	1082,1	**11167,5**
	Carbon content in BFG	kg C/m3	0,19	0,21	0,20	0,21	0,21	0,21	0,22	0,21	0,21	0,21	0,21	0,21	**0,21**
		ths. tons C	84,9	151,5	177,2	190,3	185,8	204,0	232,5	223,7	228,7	233,0	206,0	227,0	**2344,5**
3	**Total mass of carbon in the output flow from production of pig iron**	**ths. tons C**	**103,7**	**177,4**	**207,3**	**221,7**	**215,9**	**236,8**	**269,0**	**260,2**	**265,0**	**270,1**	**238,2**	**262,9**	**2728,2**

CO2 emissions from production of pig iron

#	Data variable	Unit	Jan	Feb	March	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Total for year
1	Carbon burning during production of pig iron	ths. tons	127,0	122,5	132,7	123,1	118,6	120,4	120,1	130,7	132,3	131,6	100,2	104,7	**1463,8**
2	CO2 emissions from production of pig iron in the blast furnace plant	ths. tons CO2	465,8	449,1	486,4	451,5	435,0	441,5	440,4	479,2	485,0	482,4	367,4	383,8	**5367,4**
3	**Specific CO2 emissions per ton of pig iron produced**	**ton CO2/ton**	**1,163**	**0,814**	**0,760**	**0,675**	**0,679**	**0,634**	**0,566**	**0,618**	**0,627**	**0,612**	**0,536**	**0,501**	**0,658**

12 months of 2010

Input carbon flows

#	Data variable	Unit	Jan	Feb	March	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Total for year
1	Consumption of skip metallurgical coke in BFP	ths. tons	310,8	314,3	379,5	368,5	337,2	305,4	323,4	337,8	369,5	348,5	352,1	357,3	**4104,3**
	Carbon content in dry metallurgical coke	%by mass	83,10	82,60	83,20	83,50	83,30	83,00	83,00	82,90	82,80	82,90	82,90	83,00	**83,02**
		ths. tons C	258,3	259,6	315,7	307,7	280,9	253,5	268,4	280,0	306,0	288,9	291,9	296,6	**3407,4**
2	Consumption of COG in BFP	mln. m3	2,1	1,3	3,0	6,2	6,4	5,3	5,6	5,0	4,7	3,5	6,3	9,4	**58,9**
	Carbon content in COG	kg C/m3	0,18	0,18	0,18	0,18	0,18	0,18	0,19	0,19	0,19	0,19	0,19	0,19	**0,18**
		ths. tons C	0,38	0,23	0,55	1,09	1,14	0,95	1,05	0,94	0,88	0,67	1,17	1,74	**10,8**
	Consumption of NG in BFP	mln. m3	65,5	70,0	86,5	89,7	79,9	76,5	79,7	77,4	77,9	83,4	82,6	85,4	**954,4**
	Carbon content in NG	kg C/m3	0,50	0,50	0,49	0,49	0,49	0,49	0,49	0,49	0,49	0,49	0,49	0,49	**0,49**
		ths. tons C	32,4	34,6	42,8	44,4	39,5	37,8	39,4	38,3	38,5	41,2	40,8	42,2	**472,1**
	Consumption of BFG in BFP	mln. m3	345,9	340,5	435,0	414,0	367,4	313,5	337,0	343,1	353,8	368,3	364,9	357,9	**4341,3**
	Carbon content in BFG	kg C/m3	0,21	0,21	0,21	0,21	0,21	0,21	0,21	0,21	0,21	0,22	0,22	0,22	**0,21**
		ths. tons C	73,3	71,4	91,7	87,6	78,0	66,6	71,5	72,3	75,2	79,3	79,9	78,7	**925,5**
3	**Total mass of carbon in the input flow for production of pig iron**	**ths. tons C**	**364,4**	**365,9**	**450,7**	**440,8**	**399,5**	**358,9**	**380,3**	**391,6**	**420,5**	**410,1**	**413,9**	**419,2**	**4815,9**

Output carbon flows

#	Data variable	Unit	Jan	Feb	March	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Total for year

Specific CO_2 emissions form metallurgical conversions same for project and baseline. Production of pig iron

#	Data variable	Unit	Jan	Feb	March	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Total for year
1	Production of pig iron in BFP	ths. tons	686,3	700,0	849,3	842,4	769,6	708,4	754,5	761,4	799,0	781,0	786,9	795,1	**9234,0**
	Carbon content in pig iron	% by mass	4,70	4,70	4,70	4,70	4,70	4,70	4,70	4,70	4,70	4,70	4,70	4,70	**4,70**
		ths. tons C	32	33	40	40	36	33	35	36	38	37	37	37	**434**
2	Output of BFG in BFP	mln. m3	955,5	976,5	1199,3	1188,3	1068,8	974,1	1029,5	1024,5	1051,0	1071,1	1044,4	1083,8	**12666,9**
	Carbon content in BFG	kg C/m3	0,21	0,21	0,21	0,21	0,21	0,21	0,21	0,21	0,21	0,22	0,22	0,22	**0,21**
		ths. tons C	202,5	204,8	252,8	251,5	226,9	207,0	218,3	216,0	223,3	230,6	228,7	238,2	**2700,7**
3	**Total mass of carbon in the output flow from production of pig iron**	**ths. tons C**	**234,8**	**237,7**	**292,7**	**291,1**	**263,1**	**240,3**	**253,8**	**251,8**	**260,9**	**267,3**	**265,7**	**275,6**	**3134,7**

CO2 emissions from production of pig iron

#	Data variable	Unit	Jan	Feb	March	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	**Total for year**
1	Carbon burning during production of pig iron	ths. tons	129,6	128,2	158,1	149,7	136,5	118,6	126,6	139,7	159,7	142,8	148,2	143,6	**1681,2**
2	CO2 emissions from production of pig iron in the blast furnace plant	ths. tons CO2	475,2	470,2	579,6	548,8	500,4	434,8	464,1	512,4	585,5	523,5	543,3	526,6	**6164,3**
3	**Specific CO2 emissions per ton of pig iron produced**	**ton CO2/ton**	**0,692**	**0,672**	**0,682**	**0,651**	**0,650**	**0,614**	**0,615**	**0,673**	**0,733**	**0,670**	**0,690**	**0,662**	**0,668**

Specific CO_2 emissions form metallurgical conversions same for project and baseline. Production of pig iron

Production of slab steel billet in EAFP

$$PE_{EAFP} = [(M_{pig\ iron\_EAFP} * \%C_{pig\ iron}) + (M_{carbon\ powder\_EAFP} * \%C_{carbon\ powder\_EAFP}) + (M_{scrap\_EAFP} * \%C_{scrap}) + (M_{electrodes\_EAFP} * \%C_{electrodes\_EAFP}) + (FC_{NG\_EAFP} * C_{NG\_PJ}) - (\sum P_{profiled\&slab\ steel\_EAFP} * \%C_{steel})] * 44/12$$

(PDD formula D.1.1.2-5)

Specific CO2 emissions per ton of steel billet produced in EAFP

$$SPE_{EAFP} = PE_{EAFP} / \sum P_{profiled\&slab\ steel\_EAFP}$$

(PDD formula D.1.1.2-6)

Symbol	Data variable	Unit	Symbol	Data variable	Unit
$M_{pig\ iron\_EAFP}$	Consumption of pig iron in EAFP	ths. tons	FC_{NG_EAFP}	Consumption of NG in EAFP	mln. m^3
$M_{carbon\ powder\_EAFP}$	Consumption of carbon-containing powder in EAFP	ths. tons	$\sum P_{profiled\&slab\ steel\_EAFP}$	Total production of slab and profiled steel billet in EAFP	ths. tons
M_{scrap_EAFP}	Consumption of scrap metal in EAFP	ths. tons	PE_{EAFP}	Project CO_2 emissions from production of slab steel billet in EAFP	ths.tons CO_2
$M_{electrodes\_EAFP}$	Consumption of electrodes in EAFP	ths. tons	SPE_{EAFP}	Specific CO_2 emissions per ton of steel billet produced in EAFP	ton CO_2/ton
$\%C_{pig\ iron}$	Carbon content in pig iron	% by mass	$\%C_{electrodes\_EAFP}$	Carbon content in electrodes	% by mass
$\%C_{carbon\ powder\_EAFP}$	Carbon content in carbon-containing powder	% by mass	C_{NG_PJ}	Carbon content in NG	kg C/m^3
$\%C_{scrap}$	Carbon content in scrap metal	% by mass	$\%C_{steel}$	Carbon content in steel	% by mass

12 months of 2008

Input carbon flows

#	Data variable	Unit	Jan	Feb	March	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	**Total for year**
1	Consumption of pig iron in EAFP	ths. tons	110,2	113,0	116,6	98,7	104,0	91,2	77,2	85,2	94,3	48,9	34,7	38,9	**1012,8**
	Carbon content in pig iron	% by mass	4,70	4,70	4,70	4,70	4,70	4,70	4,70	4,70	4,70	4,70	4,70	4,70	**4,70**
		ths. tons C	5,2	5,3	5,5	4,6	4,9	4,3	3,6	4,0	4,4	2,3	1,6	1,8	**47,6**
2	Consumption of carbon-containing powder in EAFP	ths. tons	0,95	0,75	1,24	0,95	0,90	1,31	1,08	0,92	0,95	0,62	0,54	0,47	**10,7**
	Carbon content in carbon-containing powder	% by mass	95,00	95,00	95,00	95,00	95,00	95,00	95,00	95,00	95,00	95,00	95,00	95,00	**95,00**
		ths. tons C	0,9	0,7	1,2	0,9	0,9	1,2	1,0	0,9	0,9	0,6	0,5	0,4	**10,1**
3	Consumption of scrap metal in EAFP	ths. tons	255,5	223,9	244,8	237,3	228,0	236,4	248,8	253,3	244,4	111,4	75,9	136,6	**2496,3**
	Carbon content in scrap metal	% by mass	0,18	0,18	0,18	0,18	0,18	0,18	0,18	0,18	0,18	0,18	0,18	0,18	**0,18**
		ths. tons C	0,46	0,40	0,44	0,43	0,41	0,43	0,45	0,46	0,44	0,20	0,14	0,25	**4,5**
4	Consumption of electrodes in EAFP	ths. tons	0,41	0,36	0,45	0,37	0,38	0,40	0,43	0,44	0,44	0,21	0,14	0,25	**4,3**
	Carbon content in electrodes	% by mass	99,00	99,00	99,00	99,00	99,00	99,00	99,00	99,00	99,00	99,00	99,00	99,00	**99,00**
		ths. tons C	0,4	0,4	0,4	0,4	0,4	0,4	0,4	0,4	0,4	0,2	0,1	0,3	**4,3**
5	Consumption of NG in EAFP	mln. m3	7,4	6,2	6,2	5,4	5,6	5,3	5,8	5,9	5,5	4,4	3,3	4,3	**65,4**
	Carbon content in NG	kg C/m3	0,50	0,50	0,50	0,49	0,49	0,49	0,49	0,49	0,49	0,49	0,49	0,49	**0,49**
		ths. tons C	3,7	3,1	3,1	2,7	2,8	2,6	2,8	2,9	2,7	2,2	1,6	2,1	**32,4**
6	**Total mass of carbon in the input flow in EAFP**	**ths. tons C**	**10,6**	**9,9**	**10,6**	**9,0**	**9,3**	**9,0**	**8,4**	**8,7**	**9,0**	**5,5**	**4,0**	**4,9**	**98,8**

Output carbon flows

#	Data variable	Unit	Jan	Feb	March	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	**Total for year**
1	Total production of slab and profiled steel billet in EAFP	ths. tons	322,6	298,0	320,4	300,5	297,0	291,0	289,3	305,5	301,5	142,0	97,9	152,7	**3118,3**
	Carbon content in steel	% by mass	0,18	0,18	0,18	0,18	0,18	0,18	0,18	0,18	0,18	0,18	0,18	0,18	**0,18**
		ths. tons C	0,6	0,5	0,6	0,5	0,5	0,5	0,5	0,5	0,5	0,3	0,2	0,3	**5,6**
2	**Total mass of carbon in the output flow from EAFP**	**ths. tons C**	**0,6**	**0,5**	**0,6**	**0,5**	**0,5**	**0,5**	**0,5**	**0,5**	**0,5**	**0,3**	**0,2**	**0,3**	**5,6**

CO2 emissions from production of steel

#	Data variable	Unit	Jan	Feb	March	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Total for year
1	Burning of carbon during production of steel billet in EAFP	ths. tons C	10,0	9,3	10,1	8,5	8,8	8,5	7,8	8,1	8,4	5,2	3,9	4,6	**93,2**
2	CO2 emissions from production of steel billet in EAFP	ths. tons CO2	36,7	34,2	36,9	31,1	32,2	31,0	28,7	29,8	30,8	19,2	14,2	16,9	**341,8**
3	**Specific CO2 emissions per ton of steel billet produced in EAFP**	**tons CO2/ton**	**0,114**	**0,115**	**0,115**	**0,104**	**0,108**	**0,107**	**0,099**	**0,098**	**0,102**	**0,135**	**0,145**	**0,111**	**0,110**

12 months of 2009

Input carbon flows

#	Data variable	Unit	Jan	Feb	March	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Total for year
1	Consumption of pig iron in EAFP	ths. tons	31,8	55,8	83,8	87,0	67,4	94,6	92,5	96,4	95,3	79,2	72,1	73,8	**929,6**
	Carbon content in pig iron	% by mass	4,70	4,70	4,70	4,70	4,70	4,70	4,70	4,70	4,70	4,70	4,70	4,70	**4,70**
		ths. tons C	1,5	2,6	3,9	4,1	3,2	4,4	4,3	4,5	4,5	3,7	3,4	3,5	**43,7**
2	Consumption of carbon-containing powder in EAFP	ths. tons	0,6	0,7	0,2	0,2	0,1	0,2	0,2	0,3	0,5	0,2	0,1	0,2	**3,4**
	Carbon content in carbon-containing powder	% by mass	95,00	95,00	95,00	95,00	95,00	95,00	95,00	95,00	95,00	95,00	95,00	95,00	**95,00**
		ths. tons C	0,5	0,7	0,2	0,2	0,1	0,2	0,2	0,3	0,5	0,1	0,1	0,1	**3,2**
3	Consumption of scrap metal in EAFP	ths. tons	129,4	183,4	26,0	18,3	13,8	30,2	33,4	78,5	72,4	28,4	24,8	17,8	**656,5**
	Carbon content in scrap metal	% by mass	0,18	0,18	0,18	0,18	0,18	0,18	0,18	0,18	0,18	0,18	0,18	0,18	**0,18**
		ths. tons C	0,23	0,33	0,05	0,03	0,02	0,05	0,06	0,14	0,13	0,05	0,04	0,03	**1,2**
4	Consumption of electrodes in EAFP	ths. tons	0,23	0,37	0,04	0,03	0,03	0,05	0,04	0,14	0,12	0,05	0,04	0,02	**1,2**
	Carbon content in electrodes	% by mass	99,00	99,00	99,00	99,00	99,00	99,00	99,00	99,00	99,00	99,00	99,00	99,00	**99,00**
		ths. tons C	0,2	0,4	0,0	0,0	0,0	0,0	0,0	0,1	0,1	0,0	0,0	0,0	**1,1**
5	Consumption of NG in EAFP	mln. m3	4,7	5,2	4,1	3,9	3,4	3,1	3,0	4,0	4,1	3,8	4,2	4,8	**48,3**
	Carbon content in NG	kg C/m3	0,50	0,50	0,50	0,50	0,50	0,50	0,49	0,49	0,49	0,49	0,49	0,50	**0,50**
		ths. tons C	2,3	2,6	2,0	1,9	1,7	1,5	1,5	2,0	2,0	1,9	2,1	2,4	**23,9**
6	**Total mass of carbon in the input flow in EAFP**	**ths. tons C**	**4,8**	**6,6**	**6,2**	**6,2**	**5,0**	**6,2**	**6,1**	**7,1**	**7,2**	**5,8**	**5,7**	**6,1**	**73,1**

Specific CO_2 emissions from metallurgical conversions in the project only. Production of steel billet in EAFP

Output carbon flows

#	Data variable	Unit	Jan	Feb	March	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Total for year
1	Total production of slab and profiled steel billet in EAFP	ths. tons	140,7	211,5	95,9	92,8	72,4	110,5	111,4	155,0	148,0	95,0	85,9	81,2	**1400**
	Carbon content in steel	% by mass	0,18	0,18	0,18	0,18	0,18	0,18	0,18	0,18	0,18	0,18	0,18	0,18	**0,18**
		ths. tons C	0,3	0,4	0,2	0,2	0,1	0,2	0,2	0,3	0,3	0,2	0,2	0,1	**2,5**
2	**Total mass of carbon in the output flow from EAFP**	**ths. tons C**	**0,3**	**0,4**	**0,2**	**0,2**	**0,1**	**0,2**	**0,2**	**0,3**	**0,3**	**0,2**	**0,2**	**0,1**	**2,5**

CO2 emissions from production of steel

#	Data variable	Unit	Jan	Feb	March	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Total for year
1	Burning of carbon during production of steel billet in EAFP	ths. tons C	4,6	6,2	6,0	6,1	4,9	6,0	5,9	6,8	6,9	5,7	5,5	5,9	**70,6**
2	CO2 emissions from production of steel billet in EAFP	ths. tons CO2	16,8	22,8	22,2	22,3	18,0	22,1	21,6	25,0	25,5	20,8	20,3	21,7	**258,9**
3	**Specific CO2 emissions per ton of steel billet produced in EAFP**	**tons CO2/ton**	**0,119**	**0,108**	**0,231**	**0,240**	**0,248**	**0,200**	**0,194**	**0,161**	**0,172**	**0,219**	**0,236**	**0,267**	**0,185**

12 months of 2010

Input carbon flows

#	Data variable	Unit	Jan	Feb	March	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Total for year
1	Consumption of pig iron in EAFP	ths. tons	50,1	74,9	99,2	94,6	54,8	38,8	36,6	70,8	91,8	71,4	93,5	105,4	**882,0**
	Carbon content in pig iron	% by mass	4,70	4,70	4,70	4,70	4,70	4,70	4,70	4,70	4,70	4,70	4,70	4,70	**4,70**
		ths. tons C	2,4	3,5	4,7	4,4	2,6	1,8	1,7	3,3	4,3	3,4	4,4	5,0	**41,5**
2	Consumption of carbon-containing powder in EAFP	ths. tons	0,30	1,33	1,03	0,81	0,80	0,62	0,99	0,58	0,58	0,43	0,17	0,28	**7,9**
	Carbon content in carbon-containing powder	% by mass	95,00	95,00	95,00	95,00	95,00	95,00	95,00	95,00	95,00	95,00	95,00	95,00	**95,00**
		ths. tons C	0,3	1,3	1,0	0,8	0,8	0,6	0,9	0,5	0,6	0,4	0,2	0,3	**7,5**
3	Consumption of scrap metal in EAFP	ths. tons	38,7	116,4	125,8	112,6	162,5	131,9	146,8	135,2	135,7	75,9	33,7	37,9	**1253,2**
	Carbon content in scrap metal	% by mass	0,18	0,18	0,18	0,18	0,18	0,18	0,18	0,18	0,18	0,18	0,18	0,18	**0,18**
		ths. tons C	0,07	0,21	0,23	0,20	0,29	0,24	0,26	0,24	0,24	0,14	0,06	0,07	**2,3**

Specific CO_2 emissions from metallurgical conversions in the project only. Production of steel billet in EAFP

4	Consumption of electrodes in EAFP	ths. tons	0,07	0,22	0,23	0,20	0,36	0,31	0,32	0,25	0,24	0,15	0,05	0,05	**2,4**
	Carbon content in electrodes	% by mass	99,00	99,00	99,00	99,00	99,00	99,00	99,00	99,00	99,00	99,00	99,00	99,00	**99,00**
		ths. tons C	0,1	0,2	0,2	0,2	0,4	0,3	0,3	0,2	0,2	0,1	0,1	0,0	**2,4**
5	Consumption of NG in EAFP	mln. m3	7,0	6,0	4,9	5,5	6,0	4,7	4,5	5,3	5,6	5,0	3,4	5,4	**63,5**
	Carbon content in NG	kg C/m3	0,50	0,50	0,49	0,49	0,49	0,49	0,49	0,49	0,49	0,49	0,49	0,49	**0,49**
		ths. tons C	3,5	3,0	2,4	2,7	3,0	2,3	2,2	2,6	2,8	2,5	1,7	2,7	**31,4**
6	**Total mass of carbon in the input flow in EAFP**	**ths. tons C**	**6,2**	**8,2**	**8,5**	**8,4**	**7,0**	**5,3**	**5,5**	**7,0**	**8,1**	**6,5**	**6,4**	**8,0**	**85,1**

Output carbon flows

#	Data variable	Unit	Jan	Feb	March	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	**Total for year**
1	Total production of slab and profiled steel billet in EAFP	ths. tons	78,6	169,7	199,3	183,8	192,9	151,5	162,0	181,8	200,8	129,9	112,4	125,9	**1888,4**
	Carbon content in steel	% by mass	0,18	0,18	0,18	0,18	0,18	0,18	0,18	0,18	0,18	0,18	0,18	0,18	**0,18**
		ths. tons C	0,1	0,3	0,4	0,3	0,3	0,3	0,3	0,3	0,4	0,2	0,2	0,2	**3,4**
2	**Total mass of carbon in the output flow from EAFP**	**ths. tons C**	**0,1**	**0,3**	**0,4**	**0,3**	**0,3**	**0,3**	**0,3**	**0,3**	**0,4**	**0,2**	**0,2**	**0,2**	**3,4**

CO2 emissions from production of steel

#	Data variable	Unit	Jan	Feb	March	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	**Total for year**
1	Burning of carbon during production of steel billet in EAFP	ths. tons C	6,1	7,9	8,2	8,0	6,6	5,0	5,2	6,7	7,8	6,3	6,2	7,8	**81,7**
2	CO2 emissions from production of steel billet in EAFP	ths. tons CO2	22,3	28,9	30,0	29,4	24,3	18,4	19,0	24,5	28,4	23,1	22,6	28,5	**299,4**
3	**Specific CO2 emissions per ton of steel billet produced in EAFP**	**tons CO2/ton**	**0,284**	**0,170**	**0,151**	**0,160**	**0,126**	**0,122**	**0,117**	**0,135**	**0,141**	**0,178**	**0,201**	**0,227**	**0,159**

Specific CO_2 emissions from metallurgical conversions in the project only. Production of steel billet in EAFP

D.2 Coefficients of consumption for metallurgical conversions

<u>Coefficients of consumption for metallurgical conversions in the project</u>

Specific consumption of pig iron per ton of steel billet produced in EAFP

$$SC_{pig\ iron\_EAFP} = M_{pig\ iron\_EAFP} / \sum P_{profiled\&slab\ steel\_EAFP}$$ **(PDD formula D.1.1.2.-7)**

Specific consumption of scrap metal per ton of steel billet produced in EAFP

$$SC_{scrap\_EAFP} = M_{scrap\_EAFP} / \sum P_{profiled\&slab\ steel\_EAFP}$$ **(PDD formula D.1.1.2.-8)**

Specific consumption of dry skip metallurgical coke per ton of produced pig iron

$$SC_{skip\_metallurgical\_coke\_PJ} = M_{skip\_metallurgical\ coke\_BF\_PJ} / P_{pig\ iron\_BF\_PJ}$$ **(PDD formula D.1.1.2.-9)**

Symbol	Data variable	Unit	Symbol	Data variable	Unit
$SC_{pig\ iron\_EAFP}$	Specific consumption of pig iron per ton of steel billet produced in EAFP	ton/ton	M_{scrap_EAFP}	Consumption of scrap metal in EAFP	ths. tons
$M_{pig\ iron\_EAFP}$	Consumption of pig iron in EAFP	ths. tons	$SC_{skip\_metallurgical\_coke\_PJ}$	Specific consumption of dry skip metallurgical coke per ton of pig iron produced in BFP	tons/ton
$\sum P_{profiled\&slab\ steel\_EAFP}$	Total production of slab and profiled steel billet in EAFP	ths. tons	$M_{skip\ metallurgical\ coke\_BF\_PJ}$	Consumption of dry skip metallurgical coke in BFP	ton/ton
SC_{scrap_EAFP}	Specific consumption of pig iron per ton of steel billet produced in EAFP	ton/ton	$P_{pig\ iron\_BF\_PJ}$	Production of pig iron in BFP	ton/ton

12 months of 2008

Project factors

#	Data variable	Unit	Jan	Feb	March	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Total for year
1	Total production of slab and profiled steel billet in EAFP	ths. tons	322,6	298,0	320,4	300,5	297,0	291,0	289,3	305,5	301,5	142,0	97,9	152,7	**3118,3**
2	**Output of slab steel billet in EAFP**	**ths. tons**	**147,1**	**133,3**	**148,0**	**132,6**	**151,0**	**134,7**	**133,6**	**146,7**	**142,0**	**25,2**	**53,3**	**97,8**	**1445,2**
3	Total smelting of steel in EAF-180	ths. tons	279,3	247,5	279,5	275,4	256,7	264,3	280,0	295,6	280,2	114,4	85,0	152,3	**2810,2**
4	Consumption of pig iron in EAFP	ths. tons	110,2	113,0	116,6	98,7	104,0	91,2	77,2	85,2	94,3	48,9	34,7	38,9	**1012,8**
5	Consumption of scrap metal in EAFP	ths. tons	255,5	223,9	244,8	237,3	228,0	236,4	248,8	253,3	244,4	111,4	75,9	136,6	**2496**
6	Specific consumption of pig iron per ton of steel billet produced in EAFP	ton/ton	0,341	0,379	0,364	0,328	0,350	0,314	0,267	0,279	0,313	0,344	0,355	0,255	**0,325**
7	Specific consumption of scrap metal per ton of steel billet produced in EAFP	ton/ton	0,792	0,751	0,764	0,790	0,768	0,812	0,860	0,829	0,811	0,784	0,776	0,895	**0,801**
8	Specific consumption of dry skip metallurgical coke per ton of produced pig iron	ton/ton	0,447	0,444	0,444	0,457	0,468	0,479	0,476	0,473	0,470	0,456	0,459	0,477	**0,461**

Note: in this case, the calculation model operates with data including the data from cells previously submitted (*Specific consumption of coke per ton of iron*), and also contains indicators (*actual production of slab steel billet in the EAFP* and *production of steel in EAF-180*), which will be used to calculate project emissions further.

Coefficients of consumption of materials for metallurgical conversions in the project

12 months of 2009

Project factors

#	Data variable	Unit	Jan	Feb	March	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Total for year
1	Total production of slab and profiled steel billet in EAFP	ths. tons	140,7	211,5	95,9	92,8	72,4	110,5	111,4	155,0	148,0	95,0	85,9	81,2	**1400,3**
2	**Output of slab steel billet in EAFP**	**ths. tons**	**72,7**	**118,5**	**0,2**	**0,0**	**0,0**	**0,0**	**0,0**	**41,8**	**58,3**	**17,7**	**37,3**	**26,0**	**372,5**
3	Total smelting of steel in EAF-180	ths. tons	140,7	210,6	0,4	0,0	0,0	0,0	0,0	59,2	50,3	6,7	0,0	0,0	**467,9**
4	Consumption of pig iron in EAFP	ths. tons	31,8	55,8	83,8	87,0	67,4	94,6	92,5	96,4	95,3	79,2	72,1	73,8	**929,6**
5	Consumption of scrap metal in EAFP	ths. tons	129,4	183,4	26,0	18,3	13,8	30,2	33,4	78,5	72,4	28,4	24,8	17,8	**657**
6	Specific consumption of pig iron per ton of steel billet produced in EAFP	ton/ton	0,226	0,264	0,874	0,938	0,932	0,856	0,830	0,622	0,644	0,833	0,839	0,909	**0,664**
7	Specific consumption of scrap metal per ton of steel billet produced in EAFP	ton/ton	0,920	0,867	0,271	0,198	0,190	0,274	0,300	0,507	0,489	0,299	0,289	0,219	**0,469**
8	Specific consumption of dry skip metallurgical coke per ton of produced pig iron	ton/ton	0,457	0,449	0,439	0,435	0,436	0,439	0,435	0,434	0,435	0,433	0,436	0,436	**0,438**

Note: in this case, the calculation model operates with data including the data from cells previously submitted (*Specific consumption of coke per ton of iron*), and also contains indicators (*actual production of slab steel billet in the EAFP* and *production of steel in EAF-180*), which will be used to calculate project emissions further.

12 months of 2010

Project factors

#	Data variable	Unit	Jan	Feb	March	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Total for year
1	Total production of slab and profiled steel billet in EAFP	ths. tons	78,6	169,7	199,3	183,8	192,9	151,5	162,0	181,8	200,8	129,9	112,4	125,9	**1888,4**
2	**Output of slab steel billet in EAFP**	**ths. tons**	**43,4**	**78,6**	**100,3**	**95,6**	**128,4**	**92,6**	**98,6**	**50,9**	**43,4**	**33,9**	**10,6**	**4,5**	**780,9**
3	Total smelting of steel in EAF-180	ths. tons	37,3	103,4	124,3	109,0	183,3	151,5	162,0	146,3	134,6	55,8	0,0	1,7	**1209,1**
4	Consumption of pig iron in EAFP	ths. tons	50,1	74,9	99,2	94,6	54,8	38,8	36,6	70,8	91,8	71,4	93,5	105,4	**882,0**
5	Consumption of scrap metal in EAFP	ths. tons	38,7	116,4	125,8	112,6	162,5	131,9	146,8	135,2	135,7	75,9	33,7	37,9	**1253**
6	Specific consumption of pig iron per ton of steel billet produced in EAFP	ton/ton	0,638	0,442	0,498	0,515	0,284	0,256	0,226	0,389	0,457	0,550	0,832	0,838	**0,467**
7	Specific consumption of scrap metal per ton of steel billet produced in EAFP	ton/ton	0,492	0,686	0,631	0,613	0,842	0,871	0,906	0,744	0,676	0,585	0,300	0,301	**0,664**
8	Specific consumption of dry skip metallurgical coke per ton of produced pig iron	ton/ton	0,453	0,449	0,447	0,437	0,438	0,431	0,429	0,444	0,462	0,446	0,448	0,449	**0,444**

Note: in this case, the calculation model operates with data including the data from cells previously submitted (*Specific consumption of coke per ton of iron*), and also contains indicators (*actual production of slab steel billet in the EAFP* and *production of steel in EAF-180*), which will be used to calculate project emissions further.

Coefficients of consumption of materials for metallurgical conversions in the project

D.3 Project CO_2 emissions from metallurgical conversions associated with production of slab steel billet

Project CO_2 emissions from consumption of metallurgical coke for production of slab steel billet

$PE_{metallurgical\_coke\_slab\_steel} = SC_{skip\_metallurgical\_coke\_PJ} * SC_{pig\ iron\_\ EAFP} * P_{slab\ steel\_EAFP} * SPE_{metallurgical\ coke}$ **(PDD formula D.1.1.2.-10)**

Project CO_2 emissions from consumption of pig iron for production of slab steel billet

$PE_{pig\ iron\_slab\_steel} = SC_{pig\ iron\_\ EAFP} * P_{slab\ steel\_EAFP} * SPE_{pig\ iron}$ **(PDD formula D.1.1.2.-11)**

Project CO_2 emissions in EAFP from production of slab steel billet

$PE_{slab\ steel\_\ EAFP} = P_{slab\ steel\_\ EAFP} * SPE_{EAFP}$ **(PDD formula D.1.1.2.-12)**

Symbol	Data variable	Unit	Symbol	Data variable	Unit
$PE_{metallurgical\_coke\_\ slab\ \_steel}$	Project CO_2 emissions from consumption of metallurgical coke for production of slab steel billet	ths. tons CO_2	$PE_{pig\ iron\_\ slab\ \_steel}$	Project CO_2 emissions from consumption of pig iron for production of slab steel billet	ths. tons CO_2
$SC_{skip\_metallurgical\_coke\_PJ}$	Specific consumption of dry skip metallurgical coke per ton of pig iron smelted in BFP	ton/ton	$SPE_{pig\ iron}$	Specific CO_2 emissions per ton of produced pig iron	ton CO_2/ton
$SC_{pig\ iron\_\ EAFP}$	Specific consumption of pig iron per ton of steel billet produced in EAFP	ton/ton	$PE_{slab\ steel\_\ EAFP}$	Project CO_2 emissions in EAFP from production of slab steel billet	ths. tons CO_2
$SPE_{metallurgical\_coke}$	Specific CO_2 emissions per ton of dry metallurgical coke produced in BPCP	ton CO_2/ton	SPE_{EAFP}	Specific CO_2 emissions per ton of slab steel billet produced in EAFP	ton CO_2/ton
$P_{slab\ steel\_EAFP}$	Output of slab steel billet in EAFP	ths. tons			

12 months of 2008

Project CO2 emissions from metallurgical conversions during production of slab steel billet

#	Data variable	Unit	Jan	Feb	March	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Total for year
1	CO2 emissions from consumption of metallurgical coke for production of slab steel billet	ths. tons CO2	22,422	22,052	23,639	20,185	24,481	20,636	17,201	18,806	20,256	3,839	8,917	12,501	214,934
2	CO2 emissions from consumption of pig iron for production of slab steel billet	ths. tons CO2	37,151	36,109	39,473	33,042	42,552	32,536	28,215	33,172	35,816	6,886	18,201	26,300	369,454
3	CO2 emissions in EAFP from production of slab steel billet	ths. tons CO2	16,745	15,277	17,036	13,727	16,343	14,363	13,270	14,324	14,527	3,413	7,726	10,836	157,587

12 months of 2009

Project CO2 emissions from metallurgical conversions during production of slab steel billet

#	Data variable	Unit	Jan	Feb	March	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Total for year
1	CO2 emissions from consumption of metallurgical coke for production of slab steel billet	ths. tons CO2	7,521	14,336	0,059	0,000	0,000	0,000	0,000	10,756	15,911	6,212	13,719	10,190	78,705
2	CO2 emissions from consumption of pig iron for production of slab steel billet	ths. tons CO2	19,104	25,472	0,107	0,000	0,000	0,000	0,000	16,071	23,571	9,012	16,786	11,830	121,951
3	CO2 emissions in EAFP from production of slab steel billet	ths. tons CO2	8,665	12,760	0,037	0,000	0,000	0,000	0,000	6,745	10,039	3,862	8,802	6,938	57,847

Project CO_2 emissions from metallurgical conversions associated with production of slab steel billet

12 months of 2010

Project CO2 emissions from metallurgical conversions during production of slab steel billet

#	Data variable	Unit	Jan	Feb	March	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Total for year
1	CO2 emissions from consumption of metallurgical coke for production of slab steel billet	ths. tons CO2	13,095	17,055	22,774	21,441	15,837	10,169	9,276	8,733	8,591	7,901	3,828	1,707	140,408
2	CO2 emissions from consumption of pig iron for production of slab steel billet	ths. tons CO2	19,157	23,322	34,059	32,052	23,720	14,546	13,718	13,328	14,554	12,498	6,113	2,523	209,592
3	CO2 emissions in EAFP from production of slab steel billet	ths. tons CO2	12,330	13,375	15,105	15,292	16,151	11,260	11,570	6,847	6,147	6,032	2,140	1,031	117,280

Project CO_2 emissions from metallurgical conversions associated with production of slab steel billet

D.4 CO_2 emissions from electricity consumption associated with production of slab steel billet in EAFP

CO_2 emissions from consumption of grid electricity by EAF-180 via 220/35 kV step-down substation during smelting of slab steel grades

$$PE_{EC\_grid\_slab\_steel\_EAF} = SEC_{grid\_steel\_EAF} * P_{slab\ steel\_EAFP} * \sum P_{steel\_EAF} / \sum P_{profiled\ \&slab\ steel\_EAFP} * EF_{grid} * (1+TDL)$$ **(PDD formula D.1.1.2.-14)**

Specific consumption of grid electricity by EAF-180 via 220/35 kV step-down substation during steel smelting

$$SEC_{grid\_steel\_EAF} = EC_{grid\_steel\_EAF} / \sum P_{steel\_EAF}$$ **(PDD formula D.1.1.2.-15)**

Symbol	Data variable	Unit	Symbol	Data variable	Unit
$EC_{grid\_steel\_EAF}$	Consumption of grid electricity by EAF-180 via 220/35 kV step-down substation	GW-h	**$SEC_{grid\_steel\_EAF}$**	Specific consumption of grid electricity by EAF-180 via 220/35 kV step-down substation per ton of all smelted steel	MW-h/ton
$\sum P_{steel\_EAF}$	Total smelting of steel in EAF-180	ths. tons	**EF_{grid}**	CO_2 emission factor for grid electricity from Unified Energy Systems of Urals (EF grid = 0.541 t CO2/MW-h)	tons CO2/MW-h
$P_{slab\ steel\_EAFP}$	Output of slab steel billet in EAFP	ths. tons	**TDL**	Technological losses during transportation and distribution of grid electricity in Unified Energy System of Urals	%
$\sum P_{profiled\&slab\ steel\_EAFP}$	Total production of slab and profiled steel billet in EAFP	ths. tons	**$PE_{EC\_grid\_\ slab\_steel\_EAF}$**	CO_2 emissions from consumption of grid electricity by EAF-180 via 220/35 kV step-down substation during smelting of slab steel grades	ths. tons CO_2

CO_2 emissions from consumption of electricity from corporate MMK grid by other equipment of EAFP (including DBSU) during production of slab steel billet

$$PE_{EC\_slab\_steel\_other\ EAFP} = (SEC_{steel\ refinement\ and\ casting\ EAFP} * P_{slab\ steel\_EAFP} + SEC_{steel\_OHFP} * P_{slab\ steel\_EAFP} * (\sum P_{profiled\&slab\ steel\_EAFP} - \sum P_{steel\_EAF}) / \sum P_{profiled\&slab\ steel\_EAFP})) * ((EF_{own\ generation\_PJ} * (EC_{gross\_PJ} - EC_{import\_PJ}) + EF_{grid} * (EC_{import\_PJ} - EC_{grid\_steel\_EAF}) * (1+TDL)) / (EC_{gross\_PJ} - EC_{grid\_steel\_EAF}))$$

(PDD formula D.1.1.2.-16)

Specific electricity consumption in EAFP for steel refining and casting

$$SEC_{\text{steel refinement and casting EAFP}} = (EC_{EAFP} - EC_{grid\_steel\_EAF} - SEC_{steel\_OHFP} * (\sum P_{\text{profiled\&slab steel\_EAFP}} - \sum P_{steel\_EAF})) / \sum P_{\text{profiled\&slab steel\_EAFP}}$$

(PDD formula D.1.1.2.-17)

Symbol	Data variable	Unit	Symbol	Data variable	Unit
PE $_{\text{EC\_other equipment\_EAFP\_PJ}}$	CO_2 emissions from consumption of electricity from corporate MMK grid by other equipment of EAFP (including DBSU) during production of slab steel billet	ths. tons CO_2	**EF** $_{\text{own generation\_PJ}}$	CO_2 emission factor for electricity produced by own generating capacities of MMK	tons CO_2/MW-h
SEC $_{\text{steel refinement and casting EAFP}}$	Specific electricity consumption in EAFP for steel refining and casting,	MW-h/ton	**EC** $_{\text{gross\_PJ}}$	Total electricity consumption by MMK	GW-h
P $_{\text{slab steel\_EAFP}}$	Output of slab steel billet in EAFP	ths. tons	**EC** $_{\text{import\_PJ}}$	Electricity purchases from Unified Energy Systems of Urals grid	GW-h
$\sum$**P** $_{\text{profiled\&slab steel\_EAFP}}$	Total production of slab and profiled steel billet in EAFP	ths. tons	**EC** $_{\text{grid\_steel\_EAF}}$	Consumption of grid electricity by EAF-180 via 220/35 kV step-down substation	GW-h
$\sum$**P** $_{\text{steel\_EAF}}$	Total smelting of steel in EAF-180	ths. tons	**EC** $_{\text{EAFP}}$	Total electricity consumption in EAFP	GW-h
SEC $_{\text{steel\_OHFP}}$	Specific consumption of electricity in open-hearth furnace plant per ton of smelted steel (remain fixed over the crediting period – **0.007**, calculated on basis of average historical data of electricity consumption in OHFP and output of steel in OHFP in 2000-2002[13])	MW-h/ton	**TDL**	Technological losses during transportation and distribution of grid electricity in Unified Energy System of Urals[14]	%
EF $_{\text{grid}}$	CO_2 emission factor for grid electricity from Unified Energy Systems of Urals (EF grid = 0.541 t CO2/MW-h)	tons CO_2/MW-h			

[13] http://ji.unfccc.int/JI_Projects/DB/3YOHME3FSIKG8602M8WN9D60QNIQT7/PublicPDD/YAGHLX0KYONQCEVWW7EHHU3EW75Z32/view.html

[14] http://www.mrsk-ural.ru/ru/460

CO_2 emissions from electricity consumption associated with production of slab steel billet in EAFP

CO_2 emissions from consumption of electricity from corporate grid of MMK, for production of nitrogen, pure nitrogen and argon needed for production of slab steel billet

$PE_{EC\_Ar\_N2\_slab\_steel} = (EC_{N2\_slab\_steel} + EC_{pure\ N2\_slab\_steel} + EC_{Ar\_slab\_steel}) * ((EF_{own\ generation\_PJ} * (EC_{gross\_PJ} - EC_{import\_PJ}) + EF_{grid} * (EC_{import\_PJ} - EC_{grid\_steel\_EAF}) * (1+TDL))/(EC_{gross\_PJ} - EC_{grid\_steel\_EAF})$ **(PDD formula D.1.1.2.-18)**

Electricity consumption for production of nitrogen, which is used during production of slab steel billet in EAFP

$EC_{N2\_slab\_steel} = SEC_{N2\_PJ} * V_{N2\_EAFP} * P_{slab\_steel\_EAFP} / \sum P_{profiled\&slab\ steel\_EAFP}$ **(PDD formula D.1.1.2.-19)**

Electricity consumption for production of pure nitrogen, which is used during production of slab steel billet in EAFP

$EC_{pure\_N2\_slab\_steel} = SEC_{pure\_N2\_PJ} * V_{pure\_N2\_EAFP} * P_{slab\_steel\_EAFP\_} / \sum P_{profiled\&slab\ steel\_EAFP}$ **(PDD formula D.1.1.2.-20)**

Electricity consumption for production of argon, which is used during production of slab steel billet in EAFP

$EC_{Ar\_slab\_steel} = SEC_{Ar\_PJ} * V_{Ar\_EAFP} * P_{slab\_steel\_EAFP} /\_\sum P_{profiled\&slab\ steel\_EAFP}$ **(PDD formula D.1.1.2.-21)**

CO_2 emissions from consumption of electricity from corporate grid of MMK for production of oxygen needed for production of slab steel billet in EAFP

$PE_{EC\_O2\_slab\_steel} = EC_{O2\_slab\_steel} * ((EF_{own\ generation\_PJ} * (EC_{gross\_PJ} - EC_{import\_PJ}) + EF_{grid} * (EC_{import\_PJ} - EC_{grid\_steel\_EAF}) * (1+TDL))/(EC_{gross\_PJ} - EC_{grid\_steel\_EAF})$

(PDD formula D.1.1.2.-22)

Electricity consumption for production of oxygen, which is used during production of slab steel billet in EAFP

$EC_{O2\_slab\_steel} = SEC_{O2\_PJ} * V_{O2\_EAFP} * P_{slab\_steel\_EAFP} /\_\sum P_{profiled\&slab\ steel\_EAFP}$ **(PDD formula D.1.1.2.-23)**

Specific electricity consumption for production of oxygen at MMK

$SEC_{O2\_PJ} = ((P_{O2\ OCS\ \#1} * SEC_{O2\ OCS\ \#1}) + (P_{O2\ OCS\ \#2} * SEC_{O2\ OCS\ \#2}))/(P_{O2\ OCS\ \#1} + P_{O2\ OCS\ \#2})$ **(PDD formula D.1.1.2.-24)**

CO_2 emissions from electricity consumption associated with production of slab steel billet in EAFP

Symbol	Data variable	Unit	Symbol	Data variable	Unit
$PE_{EC\_Ar\_N2\_slab\_steel}$	CO_2 emissions from consumption of electricity from corporate grid of MMK for production of nitrogen, pure nitrogen and argon needed for production of slab steel billet	ths. tons CO_2	**EC_{gross_PJ}**	Total electricity consumption by MMK	GW-h
$EC_{N2\_slab\_steel}$	Electricity consumption for production of nitrogen, which is used during production of slab steel billet in EAFP	GW-h	**EC_{import_PJ}**	Electricity purchases from Unified Energy Systems of Urals grid	GW-h
$EC_{pure\ N2\_slab\_steel}$	Electricity consumption for production of pure nitrogen, which is used during production of slab steel billet in EAFP	GW-h	**$EC_{grid\_steel\_EAF}$**	Consumption of grid electricity by EAFP-180, via 220/35 kV step-down substation	GW-h
$EC_{Ar\_slab\_steel}$	Electricity consumption for production of argon, which is used during production of slab steel billet in EAFP	GW-h	**EF_{grid}**	CO_2 emission factor for grid electricity from Unified Energy Systems of Urals (EF grid = 0.541 t CO2/MW-h)	tons CO_2/ MW-h
$EF_{own\ generation\_PJ}$	CO_2 emission factor for electricity produced by own generating capacities of MMK	tons CO_2/ MW-h	**TDL**	Technological losses during transportation and distribution of grid electricity in Unified Energy System of Urals	%
SEC_{N2_PJ}	Specific electricity consumption for production of nitrogen at MMK	MW-h/1000 m^3	**V_{N2_EAFP}**	Consumption of nitrogen in EAFP	mln. m^3
$SEC_{pure\_N2\_PJ}$	Specific electricity consumption for production of pure nitrogen at MMK	MW-h/1000 m^3	**$V_{pure\_N2\_EAFP}$**	Consumption of pure nitrogen in EAFP	mln. m^3
SEC_{Ar_PJ}	Specific electricity consumption for production of argon at MMK	MW-h/1000 m^3	**V_{Ar_EAFP}**	Consumption of argon in EAFP	mln. m^3
$P_{slab\ steel\_EAFP}$	Output of slab steel billet in EAFP	ths. tons	**$\sum P_{profiled\&slab\ steel\_EAFP}$**	Total production of slab and profiled steel billet in EAFP	ths. tons
$PE_{EC\_O2\_slab\_steel}$	CO_2 emissions from consumption of electricity from corporate grid of MMK for production of oxygen needed for production of slab steel billet	ths. tons CO_2	**$EC_{O2\_slab\_steel}$**	Electricity consumption for production of oxygen, which is used during production of slab steel billet in EAFP	GW-h
SEC_{O2_PJ}	Specific electricity consumption for production of oxygen at MMK	MW-h/1000 m^3	**V_{O2_EAFP}**	Consumption of oxygen in EAFP	mln. m^3/t

CO_2 emissions from electricity consumption associated with production of slab steel billet in EAFP

P $_{O2\ OCS\ \#1}$	Output of oxygen by oxygen-compressor shop #1	ths.m^3	**P** $_{O2\ OCS\ \#2}$	Output of oxygen by oxygen-compressor shop #2	ths.m^3
SEC $_{O2\ OCS\ \#1}$	Specific electricity consumption for production of oxygen in oxygen-compressor shop #1	MW-h/1000 m^3	**SEC** $_{O2\ OCS\ \#2}$	Specific electricity consumption for production of oxygen in oxygen-compressor shop #2	MW-h/1000 m^3

12 months of 2008

Electricity balance in project

#	Data variable	Unit	Jan	Feb	March	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Total for year
1	Total electricity consumption in EAFP	GWh	98,3	86,3	96,9	93,0	89,6	93,9	97,2	103,3	98,3	48,5	34,1	60,3	**999,6**
2	Specific electricity consumption in EAFP for steel refining and casting	MWh/ton	0,046	0,046	0,046	0,045	0,047	0,049	0,054	0,061	0,059	0,078	0,092	0,091	**0,060**
3	Consumption of grid electricity by EAF-180 via 220/35 kV step-down substation	GWh	83,1	72,2	81,9	79,3	75,3	79,4	81,5	84,5	80,3	37,3	25,0	46,5	**826,3**
4	Specific consumption of grid electricity by EAF-180 via 220/35 kV step-down substation during steel smelting	MWh/ton	0,298	0,292	0,293	0,288	0,293	0,301	0,291	0,286	0,287	0,326	0,294	0,305	**0,296**
5	Total electricity consumption by MMK	GWh	655,9	610,9	640,5	618,2	617,7	610,8	613,5	645,0	624,9	533,8	398,3	403,2	**6972,9**
6	Electricity purchases from Unified Energy Systems of Urals grid	GWh	175,3	166,0	183,7	184,0	179,0	162,0	201,5	227,4	222,4	102,0	25,0	46,5	**1874,7**
7	Electricity purchases from Unified Energy Systems of Urals grid except EAF-180 demand	GWh	92,1	93,7	101,8	104,7	103,7	82,6	120,0	142,9	142,0	64,7	0,0	0,0	**1048,3**
8	Electricity, generated by MMK	GWh	480,7	445,0	456,9	434,3	438,7	448,8	412,0	417,6	402,5	431,8	373,3	356,7	**5098,2**

Electricity consumption for production of nitrogen, pure nitrogen, argon and oxygen which is used during production of slab steel billet in EAFP

#	Data variable	Unit	Jan	Feb	March	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Total for year
1	*Consumption of nitrogen in EAFP*	mln. m3	3,2	2,5	2,6	2,5	2,6	2,6	2,6	2,9	2,3	1,9	1,1	1,3	**28**

CO_2 emissions from electricity consumption associated with production of slab steel billet in EAFP

2	Specific electricity consumption for production of nitrogen at MMK	MWh/ths. m3	0,200	0,209	0,216	0,217	0,202	0,201	0,216	0,206	0,209	0,215	0,275	0,175	**0,212**
3	Specific consumption of nitrogen for production of steel in EAFP	ths. m3/ton	0,010	0,008	0,008	0,008	0,009	0,009	0,009	0,009	0,008	0,013	0,011	0,009	**0,009**
4	Electricity consumption for production of nitrogen	GWh	0,29	0,23	0,26	0,24	0,27	0,24	0,26	0,28	0,23	0,07	0,17	0,15	**2,7**
5	*Consumption of pure nitrogen in EAFP*	mln. m3	0,73	0,15	0,25	0,10	0,016	0,21	0,13	0,12	0,12	0,17	0,17	0,33	**2,5**
6	Specific electricity consumption for production of pure nitrogen at MMK	MWh/ths. m3	0,826	0,826	0,826	0,826	0,826	0,826	0,826	0,826	0,826	0,826	0,826	0,826	**0,826**
7	Specific consumption of pure nitrogen for production of steel in EAFP	ths. m3/ton	0,0023	0,0005	0,0008	0,0003	0,0001	0,0007	0,0005	0,0004	0,0004	0,0012	0,0017	0,0022	**0,0009**
8	Electricity consumption for production of pure nitrogen	GWh	0,3	0,1	0,1	0,0	0,0	0,1	0,1	0,0	0,0	0,0	0,1	0,2	**1,0**
9	*Consumption of argon in EAFP*	mln. m3	0,28	0,27	0,26	0,22	0,26	0,23	0,22	0,26	0,28	0,15	0,111	0,184	**2,7**
10	Specific electricity consumption for production of argon at MMK	MWh/ths. m3	0,055	0,055	0,055	0,055	0,055	0,055	0,055	0,055	0,055	0,055	0,055	0,055	**0,055**
11	Specific consumption of argon for production of steel in EAFP	ths. m3/ton	0,001	0,001	0,001	0,001	0,001	0,001	0,001	0,001	0,001	0,001	0,001	0,001	**0,001**
12	Electricity consumption fo production of argon	GWh	0,007	0,007	0,006	0,005	0,007	0,006	0,006	0,007	0,007	0,001	0,003	0,006	**0,07**
13	Specific consumption of oxygen for production of steel in EAFP	ths. m3/ton	0,056	0,056	0,057	0,055	0,053	0,049	0,046	0,046	0,051	0,069	0,060	0,050	**0,054**
14	Specific electricity consumption for production of oxygen at MMK	MWh/ths. m3	0,401	0,424	0,439	0,459	0,460	0,511	0,490	0,503	0,443	0,439	0,630	0,947	**0,512**
15	Electricity consumption for production of oxygen	GWh	3,329	3,174	3,721	3,376	3,676	3,379	2,979	3,427	3,222	0,764	2,001	4,624	**37,67**

CO_2 emissions from electricity consumption associated with production of slab steel billet in EAFP

12 months of 2009

Electricity balance in project

#	Data variable	Unit	Jan	Feb	March	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Total for year
1	Total electricity consumption in EAFP	GWh	60,8	79,4	10,2	9,0	7,7	10,2	10,7	29,1	26,9	11,4	9,1	9,9	**274,4**
2	Specific electricity consumption in EAFP for steel refining and casting	MWh/ton	0,090	0,070	0,092	0,087	0,094	0,082	0,083	0,079	0,082	0,098	0,094	0,109	**0,088**
3	Consumption of grid electricity by EAF-180 via 220/35 kV step-down substation	GWh	48,1	64,6	0,6	0,3	0,3	0,4	0,7	16,3	14,1	1,5	0,43	0,43	**147,8**
4	Specific consumption of grid electricity by EAF-180 via 220/35 kV step-down substation during steel smelting	MWh/ton	0,342	0,307	1,791	0,000	0,000	0,000	0,000	0,274	0,280	0,227	0,000	0,000	**0,268**
5	Total electricity consumption by MMK	GWh	463,0	536,5	494,5	464,8	461,1	492,8	530,7	553,9	536,1	545,4	514,2	557,4	**6150,4**
6	Electricity purchases from Unified Energy Systems of Urals grid	GWh	48,1	121,2	41,6	26,0	48,0	97,8	138,1	149,7	122,7	102,9	75,6	88,0	**1059,7**
7	Electricity purchases from Unified Energy Systems of Urals grid except EAF-180 demand	GWh	0,0	56,6	41,0	25,6	47,7	97,4	137,4	133,4	108,6	101,4	75,2	87,6	**911,9**
8	Electricity, generated by MMK	GWh	414,9	415,3	452,9	438,8	413,1	395,0	392,7	404,2	413,4	442,5	438,6	469,3	**5090,8**

Electricity consumption for production of nitrogen, pure nitrogen, argon and oxygen which is used during production of slab steel billet in EAFP

#	Data variable	Unit	Jan	Feb	March	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Total for year
1	*Consumption of nitrogen in EAFP*	mln. m3	1,67	1,75	0,937	0,903	0,932	0,903	0,935	1,162	1,072	0,597	0,00024	0,00009	**10,9**
2	Specific electricity consumption for production of nitrogen at MMK	MWh/ths. m3	0,176	0,164	0,189	0,197	0,196	0,189	0,226	0,225	0,169	0,198	0,257	0,268	**0,204**
3	Specific consumption of nitrogen for production of steel in EAFP	ths. m3/ton	0,012	0,008	0,010	0,010	0,013	0,008	0,008	0,007	0,007	0,006	0,000003	0,000001	**0,008**
4	Electricity consumption for production of nitrogen	GWh	0,15	0,16	0,00	0,00	0,00	0,00	0,00	0,07	0,07	0,02	0,00003	0,00001	**0,48**

CO_2 emissions from electricity consumption associated with production of slab steel billet in EAFP

5	*Consumption of pure nitrogen in EAFP*	mln. m3	0,130	0,135	0,141	0,133	0,136	0,128	0,116	0,126	0,140	0,083	0,0012	0,00096	**1,3**
6	Specific electricity consumption for production of pure nitrogen at MMK	MWh/ths. m3	0,826	0,826	0,826	0,826	0,826	0,826	0,826	0,826	0,826	0,826	0,826	0,826	**0,826**
7	Specific consumption of pure nitrogen for production of steel in EAFP	ths. m3/ton	0,0009	0,0006	0,0015	0,0014	0,0019	0,0012	0,0010	0,0008	0,0009	0,0009	0,00001	0,00001	**0,001**
8	Electricity consumption for production of pure nitrogen	GWh	0,1	0,1	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	**0,21**
9	*Consumption of argon in EAFP*	mln. m3	0,185	0,250	0,102	0,086	0,069	0,076	0,109	0,133	0,116	0,072	0,073	0,082	**1,35**
10	Specific electricity consumption for production of argon at MMK	MWh/ths. m3	0,055	0,055	0,055	0,055	0,055	0,055	0,055	0,055	0,055	0,055	0,055	0,055	**0,055**
11	Specific consumption of argon for production of steel in EAFP	ths. m3/ton	0,001	0,001	0,001	0,001	0,001	0,001	0,001	0,001	0,001	0,001	0,001	0,001	**0,001**
12	Electricity consumption fo production of argon	GWh	0,005	0,008	0,000	0,000	0,000	0,000	0,000	0,002	0,003	0,001	0,002	0,001	**0,02**
13	Specific consumption of oxygen for production of steel in EAFP	ths. m3/ton	0,046	0,054	0,092	0,098	0,112	0,095	0,093	0,070	0,068	0,092	0,091	0,083	**0,083**
14	Specific electricity consumption for production of oxygen at MMK	MWh/ths. m3	0,486	0,426	0,445	0,396	0,445	0,466	0,464	0,473	0,388	0,411	0,386	0,407	**0,433**
15	Electricity consumption for production of oxygen	GWh	1,618	2,702	0,007	0,000	0,000	0,000	0,000	1,382	1,528	0,670	1,306	0,871	**10,08**

12 months of 2010

Electricity balance in project

#	Data variable	Unit	Jan	Feb	March	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Total for year
1	Total electricity consumption in EAFP	GWh	19,8	49,1	50,5	45,1	71,8	60,3	64,7	56,8	54,0	30,4	10,8	12,7	**526,1**
2	Specific electricity consumption in EAFP for steel refining and casting	MWh/ton	*0,110*	*0,079*	*0,070*	*0,069*	*0,071*	*0,079*	*0,080*	*0,075*	*0,069*	*0,085*	*0,085*	*0,086*	**0,080**

CO_2 emissions from electricity consumption associated with production of slab steel billet in EAFP

3	Consumption of grid electricity by EAF-180 via 220/35 kV step-down substation	GWh	10,9	35,2	36,2	31,9	57,9	48,4	51,8	42,9	39,8	18,9	0,5	1,0	**375,3**
4	Specific consumption of grid electricity by EAF-180 via 220/35 kV step-down substation during steel smelting	MWh/ton	*0,292*	*0,340*	*0,291*	*0,293*	*0,316*	*0,320*	*0,320*	*0,293*	*0,295*	*0,339*	*0,000*	*0,621*	**0,310**
5	Total electricity consumption by MMK	GWh	557,5	573,3	624,9	598,5	631,0	590,0	616,3	604,3	588,4	585,9	552,3	582,7	**7105,1**
6	Electricity purchases from Unified Energy Systems of Urals grid	GWh	85,8	148,8	165,6	184,2	192,7	185,3	224,6	196,0	182,8	127,0	97,8	107,0	**1897,8**
7	Electricity purchases from Unified Energy Systems of Urals grid except EAF-180 demand	GWh	75,0	113,6	129,5	152,3	134,8	136,9	172,8	153,1	143,0	108,1	97,3	106,0	**1522,4**
8	Electricity, generated by MMK	GWh	471,7	424,4	459,3	414,3	438,3	404,7	391,7	408,3	405,6	458,8	454,5	475,7	**5207,3**

Electricity consumption for production of nitrogen, pure nitrogen, argon and oxygen which is used during production of slab steel billet in EAFP

#	Data variable	Unit	Jan	Feb	March	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	**Total for year**
1	*Consumption of nitrogen in EAFP*	mln. m3	0,3	1,1	1,2	1,4	2,0	2,5	2,4	2,6	2,2	1,2	1,0	1,0	**19**
2	Specific electricity consumption for production of nitrogen at MMK	MWh/ths. m3	0,207	0,167	0,160	0,154	0,108	0,053	0,150	0,150	0,150	0,150	0,150	0,150	**0,146**
3	Specific consumption of nitrogen for production of steel in EAFP	ths. m3/ton	0,004	0,006	0,006	0,007	0,010	0,017	0,015	0,014	0,011	0,010	0,009	0,008	**0,010**
4	Electricity consumption for production of nitrogen	GWh	0,03	0,08	0,09	0,11	0,14	0,08	0,22	0,11	0,07	0,05	0,01	0,01	**1,0**
5	*Consumption of pure nitrogen in EAFP*	mln. m3	0,14	0,21	0,09	0,12	0,275	0,08	0,06	0,18	0,13	0,08	0,08	0,09	**1,5**
6	Specific electricity consumption for production of pure nitrogen at MMK	MWh/ths. m3	0,826	0,826	0,826	0,826	0,826	0,826	0,826	0,826	0,826	0,826	0,826	0,826	**0,826**
7	Specific consumption of pure nitrogen for production of steel in EAFP	ths. m3/ton	0,0017	0,0012	0,0005	0,0006	0,0014	0,0005	0,0004	0,0010	0,0007	0,0006	0,0007	0,0007	**0,0008**
8	Electricity consumption for production of pure nitrogen	GWh	0,1	0,1	0,0	0,1	0,2	0,0	0,0	0,0	0,0	0,0	0,0	0,0	**0,5**

CO_2 emissions from electricity consumption associated with production of slab steel billet in EAFP

9	*Consumption of argon in EAFP*	mln. m3	0,11	0,19	0,17	0,17	0,20	0,16	0,14	0,14	0,13	0,12	0,081	0,102	**1,7**
10	Specific electricity consumption for production of argon at MMK	MWh/ths. m3	0,055	0,055	0,055	0,055	0,055	0,055	0,055	0,055	0,055	0,055	0,055	0,055	**0,055**
11	Specific consumption of argon for production of steel in EAFP	ths. m3/ton	0,001	0,001	0,001	0,001	0,001	0,001	0,001	0,001	0,001	0,001	0,001	0,001	**0,001**
12	Electricity consumption fo production of argon	GWh	0,003	0,005	0,005	0,005	0,007	0,005	0,005	0,002	0,002	0,002	0,000	0,000	**0,04**
13	Specific consumption of oxygen for production of steel in EAFP	ths. m3/ton	0,054	0,065	0,060	0,060	0,047	0,048	0,048	0,060	0,059	0,066	0,070	0,068	**0,059**
14	Specific electricity consumption for production of oxygen at MMK	MWh/ths. m3	0,347	0,405	0,396	0,416	0,448	0,495	0,480	0,436	0,393	0,422	0,410	0,414	**0,422**
15	Electricity consumption for production of oxygen	GWh	0,820	2,063	2,384	2,375	2,724	2,220	2,287	1,324	1,007	0,945	0,307	0,128	**18,58**

CO_2 emissions from electricity consumption associated with production of slab steel billet in EAFP

Total CO_2 emissions from electricity consumption associated with production of slab steel billet in EAFP

$$PE_{electricity\_slab\_steel\_EAFP} = PE_{EC\_grid\_slab\_steel\_EAF} + PE_{EC\_slab\_steel\_other\ EAFP} + PE_{EC\_Ar\_N2\_slab\_steel} + PE_{EC\_O2\_slab\_steel}$$ **(PDD formula D.1.1.2.-13)**

Symbol	Data variable	Unit	Symbol	Data variable	Unit
$PE_{electricity\_slab\_steel\_EAFP}$	Total CO_2 emissions from electricity consumption associated with production of slab steel billet in EAFP	ths. tons CO_2	$PE_{EC\_slab\_steel\_other\ EAFP}$	CO_2 emissions from consumption of electricity from corporate MMK grid by other equipment of EAFP (including DBSU) during production of slab steel billet	ths. tons CO_2
$PE_{EC\_grid\_slab\_steel\_EAF}$	CO_2 emissions from consumption of grid electricity by EAF-180 via 220/35 kV step-down substation during smelting of slab steel grades in EAFP	ths. tons CO_2	$PE_{EC\_Ar\_N2\_slab\_steel}$	CO_2 emissions from consumption of electricity from corporate grid of MMK for production of nitrogen, pure nitrogen and argon needed for production of slab steel billet	ths. tons CO_2
$PE_{EC\_O2\_slab\_steel}$	CO_2 emissions from consumption of electricity from corporate grid of MMK for production of oxygen needed for production of slab steel billet	ths. tons CO_2			

12 months of 2008

CO_2 emissions from electricity consumption associated with production of slab steel billet in EAFP

#	Data variable	Unit	Jan	Feb	March	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Total for year
1	CO_2 emissions from consumption of grid electricity by EAF-180 via 220/35 kV step-down substation	ths. tons CO_2	22,006	18,764	21,970	20,329	22,225	21,354	21,874	23,554	21,980	3,846	7,902	17,287	**223,091**
2	CO_2 emissions from consumption of electricity from corporate MMK grid in for production of nitrogen, pure nitrogen, and argon	ths. tons CO_2	0,427	0,226	0,281	0,223	0,252	0,298	0,275	0,287	0,247	0,075	0,149	0,201	**2,941**
3	CO_2 emissions from consumption of electricity from corporate MMK grid by other equipment of EAFP (including DBSU)	ths. tons CO_2	5,146	4,803	5,390	4,733	6,428	6,110	6,276	7,677	7,381	1,513	2,987	5,384	**63,828**
4.	CO_2 emissions from consumption of electricity from corporate MMK grid in for production of oxygen	ths. tons CO_2	2,472	2,426	2,878	2,639	3,252	3,090	2,588	2,917	2,816	0,579	1,206	2,809	**29,673**
5	**Total CO_2 emissions from electricity consumption associated with production of slab steel billet in EAFP**	**ths. tons CO_2**	**30,051**	**26,219**	**30,519**	**27,924**	**32,158**	**30,852**	**31,012**	**34,435**	**32,424**	**6,013**	**12,24**	**25,681**	**319,532**

CO_2 emissions from electricity consumption associated with production of slab steel billet in EAFP

12 months of 2009

CO_2 emissions from electricity consumption associated with production of slab steel billet in EAFP

#	Data variable	Unit	Jan	Feb	March	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Total for year
1	CO_2 emissions from consumption of grid electricity by EAF-180 via 220/35 kV step-down substation	ths. tons CO_2	14,596	21,255	0,001	0,000	0,000	0,000	0,000	2,574	3,256	0,165	0,000	0,000	**41,846**
2	CO_2 emissions from consumption of electricity from corporate MMK grid in for production of nitrogen, pure nitrogen, and argon	ths. tons CO_2	0,153	0,163	0,000	0,000	0,000	0,000	0,000	0,096	0,113	0,030	0,002	0,001	**0,558**
3	CO_2 emissions from consumption of electricity from corporate MMK grid by other equipment of EAFP (including DBSU)	ths. tons CO_2	4,714	5,844	0,012	0,000	0,000	0,000	0,000	3,323	4,779	1,538	2,920	2,312	**25,443**
4.	CO_2 emissions from consumption of electricity from corporate MMK grid in for production of oxygen	ths. tons CO_2	1,165	1,902	0,005	0,000	0,000	0,000	0,000	1,321	1,442	0,559	1,009	0,668	**8,071**
5	**Total CO_2 emissions from electricity consumption associated with production of slab steel billet in EAFP**	**ths. tons CO_2**	**20,629**	**29,163**	**0,018**	**0,000**	**0,000**	**0,000**	**0,000**	**7,313**	**9,590**	**2,292**	**3,931**	**2,981**	**75,918**

12 months of 2010

CO_2 emissions from electricity consumption associated with production of slab steel billet in EAFP

#	Data variable	Unit	Jan	Feb	March	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Total for year
1	CO_2 emissions from consumption of grid electricity by EAF-180 via 220/35 kV step-down substation	ths. tons CO_2	3,480	9,457	10,555	9,627	22,361	17,173	18,300	6,966	4,989	2,862	0,000	0,022	**105,793**
2	CO_2 emissions from consumption of electricity from corporate MMK grid in for production of nitrogen, pure nitrogen, and argon	ths. tons CO_2	0,073	0,125	0,107	0,131	0,276	0,118	0,231	0,140	0,089	0,058	0,016	0,007	**1,372**
3	CO_2 emissions from consumption of electricity from corporate MMK grid by other equipment of EAFP (including DBSU)	ths. tons CO_2	3,646	4,808	5,616	5,494	8,379	6,800	7,185	3,603	2,842	2,599	0,783	0,332	**52,087**
4.	CO_2 emissions from consumption of electricity from corporate MMK grid in for production of oxygen	ths. tons CO_2	0,606	1,541	1,850	1,906	2,475	2,071	2,092	1,225	0,927	0,815	0,246	0,101	**15,854**
5	**Total CO_2 emissions from electricity consumption associated with production of slab steel billet in EAFP**	**ths. tons CO_2**	**7,806**	**15,931**	**18,129**	**17,158**	**33,490**	**26,162**	**27,808**	**11,934**	**8,846**	**6,335**	**1,045**	**0,461**	**175,106**

CO_2 emissions from electricity consumption associated with production of slab steel billet in EAFP

CO$_2$ emission factor for electricity produced at MMK

$$EF_{own\ generation\_PJ} = PE_{total\ electricity\ generation} / (EC_{gross\_PJ} - EC_{import\_PJ})$$ **(PDD formula D.1.1.2.-25)**

CO$_2$ emissions from electricity generation at MMK

$$PE_{total\ electricity\ generation} = PE_{combustion\ gases\_electricity} + PE_{combustion\ coal\_electricity}$$ **(PDD formula D.1.1.2.-26)**

Symbol	Data variable	Unit	Symbol	Data variable	Unit
$EF_{own\ generation\_PJ}$	CO_2 emission factor for electricity produced at MMK	tons CO_2/MW-h	EC_{gross_PJ}	Total electricity generation at MMK	GW-h
$PE_{total\ electricity\ generation}$	Total CO_2 emissions from electricity generation at MMK	ths. tons CO_2	EC_{import_PJ}	Electricity purchases from Unified Energy Systems of Urals grid	GW-h
$PE_{combustion\ gases\_electricity}$	CO_2 emissions from combustion of gases for electricity generation at MMK	ths. tons CO_2	$PE_{combustion\ coal\_electricity}$	CO_2 emissions from combustion of power station coal	ths. tons CO_2

CO$_2$ emissions from combustion of gases for electricity generation at MMK

$$PE_{combustion\ gases\_electricity} = (FC_{BFG\_CPP\_PJ} * C_{BFG\_PJ} + FC_{NG\_CPP\_PJ} * C_{NG\_.PJ} + FC_{NG\_CHPP\_PJ} * C_{NG\_PJ} + FC_{BFG\_SABPP\_PJ} * C_{BFG\_PJ} + FC_{COG\_SABPP\_PJ} * C_{COG\_PJ} + FC_{NG\_SABPP\_PJ} * C_{NG\_PJ} + FC_{NG\_turbine\ section\ of\ SP\ \_PJ} * C_{NG\_.PJ} + FC_{NG\_gas\ recovery\ unit\text{-}2\ of\ SP\ \_PJ} * C_{NG\_PJ})/100 * 44/1$$ **(PDD formula D.1.1.2.-27)**

CO$_2$ emissions from combustion of power station coal for electricity generation at MMK

$$PE_{combustion\ coal\_electricity} = (FC_{energy\ coal\_CHPP\_PJ} * \%C_{energy\ coal})/100 * 44/12$$ **(PDD formula D.1.1.2.-28)**

Symbol	Data variable	Unit	Symbol	Data variable	Unit
$PE_{combustion\ gases\_electricity}$	CO_2 emissions from combustion of gases for electricity generation at MMK	ths. tons CO_2	$PE_{combustion\ coal\_electricity}$	CO_2 emissions from combustion of power station coal	ths. tons CO_2
$FC_{BFG\_CPP\_PJ}$	Consumption of BFG in CPP	mln. m^3	$FC_{COG\_SABPP\_PJ}$	Consumption of COG in SABPP	mln. m^3
$FC_{NG\_CPP\_PJ}$	Consumption of NG in CPP	mln. m^3	$FC_{NG\_SABPP\_PJ}$	Consumption of NG in SABPP	mln. m^3

CO_2 emission factor for electricity produced at MMK

FC $_{NG\_CHPP\_PJ}$	Consumption of NG in CHPP	mln. m^3	**FC** $_{NG\_turbine\ section\ of\ SP\ \_PJ}$	Consumption of NG in turbine section of SP	mln. m^3
FC $_{BFG\_SABPP\_PJ}$	Consumption of BFG in SABPP	mln. m^3	**FC** $_{NG\ \ gas\ recovery\ unit-2\ of\ SP\ \_PJ}$	Consumption of NG in gas recovery unit of SP	mln. m^3
C $_{BFG\_PJ}$	Carbon content in BFG	kg C/m^3	**C** $_{NG\_PJ}$	Carbon content in NG	kg C/m^3
C $_{COG\_PJ}$	Carbon content in COG	kg C/m^3	**%C** $_{energy\ coal}$	Carbon content in power station coal	% by mass
FC $_{energy\ coal\_CHPP\_PJ}$	Consumption of power station coal by CHPP	ths. tons			

12 months of 2008

Input carbon flows, burning of gases

#	Data variable	Unit	Jan	Feb	March	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Total for year
1	Consumption of BFG in CPP	mln. m^3	163,3	172,8	181,5	182,3	252,8	239,7	209,4	220,9	241,5	146,8	41,6	34,2	**2086,8**
2	Carbon content in BFG	kg C/m^3	0,20	0,20	0,21	0,20	0,19	0,20	0,20	0,20	0,20	0,20	0,17	0,17	**0,20**
		ths. tons C	33,0	35,4	37,3	37,2	49,1	48,9	41,8	43,1	47,1	28,9	7,2	5,8	**414,8**
3	Consumption of NG in CPP	mln. m^3	27,7	23,4	25,6	24,8	26,3	29,7	35,5	33,8	27,9	34,7	35,9	35,1	**360,5**
4	Carbon content in NG	kg C/m^3	0,50	0,50	0,50	0,49	0,49	0,49	0,49	0,49	0,49	0,49	0,49	0,49	**0,49**
		ths. tons C	13,7	11,6	12,7	12,3	13,0	14,7	17,4	16,7	13,8	17,2	17,8	17,4	**178,2**
5	Consumption of NG in CHPP	mln. m^3	54,7	49,4	51,2	61,6	66,4	74,0	62,9	60,7	55,8	53,5	50,4	48,1	**688,6**
6	Carbon content in NG	kg C/m^3	0,50	0,50	0,50	0,49	0,49	0,49	0,49	0,49	0,49	0,49	0,49	0,49	**0,49**
		ths. tons C	27,1	24,5	25,3	30,5	32,9	36,6	30,8	30,0	27,6	26,5	24,9	23,8	**340,5**
7	Consumption of COG in SABPP	mln. m^3	76,2	62,1	74,4	64,6	71,8	69,3	59,2	64,4	68,4	63,1	22,2	10,8	**707**
8	Carbon content in COG	kg C/m^3	0,20	0,20	0,21	0,20	0,19	0,20	0,20	0,20	0,20	0,20	0,17	0,17	**0,20**
		ths. tons C	15,4	12,7	15,3	13,2	14,0	14,2	11,8	12,6	13,4	12,4	3,8	1,8	**140,5**
9	Consumption of BFG in SABPP	mln. m^3	17,0	11,4	14,5	13,2	14,8	14,8	12,1	12,5	12,1	12,1	3,1	2,6	**140,2**
10	Carbon content in BFG	kg C/m^3	0,20	0,19	0,19	0,19	0,20	0,19	0,19	0,19	0,18	0,19	0,18	0,17	**0,19**
		ths. tons C	3,3	2,2	2,8	2,6	2,9	2,9	2,3	2,4	2,2	2,3	0,6	0,5	**26,9**
11	Consumption of NG in SABPP	mln. m^3	5,6	5,7	6,4	4,6	4,9	4,3	5,8	5,1	6,0	8,7	9,7	11,2	**78**

CO_2 emission factor for electricity produced at MMK

#	Data variable	Unit	Jan	Feb	March	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Total for year
12	Carbon content in NG	kg C/m^3	0,50	0,50	0,50	0,49	0,49	0,49	0,49	0,49	0,49	0,49	0,49	0,49	**0,49**
		ths. tons C	2,8	2,8	3,2	2,3	2,4	2,1	2,9	2,5	3,0	4,3	4,8	5,5	**38,6**
13	Consumption of NG in turbine section of SP	mln. m^3	0,519	0,387	0,408	0,348	0,342	0,263	0,148	0,190	0,181	0,275	0,245	0,118	**3,4**
14	Carbon content in NG	kg C/m^3	0,50	0,50	0,50	0,49	0,49	0,49	0,49	0,49	0,49	0,49	0,49	0,49	**0,49**
		ths. tons C	0,26	0,19	0,20	0,17	0,17	0,13	0,07	0,09	0,09	0,14	0,12	0,06	**1,7**
15	Consumption of NG in gas recovery unit of SP	mln. m^3	0,21	0,17	0,21	0,19	0,10	0	0,03	0,15	0,16	0,13	0,19	0,12	**1,6**
16	Carbon content in NG	kg C/m^3	0,50	0,50	0,50	0,49	0,49	0,49	0,49	0,49	0,49	0,49	0,49	0,49	**0,49**
		ths. tons C	0,10	0,08	0,10	0,09	0,05	0,00	0,01	0,08	0,08	0,06	0,10	0,06	**0,8**
17	**Total carbon input stream with gases**	**ths. tons C**	**95,7**	**89,5**	**96,8**	**98,3**	**114,5**	**119,4**	**107,0**	**107,5**	**107,3**	**91,7**	**59,3**	**54,9**	**1142,0**

Input carbon flows, burning of coal

#	Data variable	Unit	Jan	Feb	March	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Total for year
1	Consumption of power station coal by CHPP	ths. tons	7,8	10,9	6,7	0,0	0,0	0,0	0,0	0,0	0,0	0,9	2,9	5,8	**34,9**
2	Carbon content in power station coal	% by mass	73,00	73,00	73,00	73,00	73,00	73,00	73,00	73,00	73,00	73,00	73,00	73,00	73,00
		ths. tons C	5,7	7,9	4,9	0,0	0,0	0,0	0,0	0,0	0,0	0,6	2,1	4,2	**25,5**
3	**Total ouput carbon flow**	**ths. tons C**	**5,7**	**7,9**	**4,9**	**0,0**	**0,0**	**0,0**	**0,0**	**0,0**	**0,0**	**0,6**	**2,1**	**4,2**	**25,5**

CO2 emissions from electricity generation

#	Data variable	Unit	Jan	Feb	March	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Total for year
1	Carbon burning in the gas-burning processes	ths. tons C	95,7	89,5	96,8	98,3	114,5	119,4	107,0	107,5	107,3	91,7	59,3	54,9	**1142,0**
2	CO_2 emissions from burning of gases	ths. tons CO_2	350,9	328,2	355,0	360,5	419,7	437,9	392,5	394,2	393,4	336,4	217,3	201,3	**4187,2**
3	Carbon burning in the coal burning process	ths. tons C	5,7	7,9	4,9	0,0	0,0	0,0	0,0	0,0	0,0	0,6	2,1	4,2	**25,5**
4	CO_2 emissions from coal burning	ths. tons CO_2	20,9	29,1	18,0	0,0	0,0	0,0	0,0	0,0	0,0	2,3	7,8	15,4	**93,5**
5	**CO_2 emission factor for electricity produced at MMK**	**ths. tons CO_2**	**371,8**	**357,3**	**373,0**	**360,5**	**419,7**	**437,9**	**392,5**	**394,2**	**393,4**	**338,7**	**225,1**	**216,7**	**4280,7**

CO_2 emission factor for electricity produced at MMK

Emission factors for electricity and power transmission/distribution losses

#	Data variable	Unit	Jan	Feb	March	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Total for year
1	**CO_2 emission factor for electricity generated at MMK**	**tons CO_2/MWh**	**0,774**	**0,803**	**0,816**	**0,830**	**0,957**	**0,976**	**0,953**	**0,944**	**0,977**	**0,784**	**0,603**	**0,607**	**0,840**
2	**CO_2 emissions factor for grid electricity purchased from Unified Energy System of Urals** (fixed ex-ante, 2008-2012)	**tons CO_2/MWh**	**0,541**	**0,541**	**0,541**	**0,541**	**0,541**	**0,541**	**0,541**	**0,541**	**0,541**	**0,541**	**0,541**	**0,541**	**0,541**
3	Power transmission and distribution losses in Unified energy Systems of Urals grid*	%/100	0,0736	0,0736	0,0736	0,0736	0,0736	0,0736	0,0736	0,0736	0,0736	0,0736	0,0736	0,0736	**0,0736**

* http://www.mrsk-ural.ru/ru/440.news1434.html

12 months of 2009

Input carbon flows, burning of gases

#	Data variable	Unit	Jan	Feb	March	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Total for year
1	Consumption of BFG in CPP	mln. m^3	66,1	105,4	144,2	168,6	218,1	239,2	274,5	262,8	252,3	192,9	166,0	168,0	**2258,2**
2	Carbon content in BFG	kg C/m^3	0,19	0,21	0,20	0,21	0,21	0,21	0,22	0,21	0,21	0,21	0,21	0,21	**0,21**
		ths. tons C	12,2	21,8	29,5	35,4	45,6	51,1	59,2	54,6	53,9	41,2	35,5	35,2	**475,3**
3	Consumption of NG in CPP	mln. m^3	38,8	24,2	23,1	21,5	22,6	19,8	16,0	16,0	20,0	19,7	21,5	24,2	**267,5**
4	Carbon content in NG	kg C/m^3	0,50	0,50	0,50	0,50	0,50	0,50	0,49	0,49	0,49	0,49	0,49	0,50	**0,50**
		ths. tons C	19,2	12,0	11,5	10,7	11,2	9,8	7,9	7,9	9,9	9,7	10,7	12,0	**132,4**
5	Consumption of NG in CHPP	mln. m^3	50,8	51,6	55,8	55,0	62,7	62,2	68,7	70,9	67,5	65,2	57,5	57,5	**725,6**
6	Carbon content in NG	kg C/m^3	0,50	0,50	0,50	0,50	0,50	0,50	0,49	0,49	0,49	0,49	0,49	0,50	**0,50**
		ths. tons C	25,2	25,6	27,7	27,2	31,0	30,8	34,0	35,1	33,4	32,3	28,5	28,5	**359,2**
7	Consumption of COG in SABPP	mln. m^3	31,2	62,7	63,1	69,6	65,9	69,8	53,5	79,8	70,7	70,1	59,2	71,5	**767**
8	Carbon content in COG	kg C/m^3	0,19	0,21	0,20	0,21	0,21	0,21	0,22	0,21	0,21	0,21	0,21	0,21	**0,21**
		ths. tons C	5,8	13,0	12,9	14,6	13,8	14,9	11,6	16,6	15,1	15,0	12,7	15,0	**160,8**
9	Consumption of BFG in SABPP	mln. m^3	5,4	11,9	10,2	15,1	15,1	12,7	9,2	11,1	8,5	10,0	11,2	12,3	**133**
10	Carbon content in BFG	kg C/m^3	0,18	0,18	0,18	0,18	0,18	0,18	0,19	0,18	0,19	0,19	0,19	0,18	**0,18**
		ths. tons C	1,0	2,1	1,8	2,7	2,8	2,3	1,7	2,0	1,6	1,9	2,1	2,2	**24,3**

CO_2 emission factor for electricity produced at MMK

11	Consumption of NG in SABPP	mln. m^3	13,5	7,0	8,6	6,0	6,3	5,2	2,5	4,8	5,8	5,9	7,5	8,0	**81**
12	Carbon content in NG	kg C/m^3	0,50	0,50	0,50	0,50	0,50	0,50	0,49	0,49	0,49	0,49	0,49	0,50	**0,50**
		ths. tons C	6,7	3,5	4,2	3,0	3,1	2,6	1,2	2,4	2,9	2,9	3,7	4,0	**40,1**
13	Consumption of NG in turbine section of SP	mln. m^3	0,2	0,3	0,4	0,3	0,2	0,2	0,2	0,3	0,3	0,2	0,5	0,3	**3,3**
14	Carbon content in NG	kg C/m^3	0,50	0,50	0,50	0,50	0,50	0,50	0,49	0,49	0,49	0,49	0,49	0,50	**0,50**
		ths. tons C	0,10	0,15	0,20	0,13	0,10	0,09	0,09	0,16	0,14	0,09	0,23	0,15	**1,6**
15	Consumption of NG in gas recovery unit of SP	mln. m^3	0,16	0,11	0,12	0,16	0,06	0,06	0,08	0,15	0,15	0,16	0,21	0,15	**1,6**
16	Carbon content in NG	kg C/m^3	0,50	0,50	0,50	0,50	0,50	0,50	0,49	0,49	0,49	0,49	0,49	0,50	**0,50**
		ths. tons C	0,08	0,05	0,06	0,08	0,03	0,03	0,04	0,07	0,07	0,08	0,10	0,07	**0,8**
17	**Total carbon input stream with gases**	**ths. tons C**	**70,2**	**78,1**	**87,9**	**93,8**	**107,6**	**111,7**	**115,8**	**118,7**	**117,0**	**103,2**	**93,4**	**97,1**	**1194,6**

Input carbon flows, burning of coal

#	Data variable	Unit	Jan	Feb	March	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	**Total for year**
1	Consumption of power station coal by CHPP	ths. tons	15,5	4,7	8,2	12,0	0,0	0,0	0,0	0,0	0,0	5,9	3,9	7,4	**57,6**
2	Carbon content in power station coal	% by mass	73,00	73,00	73,00	73,00	73,00	73,00	73,00	73,00	73,00	73,00	73,00	73,00	73,00
		ths. tons C	11,3	3,4	6,0	8,8	0,0	0,0	0,0	0,0	0,0	4,3	2,9	5,4	**42,0**
3	**Total ouput carbon flow**	**ths. tons C**	**11,3**	**3,4**	**6,0**	**8,8**	**0,0**	**0,0**	**0,0**	**0,0**	**0,0**	**4,3**	**2,9**	**5,4**	**42,0**

CO_2 emissions from electricity generation

#	Data variable	Unit	Jan	Feb	March	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	**Total for year**
1	Carbon burning in the gas-burning processes	ths. tons C	70,2	78,1	87,9	93,8	107,6	111,7	115,8	118,7	117,0	103,2	93,4	97,1	**1194,6**
2	CO_2 emissions from burning of gases	ths. tons CO_2	257,5	286,4	322,3	343,8	394,7	409,5	424,7	435,4	429,1	378,6	342,3	355,9	**4380,1**
3	Carbon burning in the coal burning process	ths. tons C	11,3	3,4	6,0	8,8	0,0	0,0	0,0	0,0	0,0	4,3	2,9	5,4	**42,0**
4	CO_2 emissions from coal burning	ths. tons CO_2	41,4	12,5	21,9	32,2	0,0	0,0	0,0	0,0	0,0	15,7	10,5	19,9	**154,1**
5	**CO_2 emission factor for electricity produced at MMK**	**ths. tons CO_2**	**298,9**	**298,9**	**344,2**	**376,0**	**394,7**	**409,5**	**424,7**	**435,4**	**429,1**	**394,3**	**352,8**	**375,8**	**4534,2**

CO_2 emission factor for electricity produced at MMK

Emission factors for electricity and power transmission/distribution losses

#	Data variable	Unit	Jan	Feb	March	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Total for year
1	**CO_2 emission factor for electricity generated at MMK**	**tons CO_2/MWh**	**0,720**	**0,720**	**0,760**	**0,857**	**0,955**	**1,037**	**1,082**	**1,077**	**1,038**	**0,891**	**0,804**	**0,801**	**0,891**
2	**CO_2 emissions factor for grid electricity purchased from Unified Energy System of Urals** (fixed ex-ante, 2008-2012)	**tons CO_2/MWh**	**0,541**	**0,541**	**0,541**	**0,541**	**0,541**	**0,541**	**0,541**	**0,541**	**0,541**	**0,541**	**0,541**	**0,541**	**0,541**
3	Power transmission and distribution losses in Unified energy Systems of Urals grid*	%/100	0,0851	0,0851	0,0851	0,0851	0,0851	0,0851	0,0851	0,0851	0,0851	0,0851	0,0851	0,0851	**0,0851**

12 months of 2010

Input carbon flows, burning of gases

#	Data variable	Unit	Jan	Feb	March	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Total for year
1	Consumption of BFG in CPP	mln. m^3	141,3	141,8	183,6	195,9	256,4	262,6	264,6	262,7	257,8	233,1	186,8	182,9	**2569,5**
2	Carbon content in BFG	kg C/m^3	0,21	0,21	0,21	0,21	0,21	0,21	0,21	0,21	0,21	0,22	0,22	0,22	**0,21**
		ths. tons C	29,9	29,7	38,7	41,5	54,4	55,8	56,1	55,4	54,8	50,2	40,9	40,2	**547,7**
3	Consumption of NG in CPP	mln. m^3	31,6	25,7	23,2	20,8	27,3	26,3	25,7	26,1	19,6	26,1	25,0	26,2	**303,6**
4	Carbon content in NG	kg C/m^3	0,50	0,50	0,49	0,49	0,49	0,49	0,49	0,49	0,49	0,49	0,49	0,49	**0,49**
		ths. tons C	15,6	12,7	11,5	10,3	13,5	13,0	12,7	12,9	9,7	12,9	12,4	13,0	**150,2**
5	Consumption of NG in CHPP	mln. m^3	54,5	49,9	56,9	55,7	69,3	67,6	63,6	67,9	65,9	63,7	57,1	58,2	**730,4**
6	Carbon content in NG	kg C/m^3	0,50	0,50	0,49	0,49	0,49	0,49	0,49	0,49	0,49	0,49	0,49	0,49	**0,49**
		ths. tons C	27,0	24,7	28,2	27,6	34,3	33,4	31,5	33,5	32,6	31,5	28,3	28,8	**361,3**
7	Consumption of COG in SABPP	mln. m^3	55,6	58,4	71,8	73,2	61,8	46,8	44,3	53,1	60,2	59,8	57,8	65,3	**708,1**
8	Carbon content in COG	kg C/m^3	0,21	0,21	0,21	0,21	0,21	0,21	0,21	0,21	0,21	0,22	0,22	0,22	**0,21**
		ths. tons C	11,8	12,2	15,1	15,5	13,1	9,9	9,4	11,2	12,8	12,9	12,6	14,4	**151,0**
9	Consumption of BFG in SABPP	mln. m^3	12,9	10,1	10,9	12,9	11,5	7,6	7,0	8,7	11,5	12,9	12,3	11,5	**129,8**
10	Carbon content in BFG	kg C/m^3	0,18	0,18	0,18	0,18	0,18	0,18	0,19	0,19	0,19	0,19	0,19	0,19	**0,18**

CO_2 emission factor for electricity produced at MMK

		ths. tons C	2,4	1,8	1,9	2,3	2,0	1,3	1,3	1,6	2,1	2,4	2,3	2,1	**23,8**
11	Consumption of NG in SABPP	mln. m^3	9,7	8,4	7,8	5,3	6,4	5,1	4,8	5,3	5,9	6,2	5,9	8,1	**79,0**
12	Carbon content in NG	kg C/m^3	0,50	0,50	0,49	0,49	0,49	0,49	0,49	0,49	0,49	0,49	0,49	0,49	**0,49**
		ths. tons C	4,8	4,2	3,9	2,6	3,2	2,5	2,4	2,6	2,9	3,1	2,9	4,0	**39,1**
13	Consumption of NG in turbine section of SP	mln. m^3	0,216	0,208	0,294	0,164	0,182	0,225	0,158	0,130	0,142	0,239	0,461	0,379	**2,8**
14	Carbon content in NG	kg C/m^3	0,50	0,50	0,49	0,49	0,49	0,49	0,49	0,49	0,49	0,49	0,49	0,49	**0,49**
		ths. tons C	0,11	0,10	0,15	0,08	0,09	0,11	0,08	0,06	0,07	0,12	0,23	0,19	**1,4**
15	Consumption of NG in gas recovery unit of SP	mln. m^3	0,000	0,000	0,129	0,166	0,094	0,053	0,09	0,09	0,14	0,11	0,07	0,13	**1,1**
16	Carbon content in NG	kg C/m^3	0,50	0,50	0,49	0,49	0,49	0,49	0,49	0,49	0,49	0,49	0,49	0,49	**0,49**
		ths. tons C	0,00	0,00	0,06	0,08	0,05	0,03	0,04	0,05	0,07	0,05	0,04	0,06	**0,5**
17	**Total carbon input stream with gases**	**ths. tons C**	**91,6**	**85,5**	**99,5**	**99,9**	**120,7**	**116,2**	**113,5**	**117,4**	**115,0**	**113,2**	**99,7**	**102,7**	**1274,9**

Input carbon flows, burning of coal

#	Data variable	Unit	Jan	Feb	March	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	**Total for year**
1	Consumption of power station coal by CHPP	ths. tons	9,1	8,4	6,4	0,0	0,0	0,0	0,0	0,0	0,0	4,1	7,6	7,9	**43,4**
2	Carbon content in power station coal	% by mass	73,00	73,00	73,00	73,00	73,00	73,00	73,00	73,00	73,00	73,00	73,00	73,00	73,00
		ths. tons C	6,6	6,1	4,7	0,0	0,0	0,0	0,0	0,0	0,0	3,0	5,5	5,8	**31,7**
3	**Total ouput carbon flow**	**ths. tons C**	**6,6**	**6,1**	**4,7**	**0,0**	**0,0**	**0,0**	**0,0**	**0,0**	**0,0**	**3,0**	**5,5**	**5,8**	**31,7**

CO_2 emissions from electricity generation

#	Data variable	Unit	Jan	Feb	March	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	**Total for year**
1	Carbon burning in the gas-burning processes	ths. tons C	91,6	85,5	99,5	99,9	120,7	116,2	113,5	117,4	115,0	113,2	99,7	102,7	**1274,9**
2	CO_2 emissions from burning of gases	ths. tons CO_2	335,8	313,5	364,8	366,3	442,5	426,0	416,0	430,5	421,8	415,1	365,5	376,7	**4674,5**
3	Carbon burning in the coal burning process	ths. tons C	6,6	6,1	4,7	0,0	0,0	0,0	0,0	0,0	0,0	3,0	5,5	5,8	**31,7**
4	CO_2 emissions from coal burning	ths. tons CO_2	24,3	22,5	17,1	0,0	0,0	0,0	0,0	0,0	0,0	10,9	20,2	21,2	**116,3**

5	**CO_2 emission factor for electricity produced at MMK**	**ths. tons CO_2**	**360,1**	**336,0**	**381,9**	**366,3**	**442,5**	**426,0**	**416,0**	**430,5**	**421,8**	**426,0**	**385,7**	**397,9**	**4790,8**

Emission factors for electricity and power transmission/distribution losses

#	Data variable	Unit	Jan	Feb	March	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	**Total for year**
1	**CO_2 emission factor for electricity generated at MMK**	**tons CO_2/MWh**	**0,763**	**0,792**	**0,831**	**0,884**	**1,010**	**1,053**	**1,062**	**1,054**	**1,040**	**0,928**	**0,849**	**0,837**	**0,920**
2	**CO_2 emissions factor for grid electricity purchased from Unified Energy System of Urals** (fixed ex-ante, 2008-2012)	**tons CO_2/MWh**	**0,541**	**0,541**	**0,541**	**0,541**	**0,541**	**0,541**	**0,541**	**0,541**	**0,541**	**0,541**	**0,541**	**0,541**	**0,541**
3	Power transmission and distribution losses in Unified energy Systems of Urals grid*	%/100	0,0724	0,0724	0,0724	0,0724	0,0724	0,0724	0,0724	0,0724	0,0724	0,0724	0,0724	0,0724	**0,0724**

CO_2 emission factor for electricity produced at MMK

D.5 CO_2 emissions from generation of air blast for production of pig iron used for production of slab steel billet

<u>CO_2 emissions from generation of air blast for production of pig iron used for production of slab steel billet in the project</u>

$$PE_{air\ blast\_for\_pig\_iron} = P_{slab\ steel\_EAFP} * SC_{pig\ iron\_EAFP} * SC_{air\ blast\ generation} * EF_{air\ blast\ generation}$$ **(PDD formula D.1.1.2.-29)**

$$EF_{air\ blast\ generation\_PJ} = PE_{air\ blast\ generation} / OC_{air\ blast\ generation\_PJ}$$ **(PDD formula D.1.1.2.-30)**

$$PE_{air\ blast\ generation} = (FC_{BFG\_SABPP\_air\ blast\ generation\_PJ} * C_{BFG\_PJ} + FC_{COG\_SABPP\_air\ blast\ generation\_PJ} * C_{COG.PJ} + FC_{NG\_SABPP\_air\ blast\ generation\_PJ} * C_{NG\_.PJ})/100 * 44/12$$

(PDD formula D.1.1.2.-31)

Specific consumption of air blast per ton of pig iron produced

$$SC_{air\ blast\ generation\_PJ} = OC_{air\ blast\ generation\_PJ} / P_{pig\ iron\_BF\_PJ}$$ **(PDD formula D.1.1.2.-32)**

Symbol	Data variable	Unit	Symbol	Data variable	Unit
$PE_{air\ blast\_for\_pig\_iron}$	CO_2 emissions from generation of air blast for production of pig iron used for production of slab steel billet	ths. tons CO_2	$OC_{air\ blast\ generation\_PJ}$	Generation of air blast at MMK	mln. m^3
$P_{slab\ steel\_EAFP}$	Output of slab steel billet in EAFP	ths. tons	$FC_{BFG\ SABPP\ air\ blast\ generation\ \_PJ}$	Consumption of BFG in SABPP for generation of air blast	mln. m^3
$SC_{pig\ iron\_EAFP}$	Specific consumption of pig iron per ton of slab steel billet produced in EAFP	ton/ton	C_{BFG_PJ}	Carbon content in BFG	kg C/m^3
$SC_{air\ blast\ generation}$	Specific consumption of air blast per ton of pig iron produced	ths. m^3/ton	$FC_{COG\ SABPP\ air\ blast\ generation\ \_PJ}$	Consumption of COG in SABPP for generation of air blast	mln. m^3
$EF_{air\ blast\ generation\_PJ}$	CO_2 emission factor for air blast generation	ths. tons CO_2/ths. m^3	$C_{COG.PJ}$	Carbon content in COG	% by mass
$PE_{air\ blast\ generation}$	CO_2 emissions from combustion of fuel for generation of air blast	ths. tons CO_2	$FC_{NG\ SABPP\ air\ blast\ generation\_PJ}$	Consumption of NG in SABPP for generation of air blast	mln. m^3
$P_{pig\ iron\_BF\_PJ}$	Production of pig iron in BFP	ths. tons	$C_{NG\_.PJ}$	Carbon content in NG	kg C/m^3

CO_2 emissions from generation of air blast for production of pig iron used for production of slab steel billet in the project

12 months of 2008

Generation of air blast at MMK

#	Data variable	Unit	Jan	Feb	March	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Total for year
1	Generation of air blast at MMK	mln. m^3	1960,9	1943,8	2166,8	2083,6	2236,6	1991,0	1827,6	2131,6	1972,0	1503,5	838,4	821,4	**21477,3**
2	**Specific consumption of air blast in BFP per ton of produced pig iron**	**ths. m^3 of air blast/ton**	**2,242**	**2,306**	**2,420**	**2,538**	**2,564**	**2,639**	**2,690**	**2,714**	**2,432**	**2,418**	**2,659**	**3,063**	**2,557**

Input carbon flows

#	Data variable	Unit	Jan	Feb	March	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Total for year
1	Consumption of BFG in SABPP for generation of air blast	mln. m^3	106,5	104,9	118,0	117,3	124,7	111,8	91,8	115,4	108,8	68,9	22,1	10,6	**1100,7**
2	Carbon content in BFG	kg C/m^3	0,20	0,20	0,21	0,20	0,19	0,20	0,20	0,20	0,20	0,20	0,17	0,17	**0,20**
		ths. tons C	21,5	21,5	24,2	24,0	24,2	22,8	18,3	22,5	21,2	13,5	3,8	1,8	**219,5**
3	Consumption of COG in SABPP for generation of air blast	mln. m^3	23,7	19,4	23,0	23,9	25,7	23,8	18,7	22,5	19,3	13,2	3,1	2,5	**218,8**
4	Carbon content in COG	kg C/m^3	0,20	0,19	0,19	0,19	0,20	0,19	0,19	0,19	0,18	0,19	0,18	0,17	**0,19**
		ths. tons C	4,7	3,8	4,4	4,6	5,0	4,6	3,5	4,3	3,6	2,5	0,6	0,4	**42,0**
5	Consumption of NG in SABPP for generation of air blast	mln. m^3	7,8	9,7	10,2	8,3	8,5	6,9	9,0	9,1	9,5	9,5	9,6	10,9	**109,2**
6	Carbon content in NG	kg C/m^3	0,50	0,50	0,50	0,49	0,49	0,49	0,49	0,49	0,49	0,49	0,49	0,49	**0,49**
		ths. tons C	3,9	4,8	5,0	4,1	4,2	3,4	4,4	4,5	4,7	4,7	4,8	5,4	**54,0**
7	**Total carbon content in input gaseos flow**	**ths. tons C**	**30,0**	**30,1**	**33,6**	**32,7**	**33,5**	**30,8**	**26,3**	**31,3**	**29,5**	**20,8**	**9,1**	**7,6**	**315,4**

CO_2 emissions from generation of air blast

#	Data variable	Unit	Jan	Feb	March	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Total for year
1	**CO_2 emissions from generation of air blast**	**ths. tons CO_2**	**110,2**	**110,2**	**123,4**	**120,0**	**122,7**	**113,0**	**96,4**	**114,8**	**108,2**	**76,2**	**33,5**	**28,0**	**1156,5**

CO_2 emissions from generation of air blast for production of pig iron used for production of slab steel billet in the project

CO_2 emission factor for generation of air blast

#	Data variable	Unit	Jan	Feb	March	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Total for year
2	**CO_2 emission factor for generation of air blast at MMK**	**tons CO_2/ ths. m^3 of air blast**	**0,056**	**0,057**	**0,057**	**0,058**	**0,055**	**0,057**	**0,053**	**0,054**	**0,055**	**0,051**	**0,040**	**0,034**	**0,054**

CO_2 emissions from generation of air blast for production of pig iron used for production of slab steel billet in the project

#	Data variable	Unit	Jan	Feb	March	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Total for year
1	**CO_2 emissions from generation of air blast for production of pig iron**	**ths. tons CO_2**	**6,326**	**6,607**	**7,425**	**6,362**	**7,436**	**6,328**	**5,058**	**5,978**	**5,925**	**1,063**	**2,009**	**2,602**	**63,120**

12 months of 2009

Generation of air blast at MMK

#	Data variable	Unit	Jan	Feb	March	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Total for year
1	Generation of air blast at MMK	mln. m^3	1038,7	1256,7	1464,8	1513,5	1547,6	1747,6	1898,5	1925,0	1845,7	1841,5	1699,7	1709,8	**19489,0**
2	**Specific consumption of air blast in BFP per ton of produced pig iron**	**ths. m^3 of air blast/ton**	**2,593**	**2,279**	**2,290**	**2,263**	**2,416**	**2,508**	**2,442**	**2,483**	**2,388**	**2,336**	**2,481**	**2,233**	**2,388**

Input carbon flows

#	Data variable	Unit	Jan	Feb	March	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Total for year
1	Consumption of BFG in SABPP for generation of air blast	mln. m^3	26,5	62,3	70,3	78,0	76,5	96,1	119,5	123,7	112,5	108,5	82,8	91,3	**1048,0**
2	Carbon content in BFG	kg C/m^3	0,19	0,21	0,20	0,21	0,21	0,21	0,22	0,21	0,21	0,21	0,21	0,21	**0,21**
		ths. tons C	4,9	12,9	14,4	16,3	16,0	20,5	25,8	25,7	24,0	23,2	17,7	19,1	**220,6**
3	Consumption of COG in SABPP for generation of air blast	mln. m^3	4,6	11,9	11,4	16,9	17,6	17,5	20,5	17,3	13,6	15,5	15,6	15,7	**178,0**
4	Carbon content in COG	kg C/m^3	0,18	0,18	0,18	0,18	0,18	0,18	0,19	0,18	0,19	0,19	0,19	0,18	**0,18**
		ths. tons C	0,8	2,1	2,1	3,1	3,2	3,2	3,9	3,1	2,5	3,0	2,9	2,8	**32,7**
5	Consumption of NG in SABPP for	mln. m^3	11,5	7,0	9,6	6,8	7,3	7,2	5,6	7,4	9,2	9,0	10,4	10,2	**101,1**

	generation of air blast														
6	Carbon content in NG	kg C/m^3	0,50	0,50	0,50	0,50	0,50	0,50	0,49	0,49	0,49	0,49	0,49	0,50	**0,50**
		ths. tons C	5,7	3,4	4,7	3,3	3,6	3,6	2,8	3,6	4,6	4,5	5,2	5,1	**50,0**
7	**Total carbon content in input gaseos flow**	**ths. tons C**	**11,4**	**18,5**	**21,2**	**22,8**	**22,8**	**27,3**	**32,4**	**32,4**	**31,1**	**30,6**	**25,7**	**27,0**	**303,4**

CO_2 emissions from generation of air blast

#	Data variable	Unit	Jan	Feb	March	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Total for year
1	**CO_2 emissions from generation of air blast**	**ths. tons CO_2**	**41,9**	**67,7**	**77,7**	**83,5**	**83,7**	**100,1**	**118,8**	**118,9**	**114,2**	**112,3**	**94,4**	**99,1**	**1112,3**

CO_2 emission factor for generation of air blast

#	Data variable	Unit	Jan	Feb	March	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Total for year
1	**CO_2 emission factor for generation of air blast at MMK**	**tons CO_2/ ths. m^3 of air blast**	**0,040**	**0,054**	**0,053**	**0,055**	**0,054**	**0,057**	**0,063**	**0,062**	**0,062**	**0,061**	**0,056**	**0,058**	**0,057**

CO_2 emissions from generation of air blast for production of pig iron used for production of slab steel billet in the project

#	Data variable	Unit	Jan	Feb	March	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Total for year
1	**CO_2 emissions from generation of air blast for production of pig iron**	**ths. tons CO_2**	**1,719**	**3,839**	**0,017**	**0,000**	**0,000**	**0,000**	**0,000**	**3,986**	**5,549**	**2,098**	**4,313**	**3,056**	**24,576**

12 months of 2010

Generation of air blast at MMK

#	Data variable	Unit	Jan	Feb	March	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Total for year
1	Generation of air blast at MMK	mln. m^3	1600,1	1589,6	2044,7	2049,8	2025,5	1887,5	1005,8	1106,4	1079,8	1043,8	1113,1	1924,4	**18470,5**
2	**Specific consumption of air blast in BFP per ton of produced pig iron**	**ths. m^3 of air blast/ton**	**2,331**	**2,271**	**2,407**	**2,433**	**2,632**	**2,664**	**1,333**	**1,453**	**1,351**	**1,336**	**1,415**	**2,420**	**2,000**

CO_2 emissions from generation of air blast for production of pig iron used for production of slab steel billet in the project

Input carbon flows

#	Data variable	Unit	Jan	Feb	March	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Total for year
1	Consumption of BFG in SABPP for generation of air blast	mln. m^3	68,5	87,9	113,4	121,0	104,0	100,2	106,5	113,4	101,4	90,1	96,5	95,5	**1198,4**
2	Carbon content in BFG	kg C/m^3	0,21	0,21	0,21	0,21	0,21	0,21	0,21	0,21	0,21	0,22	0,22	0,22	**0,21**
		ths. tons C	14,5	18,4	23,9	25,6	22,1	21,3	22,6	23,9	21,5	19,4	21,1	21,0	**255,4**
3	Consumption of COG in SABPP for generation of air blast	mln. m^3	15,8	15,2	17,2	21,4	19,4	16,2	16,7	18,7	19,4	19,4	20,5	16,9	**216,8**
4	Carbon content in COG	kg C/m^3	0,18	0,18	0,18	0,18	0,18	0,18	0,19	0,19	0,19	0,19	0,19	0,19	**0,18**
		ths. tons C	2,9	2,7	3,1	3,8	3,4	2,9	3,1	3,5	3,6	3,7	3,8	3,1	**39,7**
5	Consumption of NG in SABPP for generation of air blast	mln. m^3	11,9	12,7	12,3	8,7	10,9	10,9	11,6	11,3	10,0	9,4	9,8	11,8	**131,3**
6	Carbon content in NG	kg C/m^3	0,50	0,50	0,49	0,49	0,49	0,49	0,49	0,49	0,49	0,49	0,49	0,49	**0,49**
		ths. tons C	5,9	6,3	6,1	4,3	5,4	5,4	5,7	5,6	4,9	4,6	4,8	5,9	**65,0**
7	**Total carbon content in input gaseos flow**	**ths. tons C**	**23,3**	**27,5**	**33,1**	**33,7**	**30,9**	**29,6**	**31,5**	**33,0**	**30,1**	**27,7**	**29,8**	**30,0**	**360,1**

CO_2 emissions from generation of air blast

#	Data variable	Unit	Jan	Feb	March	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Total for year
1	**CO_2 emissions from generation of air blast**	**ths. tons CO_2**	**85,5**	**100,7**	**121,3**	**123,6**	**113,2**	**108,4**	**115,3**	**121,1**	**110,3**	**101,6**	**109,3**	**109,9**	**1320,2**

CO_2 emission factor for generation of air blast

#	Data variable	Unit	Jan	Feb	March	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Total for year
1	**CO_2 emission factor for generation of air blast at MMK**	**tons CO_2/ ths. m^3 of air blast**	**0,053**	**0,063**	**0,059**	**0,060**	**0,056**	**0,057**	**0,115**	**0,109**	**0,102**	**0,097**	**0,098**	**0,057**	**0,071**

CO_2 emissions from generation of air blast for production of pig iron used for production of slab steel billet in the project

#	Data variable	Unit	Jan	Feb	March	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Total for year
1	**CO_2 emissions from generation of air blast for production of pig iron**	**ths. tons CO_2**	**3,447**	**4,994**	**7,126**	**7,216**	**5,367**	**3,626**	**3,409**	**3,149**	**2,742**	**2,426**	**1,230**	**0,527**	**45,261**

CO_2 emissions from generation of air blast for production of pig iron used for production of slab steel billet in the project

D.6 Baseline CO_2 emissions from slab steel billet production

BE = P $_{slab\ steel\_EAFP\_MMK}$ *** EF** $_{integrated\_Russian\ metallurgical\ plants}$ **(PDD formula D.1.1.4.-1)**

<u>Integrated CO_2 emission factor for steel production at the Russian metallurgical works with capacity for production of slab steel billet</u>

$$EF_{integrated\_Russian\ metallurgical\ plants} = \sum EF_n * \omega_n$$ **(PDD formula D.1.1.4.-2)**

General CO_2 emission factor for steel production at the metallurgical works n

$$EF_n = SBE_{EAF\_n} * \omega_{EAF\_n} + SBE_{converter\_n} * \omega_{converter\_n} + SBE_{pig\text{-}and\text{-}ore\ process\_n} * \omega_{pig\text{-}and\text{-}ore\ process\_n} + SBE_{DBSU\_n} * \omega_{DBSU\_n} + SBE_{scrap\ process\_n} * \omega_{scrap\ process\_n}$$

(PDD formula D.1.1.4.-3)

Symbol	Data variable	Unit	Symbol	Data variable	Unit	Symbol	Data variable	Unit
BE	Baseline CO_2 emissions from steel production at the metallurgical works of Russia	ths. tons CO_2	**P** $_{slab\ steel\_EAFP\_MMK}$	Output of slab steel billet in EAFP	ths. tons	**EF** $_{integrated\ Russian\ metallurgical\ plants}$	Integrated CO_2 emission factor for steel production at the Russian metallurgical works with capacity for production of slab steel billet	t CO_2/t steel
EF $_n$	General CO_2 emission factor for steel production at the metallurgical works n	t CO_2/t steel	ω_n	Share of each metallurgical works with capacity for production of slab steel billet in the whole volume of steel output by this group metallurgical works of Russia	-	**SBE** $_{EAF\_n}$	Specific CO_2 emissions from production of one ton of steel by arc-furnace technique at the metallurgical works n	t CO_2/ t steel
ω_{EAF_n}	Share of arc-furnace technique of steel production in the whole volume of steel output at the metallurgical works n	-	**SBE** $_{converter\_n}$	Specific CO_2 emissions from production of one ton of steel by converter technique at the metallurgical works n	t CO_2/ t steel	$\omega_{converter\_n}$	Share of converter technique of steel production in the whole volume of steel output at the metallurgical works n	-
SBE $_{pig\text{-}and\text{-}ore\ process\_n}$	Specific CO_2 emissions from production of one ton of steel by pig-and-ore technique at the	t CO_2/ t steel	$\omega_{pig\text{-}and\text{-}ore\ process\_n}$	Share of pig-and-ore technique of steel production in the whole volume of steel output at the metallurgical	-	**SBE** $_{DBSU\_n}$	Specific CO_2 emissions from production of one ton of steel in DBSU at the metallurgical works n	t CO_2/ t steel

Baseline CO_2 emissions from slab steel billet production

	metallurgical works n			works n				
ω_{DBSU_n}	Share of steel production in DBSU in the whole volume of steel output at the metallurgical works n	-	**$SBE_{scrap\ process\_n}$**	Specific CO_2 emissions from production of one ton of steel by scrap technique at the metallurgical works n	t CO_2/ t steel	**$\omega_{scrap\ process\_n}$**	Share of scrap technique of steel production in the whole volume of steel output at the metallurgical works n	-

Specific CO_2 emissions from production of one ton of steel by arc-furnace technique at the metallurgical works n

$SBE_{EAF\_n} = SBE_{iron\_EAF\_n} + SBE_{NG\_EAF\_n} + SBE_{electrodes\_EAF\_n} + SBE_{oxygen\ EAF\_n} + SBE_{electricity\ EAF\ \_n}$ **(PDD formula D.1.1.4.-4)**

$SBE_{iron\_EAF\_n} = SM_{iron\ EAF\ \_n} * EF_{iron}$ **(PDD formula D.1.1.4.-5)**

$SBE_{NG\_EAF\_n} = SM_{NG\ EAF\ \_n} /1000 * EF_{NG}$ **(PDD formula D.1.1.4.-6)**

$SBE_{electrodes\_EAF\_n} = SM_{electrodes\ EAF\_n} * EF_{electrodes}$ **(PDD formula D.1.1.4.-7)**

$SBE_{oxygen\ EAF\_n} = SM_{oxygen\ EAF\_n} /1000 * EC_{oxygen} * EF_{grid\_region}$ **(PDD formula D.1.1.4.-8)**

$SBE_{electricity\ EAF\ \_n} = SM_{electricity\ EAF\ \_n} * EF_{grid\_region}$ **(PDD formula D.1.1.4.-9)**

Symbol	Data variable	Unit	Symbol	Data variable	Unit	Symbol	Data variable	Unit
$SBE_{iron\_EAF\_n}$	Specific CO_2 emissions from production of pig iron per ton of steel produced by arc-furnace technique at the metallurgical works n	t CO_2/ t steel	**$SBE_{NG\_EAF\_n}$**	Specific CO_2 emissions from consumption of NG per ton of steel produced by arc-furnace technique at the metallurgical works n	t CO_2/ t steel	**$SBE_{electrodes\_EAF\_n}$**	Specific CO_2 emissions from consumption of electrodes per ton of steel produced by arc-furnace technique at the metallurgical works n	t CO_2/ t steel
$SBE_{oxygen\ EAF\_n}$	Specific CO_2 emissions from consumption of oxygen per ton of	t CO_2/ t steel	**$SBE_{electricity\ EAF\ \_n}$**	Specific CO_2 emissions from consumption of electricity per ton of steel produced by arc-furnace	t CO_2/ t steel	**$SM_{iron\ EAF\ \_n}$**	Specific consumption of pig iron per ton of steel produced by arc-furnace technique at the	t pig iron/ t steel

	steel produced by arc-furnace technique at the metallurgical works n			technique at the metallurgical works n			metallurgical works n	
EF_{iron}	CO_2 emission factor for iron production	t CO_2/t pig iron	**$SM_{NG\ EAF\_n}$**	Specific consumption of NG per ton of steel produced by arc-furnace technique at the metallurgical works n	m^3/ t steel	**EF_{NG}**	CO_2 emission factor for NG combustion	t CO_2/ 1,000 m^3
$SM_{electrodes\ EAF\_n}$	Specific consumption of electrodes per ton of steel produced by arc-furnace technique at the metallurgical works n	t electrodes / t steel	**$EF_{electrodes}$**	CO_2 emission factor for electrodes consumption	t CO_2/t electrodes	**$SM_{oxygen\ EAF\_n}$**	Specific consumption of oxygen per ton of steel produced by arc-furnace technique at the metallurgical works n	m^3 / t steel
EC_{oxygen}	Electricity consumption for oxygen production	MWh/ 1,000 m^3	**EF_{grid_region}**	CO_2 emissions factor for grid electricity produced by Unified Energy System of region, where metallurgical works n is situated	t CO_2 /MWh	**$SM_{electricity\ EAF\_n}$**	Specific consumption of electricity per ton of steel produced by arc-furnace technique at the metallurgical works n	MWh/ t steel
SBE_{EAF_n}	Specific CO_2 emissions from production of one ton of steel by arc-furnace technique at the metallurgical works n	t CO_2/ t steel						

Specific CO_2 emissions from production of one ton of steel by converter technique at the metallurgical works n

$$SBE_{converter\_n} = SBE_{iron\ converter\_n} + SBE_{NG\ converter\_n} + SBE_{oxygen\ converter\_n}$$ **(PDD formula D.1.1.4.-10)**

$$SBE_{iron\ converter\_n} = SM_{iron\ converter\_n} * EF_{iron}$$ **(PDD formula D.1.1.4.-11)**

$$SBE_{NG\ converter\_n} = SM_{NG\ converter\_n} /1000 * EF_{NG}$$ **(PDD formula D.1.1.4.-12)**

$$SBE_{oxygen\ converter\_n} = SM_{oxygen\ converter\_n} /1000 * EC_{oxygen} * EF_{grid\_region}$$ **(PDD formula D.1.1.4.-13)**

Baseline CO_2 emissions from slab steel billet production

Symbol	Data variable	Unit	Symbol	Data variable	Unit	Symbol	Data variable	Unit
SBE $_{converter\_n}$	Specific CO_2 emissions from production of one ton of steel by converter technique at the metallurgical works n	t CO_2/ t steel	**SBE** $_{iron\ converter\_n}$	Specific CO_2 emissions from production of pig iron per ton of steel produced by converter technique at the metallurgical works n	t CO_2/ t steel	**SBE** $_{NG\ converter\_n}$	Specific CO_2 emissions from consumption of NG per ton of steel produced by converter technique at the metallurgical works n	t CO_2/ t steel
SBE $_{oxygen\ converter\_n}$	Specific CO_2 emissions from consumption of oxygen per ton of steel produced by converter technique at the metallurgical works n	t CO_2/ t steel	**SM** $_{iron\ converter\_n}$	Specific consumption of pig iron per ton of steel produced by converter technique at the metallurgical works n	t pig iron/ t steel	**EF** $_{iron}$	CO_2 emission factor for iron production	t CO_2/t pig iron
SM $_{NG\ converter\_n}$	Specific consumption of NG per ton of steel produced by converter technique at the metallurgical works n	m^3/ t steel	**EF** $_{NG}$	CO_2 emission factor for NG combustion	t CO_2/ 1,000 m^3	**SM** $_{oxygen\ converter\_n}$	Specific consumption of oxygen per ton of steel produced by converter technique at the metallurgical works n	m^3 / t steel
EC $_{oxygen}$	Electricity consumption for oxygen production	MWh/ 1,000 m^3	**EF** $_{grid\_region}$	CO_2 emissions factor for grid electricity produced by Unified Energy System of region, where metallurgical works n is situated	t CO_2 /MWh			

Specific CO_2 emissions from production of one ton of steel by pig-and-ore technique at the metallurgical works n

$$SBE_{pig\text{-}and\text{-}ore\ process\_n} = SBE_{iron\ pig\text{-}and\text{-}ore\ process\_n} + SBE_{NG\ pig\text{-}and\text{-}ore\ process\_n} + SBE_{oxygen\ pig\text{-}and\text{-}ore\ process\_n}$$ **(PDD formula D.1.1.4.-14)**

$$SBE_{iron\ pig\text{-}and\text{-}ore\ process\_n} = SM_{iron\ pig\text{-}and\text{-}ore\ process\_n} * EF_{iron}$$ **(PDD formula D.1.1.4.-15)**

$$SBE_{NG\ pig\text{-}and\text{-}ore\ process\_n} = SM_{NG\ pig\text{-}and\text{-}ore\ process\_n} /1000 * EF_{NG}$$ **(PDD formula D.1.1.4.-16)**

$$SBE_{oxygen\ pig\text{-}and\text{-}ore\ process\_n} = SM_{oxygen\ pig\text{-}and\text{-}ore\ process\_n} /1000 * EC_{oxygen} * EF_{grid\_region}$$ **(PDD formula D.1.1.4.-17)**

Baseline CO_2 emissions from slab steel billet production

Symbol	Data variable	Unit	Symbol	Data variable	Unit	Symbol	Data variable	Unit
SBE $_{\text{pig-and-ore process\_n}}$	Specific CO_2 emissions from production of one ton of steel by pig-and-ore technique at the metallurgical works n	t CO_2/ t steel	**SBE** $_{\text{iron pig-and-ore process\_n}}$	Specific CO_2 emissions from production of pig iron per ton of steel produced by pig-and-ore technique at the metallurgical works n	t CO_2/ t steel	**SBE** $_{\text{NG pig-and-ore process\_n}}$	Specific CO_2 emissions from consumption of NG per ton of steel produced by pig-and-ore technique at the metallurgical works n	t CO_2/ t steel
SBE $_{\text{oxygen pig-and-ore process\_n}}$	Specific CO_2 emissions from consumption of oxygen per ton of steel produced by pig-and-ore technique at the metallurgical works n	t CO_2/ t steel	**SM** $_{\text{iron pig-and-ore process\_n}}$	Specific consumption of pig iron per ton of steel produced by pig-and-ore technique at the metallurgical works n	t pig iron/ t steel	**EF** $_{\text{iron}}$	CO_2 emission factor for iron production	t CO_2/t pig iron
SM $_{\text{NG pig-and-ore process\_n}}$	Specific consumption of NG per ton of steel produced by pig-and-ore technique at the metallurgical works n	m^3/ t steel	**EF** $_{\text{NG}}$	CO_2 emission factor for NG combustion	t CO_2/ 1,000 m^3	**SM** $_{\text{oxygen pig-and-ore process\_n}}$	Specific consumption of oxygen per ton of steel produced by pig-and-ore technique at the metallurgical works n	m^3 / t steel
EC $_{\text{oxygen}}$	Electricity consumption for oxygen production	MWh/ 1,000 m^3	**EF** $_{\text{grid\_region}}$	CO_2 emissions factor for grid electricity produced by Unified Energy System of region, where metallurgical works n is situated	t CO_2 /MWh			

Specific CO_2 emissions from production of one ton of steel in DBSU at the metallurgical works n

$$SBE_{DBSU\_n} = SBE_{iron\ DBSU\_n} + SBE_{NG\ DBSU\_n} + SBE_{oxygen\ DBSU\_n}$$ **(PDD formula D.1.1.4.-18)**

$$SBE_{iron\ DBSU\_n} = SM_{iron\ DBSU\_n} * EF_{iron}$$ **(PDD formula D.1.1.4.-19)**

$$SBE_{NG\ DBSU\_n} = SM_{NG\ DBSU\_n} /1000 * EF_{NG}$$ **(PDD formula D.1.1.4.-20)**

$$SBE_{oxygen\ DBSU\_n} = SM_{oxygen\ DBSU\_n} /1000 * EC_{oxygen} * EF_{grid\_region}$$ **(PDD formula D.1.1.4.-21)**

Symbol	Data variable	Unit	Symbol	Data variable	Unit	Symbol	Data variable	Unit
SBE $_{\text{DBSU\_n}}$	Specific CO_2	t CO_2/ t	**SBE** $_{\text{iron DBSU\_n}}$	Specific CO_2 emissions	t CO_2/ t	**SBE** $_{\text{NG DBSU\_n}}$	Specific CO_2 emissions	t CO_2/ t

	emissions from production of one ton of steel in DBSU at the metallurgical works n	steel		from production of pig iron per ton of steel produced in DBSU at the metallurgical works n	steel		from consumption of NG per ton of steel produced in DBSU at the metallurgical works n	steel
SBE $_{oxygen\ DBSU\_n}$	Specific CO_2 emissions from consumption of oxygen per ton of steel produced in DBSU at the metallurgical works n	t CO_2/ t steel	**SM** $_{iron\ DBSU\_n}$	Specific consumption of pig iron per ton of steel produced in DBSU at the metallurgical works n	t pig iron/ t steel	**EF** $_{iron}$	CO_2 emission factor for iron production	t CO_2/t pig iron
SM $_{NG\ DBSU\_n}$	Specific consumption of NG per ton of steel produced in DBSU at the metallurgical works n	m^3/ t steel	**EF** $_{NG}$	CO_2 emission factor for NG combustion	t CO_2/ 1,000 m^3	**SM** $_{oxygen\ DBSU\_n}$	Specific consumption of oxygen per ton of steel produced in DBSU at the metallurgical works n	m^3 / t steel
EC $_{oxygen}$	Electricity consumption for oxygen production	MWh/ 1,000 m^3	**EF** $_{grid\_region}$	CO_2 emissions factor for grid electricity produced by Unified Energy System of region, where metallurgical works n is situated	t CO_2 /MWh			

Specific CO_2 emissions from production of one ton of steel by scrap technique at the metallurgical works n

$$SBE_{scrap\ process\_n} = SBE_{iron\ scrap\ process\_n} + SBE_{NG\ scrap\ process\_n} + SBE_{oxygen\ scrap\ process\_n}$$ **(PDD formula D.1.1.4.-22)**

$$SBE_{iron\ scrap\ process\_n} = SM_{iron\ scrap\ process\_n} * EF_{iron}$$ **(PDD formula D.1.1.4.-23)**

$$SBE_{NG\ scrap\ process\_n} = SM_{NG\ scrap\ process\_n} /1000 * EF_{NG}$$ **(PDD formula D.1.1.4.-24)**

$$SBE_{oxygen\ scrap\ process\_n} = SM_{oxygen\ scrap\ process\_n} /1000 * EC_{oxygen} * EF_{grid\_region}$$ **(PDD formula D.1.1.4.-25)**

Baseline CO_2 emissions from slab steel billet production

Symbol	Data variable	Unit	Symbol	Data variable	Unit	Symbol	Data variable	Unit
SBE $_{scrap\ process\_n}$	Specific CO_2 emissions from production of one ton of steel by scrap technique at the metallurgical works n	t CO_2/ t steel	**SBE** $_{iron\ scrap\ process\_n}$	Specific CO_2 emissions from production of pig iron per ton of steel produced by scrap technique at the metallurgical works n	t CO_2/ t steel	**SBE** $_{NG\ scrap\ process\_n}$	Specific CO_2 emissions from consumption of NG per ton of steel produced by scrap technique at the metallurgical works n	t CO_2/ t steel
SBE $_{oxygen\ scrap\ process\_n}$	Specific CO_2 emissions from consumption of oxygen per ton of steel produced by scrap technique at the metallurgical works n	t CO_2/ t steel	**SM** $_{iron\ scrap\ process\_n}$	Specific consumption of pig iron per ton of steel produced by scrap technique at the metallurgical works n	t pig iron/ t steel	**EF** $_{iron}$	CO_2 emission factor for iron production	t CO_2/t pig iron
SM $_{NG\ scrap\ process\_n}$	Specific consumption of NG per ton of steel produced by scrap technique at the metallurgical works n	m^3/ t steel	**EF** $_{NG}$	CO_2 emission factor for NG combustion	t CO_2/ 1,000 m^3	**SM** $_{oxygen\ scrap\ process\_n}$	Specific consumption of oxygen per ton of steel produced by scrap technique at the metallurgical works n	m^3 / t steel
EC $_{oxygen}$	Electricity consumption for oxygen production	MWh/ 1,000 m^3	**EF** $_{grid\_region}$	CO_2 emissions factor for grid electricity produced by Unified Energy System of region, where metallurgical works n is situated	t CO_2 /MWh			

12 months of 2008

Specific CO_2 emissions from production of one ton of steel by concrete technique at the metallurgical works n

Metallurgical works	Technique of steel production (production)	Raw materials	Specific consumption of materials for steel production, kg/t	EF raw material, tCO_2/t steel	EF technique, tCO_2/t steel
			2008	2008	2008
OJSC "Magnitogorsk Iron and Steel Works"	converter steel	pig iron	846,4	1,143	**1,177**
		natural gas, m^3/t	3,3	0,006	
		oxygen, m^3/t	62,1	0,028	
OJSC "Nizhny Tagil Iron and Steel	converter steel	pig iron	1071,3	1,446	**1,471**

Plant"		oxygen, m³/t	54,8	0,025	
	pig-and-ore steel	pig iron	576,7	0,779	**0,950**
		natural gas, m³/t	74,0	0,139	
		oxygen, m³/t	70,2	0,032	
OJSC "Novokuznetsk Iron and Steel Works"	arc-furnace steel	pig iron	322,2	0,435	**0,777**
		graphite electrode	2,9	0,009	
		oxygen, m³/t	30,6	0,023	
		electricity, kWh/t	347,4	0,311	
OJSC "Ural Steel"	arc-furnace steel	pig iron	371,5	0,502	**0,713**
		natural gas, m³/t	11,6	0,022	
		graphite electrode	1,7	0,005	
		oxygen, m³/t	55,2	0,025	
		electricity, kWh/t	294,4	0,159	
	pig-and-ore steel	pig iron	704,3	0,951	**1,217**
		scrap of pig iron	48,5	0,065	
		natural gas, m³/t	90,6	0,171	
		oxygen, m³/t	65,6	0,029	
	steel from DBSU	pig iron	812,0	1,096	**1,237**
		scrap of pig iron	23,9	0,032	
		natural gas, m³/t	32,6	0,061	
		oxygen, m³/t	104,6	0,047	
OJSC "Cherepovets Steel Mill"	converter steel	pig iron	847,3	1,144	**1,189**
		natural gas, m³/t	7,6	0,014	
		oxygen, m³/t	68,3	0,031	
	arc-furnace steel	pig iron	206,8	0,279	**0,466**
		graphite electrode	1,6	0,005	
		oxygen, m³/t	55,4	0,025	
		electricity, kWh/t	285,8	0,157	
	pig-and-ore steel	pig iron	624,7	0,843	**1,125**
		scrap of pig iron	29,9	0,040	
		natural gas, m³/t	115,1	0,217	
		oxygen, m³/t	53,8	0,024	
	steel from DBSU	pig iron	768,7	1,038	**1,245**
		scrap of pig iron	24,2	0,033	
		natural gas, m³/t	70,2	0,132	

Baseline CO_2 emissions from slab steel billet production

		oxygen, m^3/t	93,4	0,042	
OJSC “Novolipetsk Steel”	converter steel	pig iron	915,8	1,236	**1,264**
		oxygen, m^3/t	65,6	0,028	
OJSC “West Siberian Iron and Steel Plant”	converter steel	pig iron	808,0	1,091	**1,144**
		oxygen, m^3/t	71,0	0,053	
OJSC “Ashinsky metallurgical works”	scrap steel	*Because of the absence of data general CO_2 emission factor from steel production by scrap technique is equal to specific CO2 emissions from production of one ton of steel at JSC “Taganrog Steel Works”, as the most conservative value (see below)*			**0,550**
OJSC “Amurmetall”	arc-furnace steel	graphite electrode	2,3	0,007	**0,346**
		oxygen, m^3/t	46,9	0,032	
		electricity, kWh/t	373,0	0,307	
OJSC “Chelyabinsk Metallurgical Plant”	converter steel	pig iron	889,4	1,201	**1,256**
		natural gas, m^3/t	14,1	0,027	
		oxygen, m^3/t	64,4	0,029	
	arc-furnace steel	pig iron	276,3	0,373	**0,606**
		natural gas, m^3/t	25,1	0,047	
		graphite electrode	2,9	0,009	
		oxygen, m^3/t	48,2	0,022	
		electricity, kWh/t	287,2	0,155	
OJSC «Krasny oktyabr»	arc-furnace steel	pig iron	2,1	0,003	**0,314**
		scrap of pig iron	16,4	0,022	
		graphite electrode	5,3	0,016	
		electricity, kWh/t	545,5	0,273	
“Metallurgical Plant Petrostal” Closed JSC	scrap steel	*Because of the absence of data general CO2 emission factor from steel production by scrap technique is equal to specific CO2 emissions from production of one ton of steel at JSC “Taganrog Steel Works”, as the most conservative value (see below)*			**0,550**
“Metallurgical Plant “Kamasteel”, LLC	***arc-furnace steel****	graphite electrode	2,3	0,007	**0,230**
		oxygen, m^3/t	46,9	0,021	
		electricity, kWh/t	373,0	0,202	
JSC “Taganrog Steel Works”	scrap steel	pig iron	227,4	0,307	**0,550**
		natural gas, m^3/t	127,9	0,241	
		oxygen, m^3/t	4,6	0,002	

*The value of specific consumption of graphite electrodes, oxygen and electricity for arc-furnace steel technique at this metal works is taken from PDD of JI project “Production modernisation at OJSC Amurmetal, Komsomolsk-on-Amur, Khabarovsk Krai, Russian Federation”. See section C for explanation.

Baseline CO_2 emissions from slab steel billet production

Integrated CO_2 emission factor for steel production at the Russian metallurgical works with capacity for production of slab steel billet

Metallurgical works	Technique of steel production (production)	Steel production, ths. tons	Share of technique	EF technique, tCO_2/t steel	EF works, tCO_2/t steel	Share of total production	EF integrated, tCO_2/t steel
		2008	2008	2008	2008	2008	2008
Russia (metallurgical works with capacity for production of slab steel billet)	Steel-Total	*52 474,5*					
OJSC "Magnitogorsk Iron and Steel Works"	converter steel	8 838,3	1,0	1,177	**1,177**	0,168	**1,103**
OJSC "Nizhny Tagil Iron and Steel Plant"	converter steel	3 451,2	0,66	1,471	**1,296**	0,099	
	pig-and-ore steel	1 743,2	0,34	0,950			
OJSC "Novokuznetsk Iron and Steel Works"	arc-furnace steel	1 320,0	1,00	0,777	**0,777**	0,025	
OJSC "Ural Steel"	arc-furnace steel	1 202,0	0,35	0,713	**1,046**	0,065	
	arc-furnace steel for casting	6,8	0,002	0,713			
	pig-and-ore steel	675,6	0,20	1,217			
	steel from DBSU	1 502,8	0,44	1,237			
OJSC "Cherepovets Steel Mill"	converter steel	8 140,5	0,74	1,189	**1,066**	0,211	
	arc-furnace steel	1 869,9	0,17	0,466			
	pig-and-ore steel	576,1	0,05	1,125			
	steel from DBSU	484,8	0,04	1,245			
OJSC "Novolipetsk Steel"	converter steel	8 438,7	1,00	1,264	**1,264**	0,161	
OJSC "West Siberian Iron and Steel Plant"	converter steel	6 566,0	1,00	1,144	**1,144**	0,125	
OJSC "Ashinsky metallurgical works"	scrap steel	652,3	1,00	0,550	**0,550**	0,012	

OJSC “Amurmetall”	arc-furnace steel	1 062,2	1,00	0,346	**0,346**	0,020	
OJSC “Chelyabinsk Metallurgical Plant”	converter steel	3 356,8	0,72	1,256	**1,072**	0,089	
	arc-furnace steel	1 324,1	0,28	0,606			
OJSC «Krasny oktyabr»	arc-furnace steel	683,2	1,00	0,314	**0,314**	0,013	
“Metallurgical Plant Petrostal” Closed JSC	scrap steel	314,0	1,00	0,550	**0,550**	0,006	
“Metallurgical Plant “Kamasteel”, LLC	arc-furnace steel	265,8	1,00	0,230	**0,230**	0,005	

12 months of 2009

Specific CO_2 emissions from production of one ton of steel by concrete technique at the metallurgical works n

Metallurgical works	Technique of steel production (production)	Raw materials	Specific consumption of materials for steel production, kg/t	EF raw material, tCO_2/t steel	EF technique, tCO_2/t steel
			2009	2009	2009
OJSC “Magnitogorsk Iron and Steel Works”	converter steel	pig iron	877,6	1,185	**1,220**
		natural gas, m^3/t	3,8	0,007	
		oxygen, m^3/t	62,7	0,028	
OJSC “Nizhny Tagil Iron and Steel Plant”	converter steel	pig iron	1082,0	1,461	**1,486**
		oxygen, m^3/t	56,3	0,025	
	pig-and-ore steel	pig iron	574,1	0,775	**0,947**
		natural gas, m^3/t	72,4	0,136	
		oxygen, m^3/t	79,6	0,036	
OJSC “Novokuznetsk Iron and Steel Works”	arc-furnace steel	pig iron	294,1	0,397	**0,805**
		graphite electrode	3,0	0,009	
		oxygen, m^3/t	37,4	0,028	
		electricity, kWh/t	414,9	0,371	
OJSC “Ural Steel”	arc-furnace steel	pig iron	448,7	0,606	**0,832**
		natural gas, m^3/t	13,3	0,025	
		graphite electrode	1,4	0,004	
		oxygen, m^3/t	58,9	0,026	

Baseline CO_2 emissions from slab steel billet production

		electricity, kWh/t	314,6	0,170	
	pig-and-ore steel	pig iron	735,7	0,993	**1,288**
		scrap of pig iron	50,1	0,068	
		natural gas, m³/t	102,1	0,192	
		oxygen, m³/t	77,6	0,035	
	steel from DBSU	pig iron	835,0	1,127	**1,289**
		scrap of pig iron	27,9	0,038	
		natural gas, m³/t	40,4	0,076	
		oxygen, m³/t	106,8	0,048	
OJSC "Cherepovets Steel Mill"	converter steel	pig iron	839,3	1,133	**1,175**
		natural gas, m³/t	5,9	0,011	
		oxygen, m³/t	67,3	0,031	
	arc-furnace steel	pig iron	206,8	0,279	**0,472**
		graphite electrode	1,7	0,005	
		oxygen, m³/t	56,3	0,026	
		electricity, kWh/t	294,8	0,162	
OJSC "Novolipetsk Steel"	converter steel	pig iron	940,6	1,270	**1,297**
		oxygen, m³/t	64,1	0,027	
OJSC "West Siberian Iron and Steel Plant"	converter steel	pig iron	810,9	1,095	**1,148**
		oxygen, m³/t	71,5	0,053	
OJSC "Ashinsky metallurgical works"	scrap steel	*Because of the absence of data general CO_2 emission factor from steel production by scrap technique is equal to specific CO2 emissions from production of one ton of steel at JSC "Taganrog Steel Works", as the most conservative value (see below)*			**0,624**
OJSC "Amurmetall"	arc-furnace steel	graphite electrode	2,3	0,007	**0,346**
		oxygen, m³/t	46,9	0,032	
		electricity, kWh/t	373,0	0,307	
OJSC "Chelyabinsk Metallurgical Plant"	converter steel	pig iron	923,9	1,247	**1,297**
		natural gas, m³/t	11,2	0,021	
		oxygen, m³/t	64,6	0,029	
	arc-furnace steel	pig iron	284,7	0,384	**0,660**
		natural gas, m³/t	28,0	0,053	
		graphite electrode	3,0	0,009	
		oxygen, m³/t	54,8	0,025	
		electricity, kWh/t	351,0	0,190	
OJSC «Krasny oktyabr»	arc-furnace steel	pig iron	2,5	0,003	**0,297**
		scrap of pig iron	22,9	0,031	

Baseline CO_2 emissions from slab steel billet production

		graphite electrode	5,5	0,017	
		oxygen, m^3/t	30,9	0,013	
		electricity, kWh/t	466,2	0,233	
“Metallurgical Plant Petrostal” Closed JSC	scrap steel	*Because of the absence of data general CO2 emission factor from steel production by scrap technique is equal to specific CO2 emissions from production of one ton of steel at JSC “Taganrog Steel Works”, as the most conservative value (see below)*			**0,624**
“Novorossmetal”, LLC	***arc-furnace steel****	graphite electrode	2,3	0,007	**0,213**
		oxygen, m^3/t	46,9	0,019	
		electricity, kWh/t	373,0	0,187	
“Metallurgical Plant “Kamasteel”, LLC	***arc-furnace steel****	graphite electrode	2,3	0,007	**0,230**
		oxygen, m^3/t	46,9	0,021	
		electricity, kWh/t	373,0	0,202	
JSC “United Metallurgical Company”	***arc-furnace steel****	graphite electrode	2,3	0,007	**0,198**
		electricity, kWh/t	373,0	0,191	
JSC “Taganrog Steel Works”	scrap steel	pig iron	234,5	0,317	**0,624**
		natural gas, m^3/t	161,8	0,305	
		oxygen, m^3/t	5,7	0,002	

*The value of specific consumption of graphite electrodes, oxygen and electricity for arc-furnace steel technique at these metal works is taken from PDD of JI project “Production modernisation at OJSC Amurmetal, Komsomolsk-on-Amur, Khabarovsk Krai, Russian Federation”. See section C for explanation.

Integrated CO_2 emission factor for steel production at the Russian metallurgical works with capacity for production of slab steel billet

Metallurgical works	Technique of steel production (production)	Steel production, ths. tons	Share of technique	EF technique, tCO_2/t steel	EF works, tCO_2/t steel	Share of total production	EF integrated, tCO_2/t steel
		2009	2009	2009	2009	2009	2009
Russia (metallurgical works with capacity for production of slab steel billet)	**Steel-Total**	***48 538,1***					
OJSC “Magnitogorsk Iron and Steel Works”	converter steel	8 217,6	1,00	1,220	**1,220**	0,169	
OJSC “Nizhny Tagil Iron and Steel Plant”	converter steel	3 866,0	1,00	1,486	**1,484**	0,080	
	pig-and-ore steel	12,2	0,00	0,947			
OJSC “Novokuznetsk Iron and Steel Works”	arc-furnace steel	1 397,6	1,00	0,805	**0,805**	0,029	
OJSC “Ural Steel”	arc-furnace steel	1 328,8	0,41	0,832	**1,101**	0,067	
	arc-furnace steel for casting	5,2	0,002	0,832			

	pig-and-ore steel	645,8	0,20	1,288			
	steel from DBSU	1 263,4	0,39	1,289			
OJSC “Cherepovets Steel Mill”	converter steel	7 990,6	0,84	1,175	**1,061**	0,196	
	arc-furnace steel	1 546,4	0,16	0,472			
OJSC “Novolipetsk Steel”	converter steel	8 518,8	1,00	1,297	**1,297**	0,176	**1,132**
OJSC “West Siberian Iron and Steel Plant”	converter steel	6 003,3	1,00	1,148	**1,148**	0,124	
OJSC “Ashinsky metallurgical works”	scrap steel	621,8	1,00	0,624	**0,624**	0,013	
OJSC “Amurmetall”	arc-furnace steel	545,8	1,00	0,346	**0,346**	0,011	
OJSC “Chelyabinsk Metallurgical Plant”	converter steel	3 504,9	0,75	1,297	**1,135**	0,097	
	arc-furnace steel	1 196,5	0,25	0,660			
OJSC «Krasny oktyabr»	arc-furnace steel	232,7	1,00	0,297	**0,297**	0,005	
“Metallurgical Plant Petrostal” Closed JSC	scrap steel	233,4	1,00	0,624	**0,624**	0,005	
“Novorossmetal”, LLC	arc-furnace steel	520,0	1,00	0,213	**0,213**	0,011	
“Metallurgical Plant “Kamasteel”, LLC	arc-furnace steel	162,3	1,00	0,230	**0,230**	0,003	
JSC “United Metallurgical Company”	arc-furnace steel	724,9	1,00	0,198	**0,198**	0,015	

12 months of 2010

Specific CO_2 emissions from production of one ton of steel by concrete technique at the metallurgical works n

Metallurgical works	Technique of steel production (production)	Raw materials	Specific consumption of materials for steel production, kg/t	EF raw material, tCO_2/t steel	EF technique, tCO_2/t steel
			2010	2010	2010
OJSC “Magnitogorsk Iron and Steel Works”	converter steel	pig iron	874,7	1,181	**1,215**
		natural gas, m^3/t	3,4	0,006	

Baseline CO_2 emissions from slab steel billet production

		oxygen, m³/t	61,0	0,027	
OJSC "Nizhny Tagil Iron and Steel Plant"	converter steel	pig iron	1083,8	1,463	**1,488**
		oxygen, m³/t	54,9	0,025	
OJSC "Novokuznetsk Iron and Steel Works"	arc-furnace steel	pig iron	260,9	0,352	**0,787**
		graphite electrode	2,8	0,009	
		oxygen, m³/t	39,4	0,029	
		electricity, kWh/t	443,7	0,397	
OJSC "Ural Steel"	arc-furnace steel	pig iron	411,1	0,555	**0,781**
		natural gas, m³/t	11,7	0,022	
		graphite electrode	1,3	0,004	
		oxygen, m³/t	134,2	0,060	
		electricity, kWh/t	258,0	0,140	
	pig-and-ore steel	pig iron	733,7	0,991	**1,400**
		scrap of pig iron	70,1	0,095	
		natural gas, m³/t	146,0	0,275	
		oxygen, m³/t	89,1	0,040	
	steel from DBSU	pig iron	856,3	1,156	**1,324**
		scrap of pig iron	10,8	0,015	
		natural gas, m³/t	53,4	0,101	
		oxygen, m³/t	116,8	0,052	
OJSC "Cherepovets Steel Mill"	converter steel	pig iron	865,3	1,168	**1,209**
		natural gas, m³/t	5,4	0,010	
		oxygen, m³/t	68,4	0,031	
	arc-furnace steel	pig iron	306,0	0,413	**0,594**
		graphite electrode	1,9	0,006	
		oxygen, m³/t	58,4	0,027	
		electricity, kWh/t	271,4	0,149	
OJSC "Novolipetsk Steel"	converter steel	pig iron	940,6	1,270	**1,296**
		oxygen, m³/t	61,1	0,026	
OJSC "West Siberian Iron and Steel Plant"	converter steel	pig iron	828,2	1,118	**1,164**
		oxygen, m³/t	62,3	0,046	
OJSC "Ashinsky metallurgical works"	scrap steel	Because of the absence of data general CO_2 emission factor from steel production by scrap technique is equal to specific CO2 emissions from production of one ton of steel at JSC "Taganrog Steel Works", as the most conservative value (see below)			**0,633**
OJSC "Amurmetall"	arc-furnace steel	graphite electrode	2,3	0,007	**0,346**
		oxygen, m³/t	46,9	0,032	

Baseline CO_2 emissions from slab steel billet production

		electricity, kWh/t	373,0	0,307	
OJSC “Chelyabinsk Metallurgical Plant”	converter steel	pig iron	935,1	1,262	**1,308**
		natural gas, m^3/t	9,5	0,018	
		oxygen, m^3/t	60,9	0,027	
	arc-furnace steel	pig iron	296,0	0,400	**0,664**
		natural gas, m^3/t	24,3	0,046	
		graphite electrode	2,9	0,009	
		oxygen, m^3/t	56,4	0,025	
		electricity, kWh/t	341,8	0,185	
OJSC «Krasny oktyabr»	arc-furnace steel	pig iron	2,8	0,004	**0,305**
		scrap of pig iron	12,4	0,017	
		graphite electrode	5,7	0,017	
		oxygen, m^3/t	28,2	0,012	
		electricity, kWh/t	511,6	0,256	
“Metallurgical Plant Petrostal” Closed JSC	scrap steel	Because of the absence of data general CO2 emission factor from steel production by scrap technique is equal to specific CO2 emissions from production of one ton of steel at JSC “Taganrog Steel Works”, as the most conservative value (see below)			**0,633**
“Metallurgical Plant “Kamasteel”, LLC	***arc-furnace steel****	graphite electrode	2,3	0,007	**0,230**
		oxygen, m^3/t	46,9	0,021	
		electricity, kWh/t	373,0	0,202	
JSC “United Metallurgical Company”	***arc-furnace steel****	graphite electrode	2,3	0,007	**0,217**
		oxygen, m^3/t	46,9	0,020	
		electricity, kWh/t	373,0	0,191	
JSC “Taganrog Steel Works”	scrap steel	pig iron	234,0	0,316	**0,633**
		natural gas, m^3/t	167,0	0,315	
		oxygen, m^3/t	5,4	0,002	

*The value of specific consumption of graphite electrodes, oxygen and electricity for arc-furnace steel technique at these metal works is taken from PDD of JI project “Production modernisation at OJSC Amurmetal, Komsomolsk-on-Amur, Khabarovsk Krai, Russian Federation”. See section C for explanation.

Integrated CO_2 emission factor for steel production at the Russian metallurgical works with capacity for production of slab steel billet

Metallurgical works	Technique of steel production (production)	Steel production, ths. tons	Share of technique	EF technique, tCO_2/t steel	EF works, tCO_2/t steel	Share of total production	EF integrated, tCO_2/t steel
		2010	2010	2010	2010	2010	2010
Russia (metallurgical works with capacity for production of slab steel billet)	**Steel-Total**	***53 144,9***					
OJSC “Magnitogorsk Iron and Steel Works”	converter steel	9 530,8	1,00	1,215	**1,215**	0,179	

Baseline CO_2 emissions from slab steel billet production

OJSC “Nizhny Tagil Iron and Steel Plant”	converter steel	3 836,0	1,00	1,488	**1,488**	0,072	
OJSC “Novokuznetsk Iron and Steel Works”	arc-furnace steel	1 311,0	1,00	0,787	**0,787**	0,025	
	arc-furnace steel	1 580,6	0,56	0,781			
OJSC “Ural Steel”	pig-and-ore steel	454,1	0,16	1,400	**1,032**	0,053	
	steel from DBSU	791,1	0,28	1,324			
OJSC “Cherepovets Steel Mill”	converter steel	9 320,9	0,84	1,209	**1,112**	0,208	
	arc-furnace steel	1 746,4	0,16	0,594			
OJSC “Novolipetsk Steel”	converter steel	9 289,1	1,00	1,296	**1,296**	0,175	**1,140**
OJSC “West Siberian Iron and Steel Plant”	converter steel	6 807,7	1,00	1,164	**1,164**	0,128	
OJSC “Ashinsky metallurgical works”	scrap steel	702,2	1,00	0,633	**0,633**	0,013	
OJSC “Amurmetall”	arc-furnace steel	730,1	1,00	0,346	**0,346**	0,014	
OJSC “Chelyabinsk Metallurgical Plant”	converter steel	3 759,6	0,73	1,308	**1,133**	0,097	
	arc-furnace steel	1 395,9	0,27	0,664			
OJSC «Krasny oktyabr»	arc-furnace steel	396,5	1,00	0,305	**0,305**	0,007	
“Metallurgical Plant Petrostal” Closed JSC	scrap steel	254,2	1,00	0,633	**0,633**	0,005	
“Metallurgical Plant “Kamasteel”, LLC	arc-furnace steel	228,8	1,00	0,230	**0,230**	0,004	
JSC “United Metallurgical Company”	arc-furnace steel	1 010,0	1,00	0,217	**0,217**	0,019	

Baseline CO_2 emissions from slab steel billet production

D.7 Emissions reduction calculation from project activity

Total project emissions from production of slab steel billet

$PE = PE_{metallurgical\ coke\_slab\_steel} + PE_{pig\ iron\_\ slab\_steel} + PE_{slab\ steel\_\ EAFP} + PE_{electricity\_slab\_steel\_EAFP} + PE_{air\ blast\_for\_pig\_iron}$ **(PDD formula D.1.1.2.-33)**

Symbol	Data variable	Unit	Symbol	Data variable	Unit
PE	Total project CO_2 emissions from production of slab steel billet	ths. tons CO_2	**$PE_{slab\ steel\_\ EAFP}$**	CO_2 emissions in EAFP from production of slab steel billet	ths. tons CO_2
$PE_{metallurgical\ coke\ \ slab\ \_steel}$	CO_2 emissions from consumption of metallurgical coke for production of slab steel billet	ths. tons CO_2	**$PE_{electricity\_\ slab\_steel\_EAFP}$**	CO_2 emissions from consumption of electricity for production of slab steel billet in EAFP	ths. tons CO_2
$PE_{pig\ iron\_\ slab\_steel}$	CO_2 emissions from consumption of pig iron for production of slab steel billet	ths. tons CO_2	**$PE_{air\ blast\_for\_pig\_iron}$**	CO_2 emissions from consumption of air blast for production of pig iron for production of slab steel billet	ths. tons CO_2

Total CO_2 emissions in the baseline

$BE = P_{slab\ steel\_EAFP\_MMK} * EF_{integrated\_Russian\ metallurgical\ plants}$ **(PDD formula D.1.1.4.-1)**

Symbol	Data variable	Unit	Symbol	Data variable	Unit
BE	Total CO_2 emissions in the baseline	ths. tons CO_2	**$P_{slab\ steel\_EAFP\_MMK}$**	Output of slab steel billet in EAFP	ths. tons
$EF_{integrated\ \ Russian\ metallurgical\ plants}$	Integrated CO_2 emission factor for steel production at the Russian metallurgical works with capacity for production of slab steel billet	t CO_2/t steel			

GHG emission reduction from the project activity

$ER_y = BE_y - PE_y$ **(PDD formula D.1.4.-1)**

Symbol	Data variable	Unit	Symbol	Data variable	Unit
ER_y	Emission reduction in the period y	tons CO_{2eq}	**PE_y**	Project emissions in the period y	ths. tons CO_2
BE_y	Baseline emissions in the period y	ths. tons CO_2			

12 months of 2008

ERUs generated in 2008 in accordance with monitoring results

#	Data variable	Unit	Jan	Feb	March	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Total for year
1	**Total project CO_2 emissions from production of slab steel billet**	**ths. tons CO_2**	**112,696**	**106,265**	**118,092**	**101,240**	**122,970**	**104,716**	**94,757**	**106,715**	**108,947**	**21,215**	**49,096**	**77,920**	**1124,628**
2	**Total CO_2 emissions in the baseline**	**ths. tons CO_2**	**162,192**	**146,990**	**163,254**	**146,251**	**166,508**	**148,543**	**147,395**	**161,743**	**156,614**	**27,815**	**58,811**	**107,850**	**1593,966**
3	**ERUs generated in 2008**	**tons CO_2eq**	**49 496**	**40 725**	**45 162**	**45 012**	**43 538**	**43 827**	**52 638**	**55 028**	**47 666**	**6 600**	**9 715**	**29 930**	**469 338**

12 months of 2009

ERUs generated in 2009 in accordance with monitoring results

#	Data variable	Unit	Jan	Feb	March	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Total for year
1	**Total project CO_2 emissions from production of slab steel billet**	**ths. tons CO_2**	**57,638**	**85,569**	**0,239**	**0,000**	**0,000**	**0,000**	**0,000**	**44,870**	**64,659**	**23,476**	**47,551**	**34,996**	**358,997**
2	**Total CO_2 emissions in the baseline**	**ths. tons CO_2**	**82,311**	**134,208**	**0,183**	**0,000**	**0,000**	**0,000**	**0,000**	**47,319**	**66,058**	**20,011**	**42,206**	**29,391**	**421,687**
3	**ERUs generated in 2009**	**tons CO_2eq**	**24 673**	**48 638**	**-56**	**0**	**0**	**0**	**0**	**2 449**	**1 399**	**-3 465**	**-5 345**	**-5 604**	**62 690**

12 months of 2010

ERUs generated in 2010 in accordance with monitoring results

#	Data variable	Unit	Jan	Feb	March	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Total for year
1	**Total project CO_2 emissions from production of slab steel billet**	**ths. tons CO_2**	**55,835**	**74,679**	**97,194**	**93,159**	**94,565**	**65,763**	**65,781**	**43,993**	**40,880**	**35,193**	**14,356**	**6,249**	**681,398**
2	**Total CO_2 emissions in the baseline**	**ths. tons CO_2**	**49,446**	**89,656**	**114,330**	**108,973**	**146,387**	**105,623**	**112,467**	**57,989**	**49,533**	**38,671**	**12,137**	**5,185**	**885,213**
3	**ERUs generated in 2010**	**tons CO_2eq**	**-6389**	**14978**	**17137**	**15813**	**51822**	**39860**	**46687**	**13996**	**8653**	**3478**	**-2219**	**-1064**	**203 815**

Appendix 1

	Color legend for calculation tables
	carbon containing flow
	data input from MMK reports
	carbon mass
0,19	carbon conent
	specific CO2 emissions
	CO2 emissions, associated with production of slab steel billet
	value fixed ex-ante
	value which requires a special note in the monitoring report (section C)

Appendix 2

List of abbreviations

BFG	Blast-furnace gas
BFP	Blast-furnace plant
BL	Blooming mill
BPCP	By-product coke plant
CCM	Continuous casting machine
CEST	Center for Energy Saving Technologies
CHPP	Combined heat power plant
CL	Central lab
COG	Coke oven gas
CPP	Central power plant
DBSU	Double-bath steelmaking unit
EAF	Electric arc furnace
EAFP	Electric arc-furnace plant
ERU	Emission reduction unit
IMP and LDW	Integrated mining-and-processing, limestone and dolomite works
IPCC	Intergovernmental Panel on Climate Change
JI	Joint Implementation
JSC	Joint stock company
LFA	Ladle-furnace aggregate
MMK	Magnitogorsk iron and steel works
MPDS	Maximum Permissible Discharge of Sewage document
MPE	Maximum Permissible Emissions
NG	Natural gas
OCP	Oxygen-converter plant
OCS	Oxygen-compressor shop
OHFP	Open-hearth furnace plant
OJSC	Open joint stock company
PNPPW	Permissible Norm of Producing and Placement of Wastes document
QMS	Quality management system
RES	Regional power system
RF	Russian Federation
SABPP	Steam-air blowing power plant
SP	Steam plant
TEE	Turbine expansion engine