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

A.1. Title of the project:

“Energy efficiency improvement under reconstruction of Oxygen shop and steel continuous casting section of Blast Oxygen Furnace shop #2 at OJSC “Novolipetsk Steel”.

Sectoral scope: 9 - Metal production.

PDD version 2.3.

22 December 2011.

A.2. Description of the project:

Open Joint-Stock Company “Novolipetsk Steel” (http://www.nlmksteel.com/) is one of the world’s largest steel producers and it produces about 15% of Russia’s steel (total steelmaking capacity is about 9.4 million tonnes of crude steel per annum). Novolipetsk Steel is a vertically integrated steel company and owns Novolipetsky Metallurgical Plant (hereinafter NLMK) and other facilities in Russia and abroad, for example: Stoilensky GOK, Altai-koks, Viz-Stal, Maxi-Group, DanSteel A/S and others[1].

NLMK is a facility of OJSC “Novolipetsk Steel”. NLMK is located in the town of Lipetsk in the European part of the Russian Federation. It is a big integrated steel-making facility with all the stages of steel production: mining, coke and by-product, blast furnace, steelmaking and rolling process. The total capacities of main products are presented in Table A.2.1.

Table A.2.1: The total capacities of main products (as of 01 January 2008)

Production area	Structure	Capacity, mln. tonnes/year
Sinter plant	Four agglomerators	14,6
Coke batteries	Four coke batteries	4,5
Pig iron	Two shops with five blast furnaces	9,6
Steel	Two basic oxygen furnace shops and nine continuous casting machines	9,5
Rolling	Hot-rolling and three cold-rolling mills	9,1
Including Hot Rolling Plant	*Hot-rolling mill 2000*	*5,4*

Source: Official NLMK website: http://www.nlmksteel.com/StandardPage____15.aspx

Also NLMK has auxiliary shops: Gas Shop (hydrogen, oxygen, nitrogen and other gases production), Fireproof Shop and etc. NLMK supplies over 40% of its main facility's energy needs through an own combined heat and power plant with 332 MW of total electricity capacity.

The project activity consists of the improvement of the energy efficiency by the implementation of two subprojects. All the proposed subprojects are implemented at NLMK. The names of subprojects are presented below:
1. Construction of new air separation plants at the Oxygen shop;

[1] Please see group structure: http://www.nlmksteel.com/StandardPage____13.aspx

2. Reconstruction of two continues casting machines No 6 and 7 at the Basic Oxygen Furnace shop No 2.

Situation existing prior to the project

Subproject 1. Construction of new air separation plants at the Oxygen shop

Before the subproject implementation the old air separation plants (ASP): No 1, 2, 6, 8-10 of the Oxygen station No 1 (OS-1) and No 11-15 of the Oxygen station No 2 (OS-2) were operated at the Oxygen shop of NLMK. These installations provided other shops of NLMK with oxygen, nitrogen, argon and inert gases.

Subproject 2. Reconstruction of two continues casting machines No 6 and 7 at the Basic Oxygen Furnace shop No 2

Before the subproject implementation the five continues casting machines (CCM) No 5-9 were operated at the Basic Oxygen Furnace shop No 2 (BOF shop No2). Four machines of them were curvilinear type design by JSC "Uralmash" (Russian Federation) and one was radial type design by company "SMS-Demag". The first of them were put into operation in 1974.

Baseline scenario

Baseline scenario is the continuation of a situation existing prior to the project. It means that an equipment of existing installations will be maintained with routine and capital repairs and operated until 2013 at least. However CCM No 8 was stopped for reconstruction in 2010 and this CCM is excluded from the project boundary. It is conservative assumption.

The technical parameters of the Oxygen shop and the CCM No 5-7 and 9 before the project implementation are presented in Section A.4.2 and Annex 2.

A JI specific approach was used for the baseline setting. Please see Section B for more detailed information.

Project scenario

Subproject 1. Construction of new air separation plants at the Oxygen shop

In 2008-2009 at Oxygen station No 1 of the Oxygen shop three new air separation plants were set in operation: one plant manufactured by Kriogenmash[2] (No 9) and two plants manufactured by Linde[3] (No 4 and 5). Old plants No 8 (nitrogen production), 6 and 9 (oxygen production) were dismantled. New ASPs use technology of oxygen and nitrogen joint production and technology of air complex purification. The second technology allows receiving products of air separation with higher extraction factor as a consequence of less compressed air consumption. Operation of new plants is possible from 70 % up to 100% of nominal productivity. That also allows reducing the compressed air consumption. It means that the lower compressed air consumption and, as result, power inputs (the electricity and steam) on its compression will be after subproject implementation. Besides, argon production is carried out by a method of rectification without use hydrogen (H_2). Therefore after subproject implementation less energy resources are consumed for oxygen, nitrogen, argon and inert gases in comparison with the baseline.

Subproject 2. Reconstruction of two continues casting machines No 6 and 7 at the Basic Oxygen Furnace shop No 2

Two new modern continues casting machine No 6 and 7 replace two old CCM No 6 and 7 at the BOF shop No 2 without the change of the shop steel casting capacity. As result of the subproject implementation the clipping and defects of slabs is decreased in comparison with the baseline. In this case the volume of

[2] http://www.cryogenmash.ru/en/

[3] http://www.linde.com/

liquid steel for slab production is decreased too. Therefore after subproject implementation less energy resources are consumed for steel (slab) production in comparison with the baseline.

Brief history of the project
The proposed projects (subprojects 1 and 2 in the PDD) were implemented in accordance with the investment programme of NLMK. All projects of the programme including proposed projects considered at NLMK in accordance with the terms of the Kyoto protocol since 2002. The main goal of the project implementation as JI to improve economic efficiency and decrease risks of the projects. However the projects realization as JI was delayed till the acceptance of National approval procedure. Finally in 2009 NLMK offered Global Carbon to consider the investment projects of the investment programme as JI. Two of them were realized as JI (#JI 0233) and approved by the involved Parties. And other two projects are subprojects 1 and 2 of the PDD.

The description of each subprojects main stages is presented below.

Subproject 1. Construction of new air separation plants at the Oxygen shop
In 2005 NLMK has concluded the contracts with LINDE-KCA-DRESDEN GmbH for the delivery of two air separate plants (NLMK's number No 4 and 5) and with OJSC "KRIOGENMASH" for the delivery of one air separate plant (NLMK's number No 9). Project Design was prepared by OJSC "Lipetsk GIPROMEZ". Construction works were realized for 2006-2008. ASPs were commissioning in period from August 2008 to March 2009.

Subproject 2. Reconstruction of two continues casting machines No 6 and 7 at the Basic Oxygen Furnace shop No 2
In the middle of 2005 NLMK has concluded the contract with Siemens VAI. Project Design was prepared by OJSC "Lipetsk GIPROMEZ". Construction works were realized during 2006-2009. The CCM No 6 was commissioning in 2008 and the CCM No 7 – in 2009.

The subprojects implementation schedules are presented in Section A.4.2 below.

A.3. Project participants:

Party involved	Legal entity project participant (as applicable)	Please, indicate if the Party involved wishes to be considered as project participant (Yes/No)
Party A: The Russian Federation (Host party)	OJSC "Novolipetsk Steel"	No
Party B: The Netherlands	Global Carbon BV	No

Role of the Project Participants:

- OJSC "Novolipetsk Steel" is one of the world's largest steel producers. It is a vertically integrated steel company and owns Novolipetsky metallurgical plant and other facilities in Russia and abroad, for example: Stoilensky GOK, Altai-koks, Viz-Stal, Maxi-Group, DanSteel A/S and others. Company will manage and fund JI project implementation at NLMK. It will own ERUs generated. OJSC "Novolipetsk Steel" is a project participant;
- Global Carbon BV is a leading expert on environmental consultancy and financial brokerage services in international greenhouse emissions trading market under Kyoto Protocol. Global Carbon BV is a

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

A.4. Technical description of the project:

A.4.1. Location of the project:

The project is located at NLMK in Lipetsk town in the Lipetsk area of the Russian Federation. The geographical location of the project is presented in Figure A.4.1.1 below.

Figure A.4.1.1: Location of the project on the Russian Federation map

A.4.1.1. Host Party(ies):

The Russian Federation.

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

Lipetsk Area is located in the European part of Russian Federation. The population of area is approximately 1.2 mln. (45^{th} place in Russia) and the surface area is approximately 24 thous.km^2 (71^{th} place in Russia).

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

Lipetsk is located within Lipetsk area and it is the capital of this area. The coordinates of the town are 52°37'N, 39°36'E. Lipetsk was founded in thirteenth century. It is the biggest town of Lipetsk area with a population of approximately 500 thousand people. Besides NLMK the big enterprise “Lipetskcement” and other facilities of consumer equipment producers (Indesit, Ariston) are located in Lipetsk.

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

The project is located at NLMK in Lipetsk town boundaries in its south-east part and has an area of approximately 25 square kilometres. NLMK business address is Lipetsk town, Metallurgists square, building 2. The coordinates of NLMK are 52°57'N, 39°62'E[4].

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

Subproject 1. Construction of new air separation plants at the Oxygen shop

The short description of Oxygen shop

Oxygen shop consists of two oxygen stations (OS): OS-1 and OS -2. And each of oxygen stations consists of three basic manufactures:

1. Air compression station (ACS),
2. Branch of air separation (ASB),
3. Branch of oxygen and nitrogen compression (ONCB).

Also into structure of Oxygen shop enters:

- Central compressor station (CCS, manufacture of compressed air),
- Station of air dewatering (ADS), in structure OS-2, and Station of dewatered air compression (DACS).

The given stations are focused on supply of other NLMK’s divisions and shops.

The main equipment and the short description of the basic manufactures of OS-1 and OS-2 are described below.

Air compression stations

Compressed air from the stations is delivered on ASPs of ASB-1 and ASB-2, accordingly, and also into the general network to other divisions and shops of NLMK.

Main equipment of the stations is not changed after subproject 1 implementation.

The main equipment of stations is shown in Table A.4.2.1.

Table A.4.2.1: The main equipment of air compression stations

ACS-1		ACS-2	
Type of compressor	**Type of motor**	**Type of compressor**	**Type of motor**
K-1500-1	Electric motor	K-1500-1	Electric motor
K-1500-2		K-1500-2	

[4] NLMK coordinates on the interactive map of Lipetsk

ACS-1		ACS-2	
Type of compressor	**Type of motor**	**Type of compressor**	**Type of motor**
K-1500-3		K-1500-3	
K-1500-4		K-1500-4	
K-1700-6		K-1500-5	
K-1700-7		K-1500-6	
K-3000-1	Steam turbine	K-1500-7	
K-3000-3		K-1500-8	
K-3000-4		K-3000-1	
K-3000-5		K-3000-2	
K-3000-6		K-3000-3	
		K-3000-4	

Branches of air separation
The main equipment of the branches is shown in Table A.4.2.2.

Table A.4.2.2: The main equipment of air separation branches

No	Before subproject 1 implementation			After subproject 1 implementation		
	Type of ASP	**Productivity, $м^3$/h**		**Type of ASP**	**Productivity, $м^3$/h**	
		O_2	**N_2**		**O_2**	**N_2**
ASB-1						
1	AKt-30 (Kriogenmash)	30,000	30,000	AKt-30 (Kriogenmash)	30,000	30,000
2	AKt-30 (Kriogenmash)	30,000	30,000	AKt-30 (Kriogenmash)	30,000	30,000
4	-	-	-	Linde	34,000	40,000
5	-	-	-	Linde	34,000	40,000
6	KTK-35-3	35,000	-	-		
8	AKt-17 (Kriogenmash)		17,000	-	-	-
9	KAr-30 (Kriogenmash)	30,000	-	AKAr-40/35 (Kriogenmash)	35,000	40,000
10	KAr-30M (Kriogenmash)	35,000	40,000	KAr-30M (Kriogenmash)	35,000	40,000
ASB-2						
11	KAr-30 (Kriogenmash)	26,000	-	KAr-30 (Kriogenmash)	26,000	-
12	KAr-30 (Kriogenmash)	26,000	-	KAr-30 (Kriogenmash)	26,000	-
13	KAr-30 (Kriogenmash)	26,000	-	KAr-30 (Kriogenmash)	26,000	-
14	KA-32 (Kriogenmash)	32,000	22,000	KA-32 (Kriogenmash)	32000	22,000
15	KA-32 (Kriogenmash)	32,000	22,000	KA-32 (Kriogenmash)	32000	22,000
	Total	**302,000**	**161,000**	**Total**	**340,000**	**264,000**

The basic products of air separation are nitrogen and oxygen of low pressure: process oxygen (95% of the oxygen content), tonnage oxygen (99.5%) and nitrogen (99.5-99.9%). Some old ASPs could produce no conditional nitrogen (less 99.5% of the nitrogen content) which was consumed for some technical process at the shops of NLMK (productivity of no conditional nitrogen production is about 20,000 m3 per hour) before and after project implementation. Therefore the total nitrogen productivity of ASPs before the subproject 1 implementation is about 181,000 m^3 of nitrogen per year (161,000 m^3 of nitrogen and 20,000 m^3 of no conditional nitrogen per year). Small part of nitrogen and oxygen is liquefied and stored in tanks and some oxygen is used for filling of cylinders at the shop. ASP No 4, 5 and 10-13 produce argon. Also new ASPs enable to take rare gases from air: krypton-xenon (a crude concentrate) and crude neon- helium mixes. However their manufacture (and power inputs on their manufacture) are insignificant and consequently is not considered in the proposed subproject.

Generated nitrogen and oxygen of low pressure from each oxygen station are gone to ONCB of corresponding oxygen station. And some oxygen is directly gone to consumers through the general networks.

Branches of oxygen and nitrogen compression
Oxygen and nitrogen are compressed at ONCBs to necessary pressure depending on consumer's needs. Main equipment of the branches is not changed after subproject 1 implementation.

Technology description
The main goal of this subproject is the replacement of old air separation plants (ASP) by new modern energy effective installations.

There are three methods of air separation: adsorptive, membranous and cryogenic. For ASP with big capacity of oxygen and nitrogen production the cryogenic method is used. New ASPs use technology of air complex purification (front-end purification unit – FERU). Earlier such technology was used in installations of small and average productivity only. And at ASPs of big productivity the air clearing was carried out by freezing out. It is explained that the technology of air complex purification was not enough made[5]. This technology is required more energy resources then technology is used at new ASPs.

Following main stages are implemented in ASP.

Preliminary cooling of air
Compressed air is preliminary cooled by cold water (SPC).

Air clearing
Impurity, such as water steam and carbonic gas leave from air by means of a so-called molecular sieve (the front-end purification units (FEPU) for ASP of type "AKAr").

Air cooling
Cleared air in the main heat exchanger is cooled to approximately -175°C at the expense of heat exchange with a stream of the cold gas made during process (FERU). Then fast dump of pressure forces compressed air to be cooled further (TECU).

Air separation
Separation of air into pure oxygen and pure nitrogen occurs in columns, average pressure and low pressure. Separation process becomes possible thanks to various boiling points of components of air. Oxygen turns to a liquid at -183°C and nitrogen at -196°C. Argon separates in additional columns (HE No 1-7).

Selection and storage
Gaseous oxygen and nitrogen arrive in pipelines for transportation to the end user. In the liquid form oxygen, nitrogen and argon remain in special tanks.

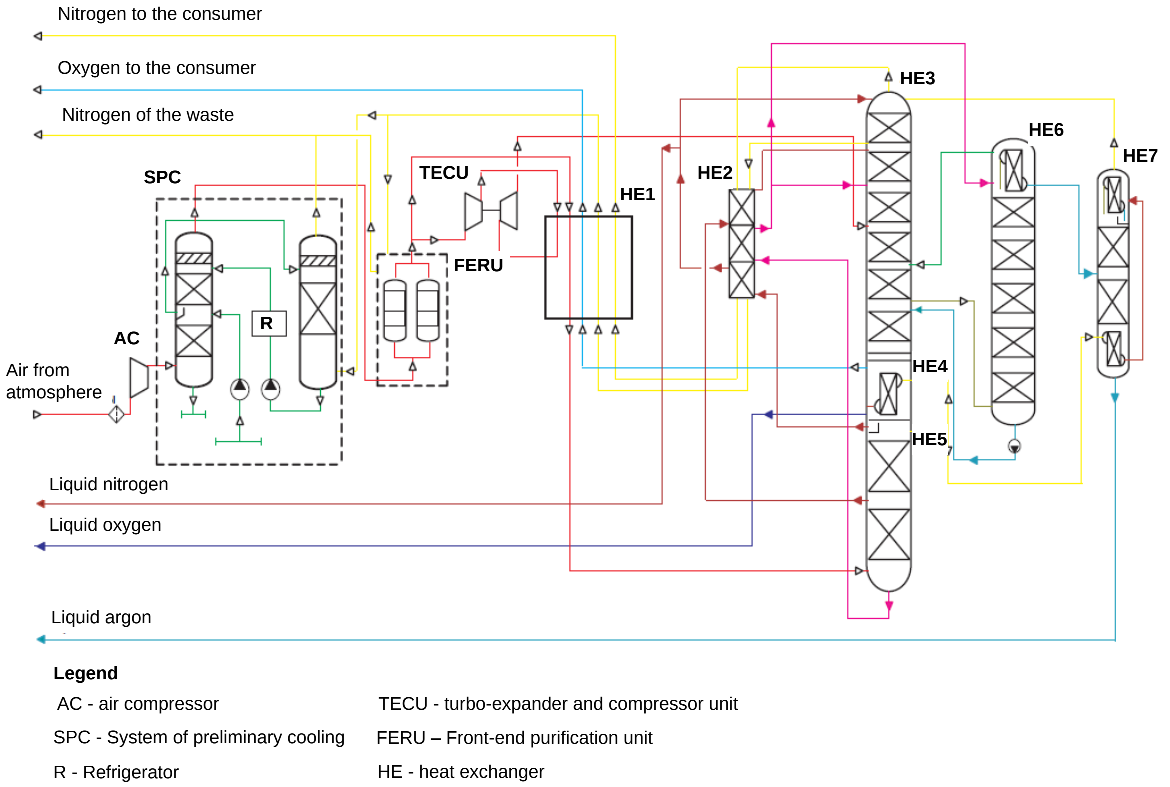
The main difference of new ASPs from old installations is the maximum reliability and safe operation with higher factor of air separation products. Also in new ASPs the technology of combined oxygen and nitrogen production is used instead old ASPs for separate oxygen and nitrogen production. It means that less compressed air is used and electricity and steam consumption for compressed air production is

[5] Front-End Purification Units for Air Separation Plants Madding by JSC "CRYOGENMASH", Y. Blaznin, V. Gorokhov, V. Golubev, Technical gases No 4, 2009

decreased. Besides, argon production is carried out by a method of rectification without use hydrogen (H_2). Thereby after subproject implementation the electricity, steam and hydrogen consumption for the manufacture of air separation products are decrease significantly.

For example, the ASP scheme of type "AKAr" produced by OJSC "CRYOGENMASH" is shown on Figure A.4.2.1:

Figure A.4.2.1: The ASP scheme of type "AKAr" produced by OJSC "CRYOGENMASH"



Source: http://www.cryogenmash.ru/upload/catalog_cryogenmash_2008.pdf

The technical parameters of new ASPs are presented in Table A.4.2.3.

Table A.4.2.3: Technical parameters of the new ASPs

N	Parameter	Unit	Value	
			ASP No 4 and 5	ASP No 9
1	Quantity of processed air	m^3/h	174,000	180,000
2	Oxygen production (gas)	m^3/h	34,000	34,000
3	Nitrogen production (gas)	m^3/h	40,000	40,000
4	Oxygen production (liquid)	m^3/h	600	600
5	Nitrogen production (liquid)	m^3/h	200	200
6	Argon (liquid)	m^3/h	1000	1000

Source: Data provided by NLMK

The dates of subproject 1 implementation main stages are presented in Table A.4.2.4.

Table A.4.2.4: The dates of subproject 1 implementation main stages

N	Stage	ASI No4	ASI No5	ASI No9
1	Engineering	2005-2006	2005-2006	2005-2006
2	Delivery and construction works	2005-2008	2005-2008	2005-2008
3	Starting-up works	June –March 2009	July-August 2008	May-August 2008
4	Commissioning	31 March 2009[6]	11 August 2008[7]	04 August 2008[8]

Source: Data provided by NLMK

Subproject 2. Reconstruction of two continues casting machines No 6 and 7 at the Basic Oxygen Furnace shop No 2
The main goals of this subproject are:
- Increase of the productivity of CCMs without shop productivity growth;
- Reduction of the technological clippings;
- Pollution reduction;
- Expeditious implementation of customer orders due to rapid adjustment of CCMs;

Technology of steel casting after the subproject implementation is not changed. The description of technology is given below.

Continuous casting machine
The process of steel casting in CCM starts in the ladle furnace. After refining in the ladle furnace, the ladle is transported to the top of the casting machine (please see Figure A4.2.2). The hot metal from the ladle is transferred via a refractory shroud (pipe) to a holding bath called a tundish (an intermediate ladle). The tundish constantly feeds the casting machine with metal thus acting as a buffer of hot metal, and smoothing metal outflow, regulating metal feed to the molds and cleaning the metal. Then the metal passes through the shroud into the top of an open-base copper mold.

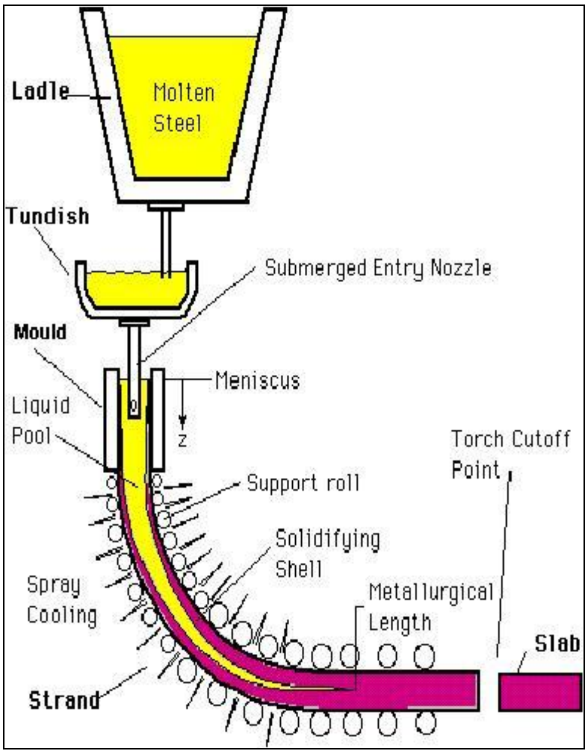
The mold is water-cooled and oscillates vertically to prevent the metal sticking to the mold walls. A thin shell of metal (called strand) starts solidifying at the mold walls, exits the base of the mold into a spray-chamber. The bulk of metal within the walls is still molten. To increase the solidification rate, the strand is also sprayed with large amounts of water as it passes through the spray-chamber. Final solidification of the strand takes place after the spray-chamber. Then the strand passes through straightening rolls and withdrawal rolls. Finally, it is cut into predetermined lengths. The cut strands are called blooms. The blooms are directed in a mill or customers.

[6] Act of an object commissioning No 972 dated 31 March 2009

[7] Act of an object commissioning No 964 dated 11 August 2008

[8] Act of an object commissioning No 963 dated 04 August 2008

Figure A4.2.2: Continuous casting machine



Source: http://www.metsoc.org/virtualtour/processes/steel/Casters.asp.

For improvement of technical process the new modern effective equipment is used in new CCMs. It includes the installation of:

- Supporting system from multibasic rollers of small diameter with minimum possible step,
- System dynamic "soft" compression slabs during casting,
- Regulation of cooler expenses on secondary cooling in a wide range,
- Rectilinear mold with the copper plates covered with nickel for decrease of cracks quantity,
- Rectilinear vertical part of a technological line for minimization of nonmetallic inclusions,
- The device for an exception of slag hit in the tundish,
- The device of fast replacement of the submerged nozzle,
- Automatic maintenance of stable level of metal in the tundish and the mold,
- The hydraulic tilting mechanism of the mold for improvement of slabs surface quality,
- System of timely recognition of breaks.

The technical parameters of the CCMs are presented in Table A.4.2.5.

Table A.4.2.5: Technical parameters of new CCM

N	Parameter	Unit	Value
1	Capacity (total)	tonnes of steel/year	2,000,000
2	Volume of the casting ladle	tonnes of steel	335
3	Casting rate	Metres/ minute of time	0.1-2.0

Source: Data provided by NLMK

The dates of subproject 2 main stages of implementation are presented in Table A.4.2.6.

Table A.4.2.6: The dates of subproject 2 implementation main stages

N	Stage	CCM No6	CCM No7
1	Engineering	2005 – 2006	2005 – 2007
2	Manufacturing/delivery	2005 – 2007	2005 – 2008
3	Construction works	2006 – 2008	2008 – 2009
4	Starting-up works	January 2008– April 2008	March 2009– July 2009
5	Commissioning	04 February 2008[9]	14 August 2009[10]

Source: Data provided by NLMK

The specialists of new equipment suppliers conducted the NLMK personnel (engineers, operations and maintenance personnel) trainings during starting-up works at project site and at the operated installations of equipment manufacturers (Siemens and Linde) in Germany. Existing staff advance in skill in the Corporative training centre of NLMK and in other organizations. NLMK has ISO 9001:2000 certificate. Also Global Carbon BV will provide a staff training on monitoring procedures, ERU calculation and preparation of annual monitoring report.

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

There are not any national and/or sectoral legislative acts and circumstances which require NLMK to implement the project. The proposed project was implemented for the steam, electricity and raw materials consumption reduction and associated with them the CO_2 emission reduction. It means that the operating costs are decreased. However the project (subprojects) does not look financially attractive as it is proved in Section B.2 through the application of the appropriate investment analysis as per the approved CDM "Tool for demonstration and assessment of additionality" (version 05.2). The IRR of each subproject is less than appropriate IRR benchmark. For more detailed information on baseline setting and additionality, please refer to Section B.

Therefore if the project is not implemented, more greenhouse gases (GHG) will be emitted. The briefly explanation how GHG emission reductions are to be achieved and the estimation of anticipated total reductions for each of subproject are presented below.

Subproject 1. Construction of new air separation plants at the Oxygen shop

After subproject implementation the specific compressed air consumption is reduced from 4.85 to 4.34 (m^3/m^3 of process oxygen equivalent)[11]. It means that in project scenario the emissions associated with electricity and steam consumption for compressed air production are less than in the baseline. Electricity and steam savings are approximately 73,100 MWh per year and 704,500 GJ per year, respectively. Total emission reduction is more than 227,600 tonnes of CO_2 per year (for emission factors of electricity and steam consumption are 1.184 tCO_2/MWh and 0.193 tCO_2/GJ, respectively, in 2010).

[9] Act of an object commissioning No 628 dated 04 February 2008

[10] Act of an object commissioning No 622 (date of completion of construction work is 14 August 2008)

[11] Based on an actual data before and after subproject implementation

Subproject 2. Reconstruction of two continues casting machines No 6 and 7 at the Basic Oxygen Furnace shop No 2

After subproject implementation the specific waste of steel was reduced from 14.04 kg per tonne of steel to 10.4 kg per tonne of steel in 2010[12]. It means that in project scenario annual production of BOF steel is less than in baseline scenario for about 18,000 tonnes. Thereby emission reduction is more than 26,000 tonnes of CO_2 per year (IPCC default emission factor for BOF steel production is 1.46 tCO_2 per tonne of steel).

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

	Years
Length of the crediting period	4.916
Year	Estimate of annual emission reductions in tonnes of CO_2 equivalent
2008	83,546
2009	218,689
2010	185,842
2011	329,467
2012	329,467
Total estimated emission reductions over the crediting period (tonnes of CO_2 equivalent)	1,147,011
Annual average of estimated emission reductions over the crediting period (tonnes of CO_2 equivalent)	233,290

	Years
Period after 2012, for which emission reductions are estimated	8
Year	Estimate of annual emission reductions in tonnes of CO_2 equivalent
2013	329,467
2014	329,467
2015	329,467
2016	329,467
2017	329,467
2018	329,467
2019	329,467
2020	329,467
Total estimated emission reductions over the period indicated (tonnes of CO_2 equivalent)	2,635,732

Detailed calculation of project emission reductions is presented in Section E.

A.5. Project approval by the Parties involved:

At the moment of this JI project implementation, procedures for carrying out Joint Implementation projects in the Russian Federation were adopted by the Russian Governement's Regulation dated October 15, 2011, No.780. According to this Resolution the PDD will have gone through the preliminary

[12] Based on an actual data before and after subproject implementation

determination process, the PDD, an Expert Opinion and other related documents will be submitted to OJSC “Sberbank of Russia” for project approval procedure as a JI Project.

The request for the project approval to the Agency of Ministry of Economic Affairs of the Netherlands was sent in October 2011.

SECTION B. Baseline

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

A baseline for the JI project has to be set in accordance with Appendix B to decision 9/CMP.1 (JI guidelines)[13], and with further guidance on baseline setting and monitoring developed by the Joint Implementation Supervisory Committee (JISC). In accordance with the Guidance on Criteria for Baseline Setting and Monitoring (version 3)[14] (hereinafter referred to as Guidance), the baseline for a JI project is the scenario that reasonably represents the anthropogenic emissions by sources or anthropogenic removals by sinks of GHGs that would occur in **the absence of the proposed project**. In accordance with the Paragraph 9 of the Guidance the project participants may select either: an approach for baseline setting and monitoring developed in accordance with appendix B of the JI guidelines (JI specific approach); or a methodology for baseline setting and monitoring approved by the Executive Board of the clean development mechanism (CDM), including methodologies for small-scale project activities, as appropriate, in accordance with paragraph 4(a) of decision 10/CMP.1, as well as methodologies for afforestation/reforestation project activities. Paragraph 11 of the Guidance allows project participants that select a JI specific approach to use selected elements or combinations of approved CDM baseline and monitoring methodologies or approved CDM methodological tools, as appropriate.

Description and justification of the baseline chosen is provided below in accordance with the "Guidelines for users of the Joint Implementation Project Design Document Form", version 04[15], using the following step-wise approach:

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

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

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

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

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

The project started in 2005. The following key factors were considered for baseline:

a) **Sectoral reform policies and legislation.** The Russian metal market is free market and the internal and foreign demands of metal develop requires for a quality and sort of metal. The main development goal of the metallurgical industry is reducing of domestic metal demand.[16] NLMK does not have any

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

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

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

[16] http://www.minprom.gov.ru/activity/metal/strateg/2

obligations for construction of new production capacity. However any project must be approved by a local administration (permission for construction) and by a local conservancy. Also the most of metallurgical plants in Russia are large enterprises. Therefore they are important for region, area or town where they are located, especially, in a social aspect: workplaces, working conditions, environmental impact and etc**;**

b) **Economic situation/growth and socio-demographic factors in the relevant sector as well as resulting predicted demand. Suppressed and/or increasing demand that will be met by the project can be considered in the baseline as appropriate (e.g. by assuming that the same level of service as in the project scenario would be offered in the baseline scenario)**. This key factor is not affect to the baseline because the possible growth of production in the project scenario is not considered for proposed project (please see relevant assumptions in section B.1);

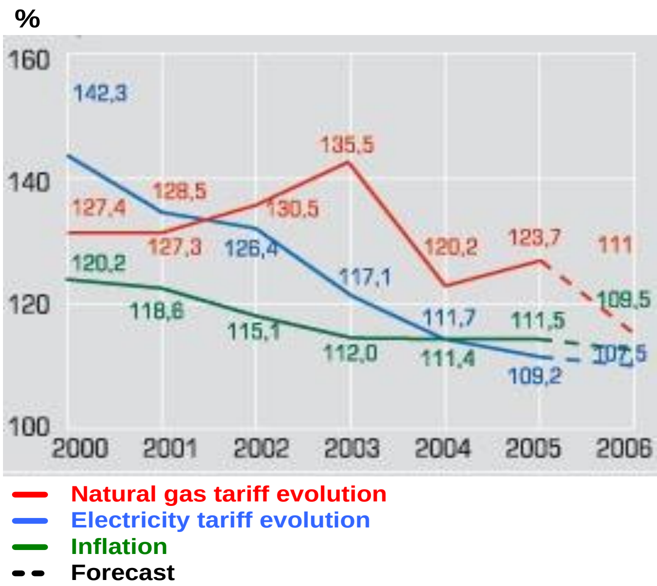
c) **Availability of capital (including investment barriers).** NLMK has a good credit history and an invested capital was availed for the project;

d) **Local availability of technologies/techniques, skills and know-how and availability of best available technologies/techniques in the future.** All technologies applied in the proposed project were well known and available. Some local and foreign companies could provide technology and equipment and implement project and construction works for the project implementation;

e) **Fuel prices and availability**. In the result of project implementation the following energy resources are reduced:
   a. Electricity and steam consumption for subproject 1;
   b. Electricity, natural gas, coke and ore (for steel production) for subproject 2.

Electricity and natural gas are widely used and available in the Central region of Russia and they are produced domestically. The natural gas and electricity prices were regulated by the Russian Government in 2005. In Russia they were lower than world market price. In 2005 for NLMK the tariff of natural gas was approximately 38 EUR/1000 m^3, the tariff of electricity was about 27 EUR/MWh. Before 2004 the annual growth of tariffs was 17-25% a year (it also includes inflation). After 2005 the growth of tariffs had to decrease down to 7-10% (please see Figure B.1.1).

Figure B.1.1: Inflation and tariffs of electricity and natural gas evolution



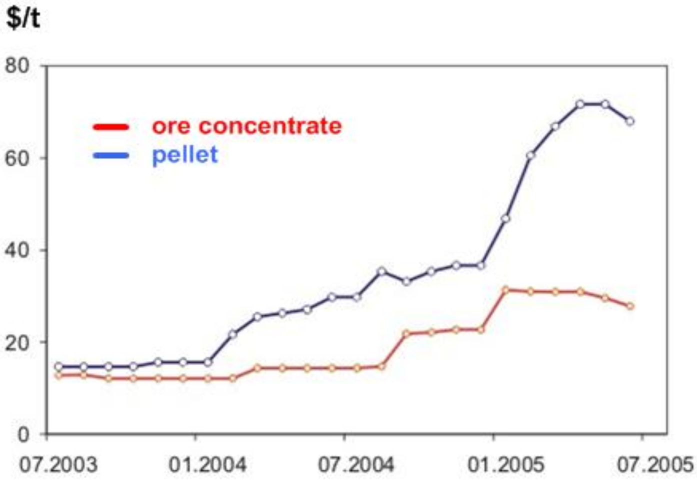
Source: Expert-Ural[17]

[17] "It is dawning", Expert-Ural, #6, 13 February 2006

However, the forecast proved for 2006 is wrong. In 2006 the annual growth of natural gas tariff was about 16.4% and one of electricity tariff was 10.3%[18].

NLMK has associated company OJSC "Stoykensky GOK" which produces ore concentrate for NLMK. Ore concentrate price evolution in 2003-2005 is presented in Figure B.1.2 below.

Figure B.1.2: Ore concentrate and pellet prices evolution in 2003-2005

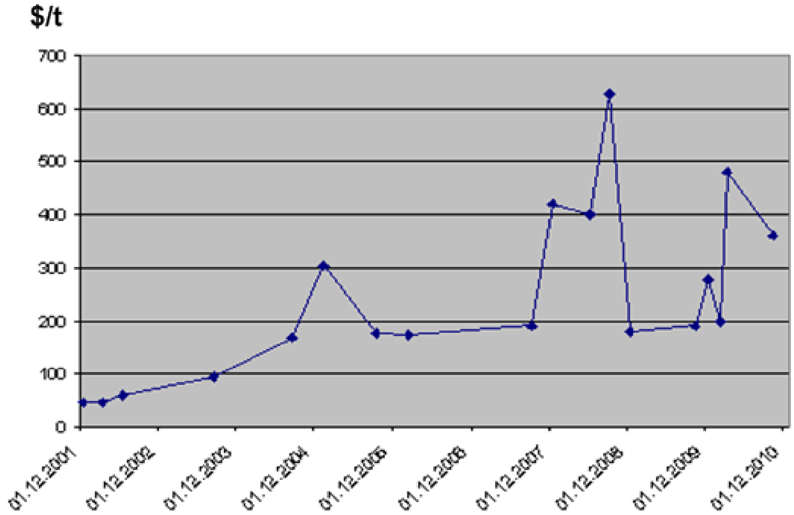


Source: National metallurgy[19]

It reached up to 200 $/tonne at the beginning of 2008 and down to 70 $/tonne at the end of 2008.

Other important energy resource for steel production is a coke. In 2005 NLMK has the coke shop and bought a coke from the other manufacturers[20]. Coke price evolution is presented in Figure B.1.3.

Figure B.1.3: Coke price evolution



Source: Institute ITKOR[21]*, INP of the Russian Academy of Sciences*[22]*, MetalTorg*[23]*, Metallurgical bulletin*[24]

[18] Annual report of OJSC "RAO UES of Russia", 2007

[19] "Raw materials market", National metallurgy, 2005

[20] OJSC "Altaykoks" (manufacturer of coke) has entered into Holding of NLMK in 2006

Therefore there were not any reliable forecasts of main parameters of proposed project in 2005.

Conclusion
Only economic factors (prices and credit rate) affect the baseline.

The baselines for each of subproject will be the most plausible scenario on the basis of conservative assumptions and key factors described above. And uncertainties will be taken into account.

Step 2. Application of the approach chosen
The basic principle applied is that the oxygen and nitrogen (subproject 1) and steel production (subproject 2) are identical in the project and the baseline scenario.

The following general conservative assumptions were used for both the subproject 1 and 2:
1. ERUs cannot be earned for decreases in activity levels outside the project activity or due to force majeure as emission factors based on specific production are used (e.g. MWh/1000 m^3 of POE[25]);
2. Information can be taken from the international publicly available sources and is referenced.

The description of the plausible scenarios and used conservative assumptions and uncertainties for each subprojects are presented below.

Subproject 1. Construction of new air separation plants at the Oxygen shop
There are three methods of air separation: adsorptive, membranous and cryogenic. For ASP with big capacity of oxygen and nitrogen production the cryogenic method is used. Old and new ASPs at NLMK are used this method for air separation. The aim of the proposed project reduces the energy resources consumption due to the replacement of old ASPs operation (including the dismantling of some old ASPs) by new ASPs with the use of new technology of air complex purification (also please see Sections A.2 and A.4.2). The old ASPs could be reconstructed using this technology however the investment costs for construction of new ASP and for reconstruction of old ASP are same so the second option was not considered before the project implementation. Therefore the two plausible scenarios were only at that time:
- Continuation of a situation existing prior to the project;
- Construction of new air separation plants at the Oxygen shop No 4, 5 and 9.

These scenarios are described below in more detail.

1) Continuation of a situation existing prior to the project (the Oxygen shop is operated without any reconstruction)

The existing ASPs before the proposed project implementation are maintained at regular intervals and larger repairs. These ASPs caver the oxygen and nitrogen demand at NLMK. And the ASPs consume the compressed air, electricity and steam according to its technical parameters (based on data for 2006-2007) using the assumptions presented below. There are no legal or other requirements that enforce NLMK to

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21 "Russian coke market", Institute ITKOR, 2003

22 Metallurgy and economic growth in Russia, INP of the RAS, 2005

23 What does coke promise metallurgists, MetalTorg Trade System, 2005

24 Metallurgical bulletin, 2010

25 POE is the process oxygen equivalent

stop or to reconstruct plants (the old ASPs are operated so far). And the additional investment is not required for this scenario. Thus, scenario 1 is feasible and plausible.

2) Construction of new air separation plants at the Oxygen shop No 4, 5 and 9

The completed reconstruction of new ASPs as described in Section A.4.2 is realized. The new ASPs replace oxygen and nitrogen production at old ASPs (including dismantled ASPs No 6, 8 and 9). As result of project implementation the electricity and steam consumption are reduced for oxygen and other gases production. However, as is shown in Section B.2 this scenario is not economically attractive. Therefore it is not the most plausible scenario.

Conclusions

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

For subproject 1 the following conservative assumptions, including avoiding any uncertainties of the emissions calculation were used:

1. Emission factors of electricity and steam consumption are calculated based on the actual data (formulae 7-10 in Section D.1.1.2) and used for both the project and baseline emissions calculation (formula 5 in Section D.1.1.2 and formula 18 in Section D.1.1.4, respectively);
2. The fuel consumption for blowing production is excluded form the definition of emission factors for electricity and heat generation at NLMK CHPP (formulae 8 and 13 in Section D.1.1.2);
3. As indicated in Section A.4.2 some of compressed air volume produced at ACSs is delivered into NLMK network (not on ASBs). Therefore the specific electricity and steam consumption of compressed air production (MWh and GJ per m^3 of compressed air consumption at ASBs) are used for calculation of electricity and steam consumption at ASBs. These parameters are defined based on the actual data including the total compressed air production at ACS-1 or ACS-2 (formula 6 in Section D.1.1.2) and used for both the project and baseline emissions calculation (formula 5 in Section D.1.1.2 and formula 23 in Section D.1.1.4, respectively);
4. As indicated in Section A.4.2 the configuration of ASB-1 and volume of the process and tonnage oxygen gases were changed therefore the term of process oxygen equivalent (POE) is used for correct definition of baseline parameters. The volume of produced gases in POE is calculated based on the conversion factors for each gas of air separation (formula 23 in Section D.1.1.4). These conversion factors were defined based on “The methodology for accounting of expenses and calculating the cost of products in the integrated production of air separation”[26] and approved by Director of the NLMK TEK in 2002 (also please see Annex 2);
5. The volumes of argon and rare gases production do not use for definition of the volume of produced gases in POE (formula 20 in Section D.1.1.4) in the baseline;
6. As indicated in Section A.4.2 the hydrogen consumption at ASBs is decreased in the project in comparison with the baseline. However the energy resources consumption for hydrogen production do not take into account in the baseline emission calculation;
7. Other specific parameters in the baseline are defined based on historical data (please see Annex 2 of the PDD):
    - the average values of the specific compressed air consumption at ASB-1 and ASB-2,
    - the specific electricity consumption at ASB-1 and ASB-2,
    - the specific steam consumption at ASB-1 and ASB-2

   and used for definition of these parameters in the baseline (formulae 25, 19 and 28, respectively);

[26] “The methodology for Accounting of Expenses and Calculating the Cost of Products in the Integrated Production of Air Separation”, Scientific-Research Institute of Technical-Economic Research, 1975

8. The total productivity of oxygen and nitrogen (please see Section A.4.2) before the project implementation (in the baseline) are:

- 114,000 m^3 of process oxygen per hour (total productivity of ASPs No 1 and 2, old ASP No 9 and 24,000 at old ASP No 6) or 968,681 thousand m^3 of process oxygen per year (114,000 × 8760 (hours per year) × 0.97 (runtime factor));
- 188,000 m^3 of tonnage oxygen per hour (total productivity of other ASPs) or 1,597,474 thousand m^3 of tonnage oxygen per year (188,000 × 8760 × 0.97);
- 181,000 m^3 of nitrogen per hour or 1,537,993 thousand m^3 of process oxygen per year (181,000 × 8760 × 0.97).

And maximum total air separation gases production in the baseline in POE (according formula 2 in Section D.1.1.2) is 3,446,031 thousand m^3 of POE. It is benchmark value.

However the total productivity of the ASPs (Table A.4.2.3) in the project scenario is more than in the baseline. At the time the Guidance requests that "by assuming that the same level of service as in the project scenario would be offered in the baseline scenario". Therefore for project and baseline emissions calculation the all measured parameters are adjusted to the benchmark value using the coefficient of reduction for subproject 1 ('k_1", please see formula 1 in Section D.1.1.2) in the relevant formulae in Section D.1.1.2 and Section D.1.1.4. When the total air separation gases production in project scenario is less than benchmark value the $k_1 = 1$.

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

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

Data/Parameter	$EF_{ELaver,y}$
Data unit	tCO_2/MWh
Description	Weighted average CO_2 emission factor for electricity consumption in year *y*
Time of determination/monitoring	Monitored during the crediting period
Source of data (to be) use	NLMK data
Value of data applied (for ex ante calculations/determinations)	1.112– for 2008, 1.219 – for 2009, 1.184 – for 2010-2012
Justification of the choice of data or description of measurement methods and procedures (to be) applied	It is calculated according to formula 7
OA/QC procedures (to be) applied	-
Any comment	-

Data/Parameter	PO_y
Data unit	1000 m^3 of process oxygen
Description	Process oxygen production at the Oxygen shop in year *y*
Time of determination/monitoring	Monitored during the crediting period
Source of data (to be) use	NLMK data
Value of data applied (for ex ante	241,783 – for 2008, 938,962 – for 2009,

calculations/determinations)	1,073,944 – for 2010-2012
Justification of the choice of data or description of measurement methods and procedures (to be) applied	It is measured by standardized flow meters
OA/QC procedures (to be) applied	It is ordinary procedure of NLMK. Please see Table D.2 for more detail information
Any comment	-

Data/Parameter	$KOEF_{PO}$
Data unit	m^3 of POE / m^3 of process oxygen
Description	Conversion factor from the m^3 of process oxygen to the POE[27]
Time of determination/monitoring	Fixed ex-ante during determination
Source of data (to be) use	NLMK data
Value of data applied (for ex ante calculations/determinations)	1.0
Justification of the choice of data or description of measurement methods and procedures (to be) applied	It is defined according to "The methodology for accounting of expenses and calculating the cost of products in the integrated production of air separation"[28] and approved by Director of the NLMK TEK in 2002
OA/QC procedures (to be) applied	-
Any comment	Please see Annex 2

Data/Parameter	TO_y
Data unit	1000 m^3 of tonnage oxygen
Description	Tonnage oxygen production at the Oxygen shop in year *y*
Time of determination/monitoring	Monitored during the crediting period
Source of data (to be) use	NLMK data
Value of data applied (for ex ante calculations/determinations)	303,352 – for 2008, 651,567 – for 2009, 697,824 – for 2010-2012
Justification of the choice of data or description of measurement methods and procedures (to be) applied	It is measured by standardized flow meters
OA/QC procedures (to be) applied	It is ordinary procedure of NLMK. Please see Table D.2 for more detail information
Any comment	-

Data/Parameter	$KOEF_{TO}$
Data unit	m^3 of POE / m^3 of tonnage oxygen

[27] POE is the process oxygen equivalent. Please see Annex 2.

[28] "The methodology for Accounting of Expenses and Calculating the Cost of Products in the Integrated Production of Air Separation", Scientific-Research Institute of Technical-Economic Research, 1975

Description	Conversion factor from the m^3 of tonnage oxygen to the POE
Time of determination/monitoring	Fixed ex-ante during determination
Source of data (to be) use	NLMK data
Value of data applied (for ex ante calculations/determinations)	1.64
Justification of the choice of data or description of measurement methods and procedures (to be) applied	It is defined according to "The methodology for accounting of expenses and calculating the cost of products in the integrated production of air separation" and approved by Director of the NLMK TEK in 2002
OA/QC procedures (to be) applied	-
Any comment	Please see Annex 2

Data/Parameter	N_y
Data unit	1000 m^3 of nitrogen
Description	Nitrogen production at the Oxygen shop in year *y*
Time of determination/monitoring	Monitored during the crediting period
Source of data (to be) use	NLMK data
Value of data applied (for ex ante calculations/determinations)	469,917 – for 2008, 1,447,214 – for 2009, 1,388,458 – for 2010-2012
Justification of the choice of data or description of measurement methods and procedures (to be) applied	It is measured by standardized flow meters
OA/QC procedures (to be) applied	It is ordinary procedure of NLMK. Please see Table D.2 for more detail information
Any comment	-

Data/Parameter	$KOEF_N$
Data unit	m^3 of POE / m^3 of nitrogen
Description	Conversion factor from the m^3 of nitrogen to the POE
Time of determination/monitoring	Fixed ex-ante during determination
Source of data (to be) use	NLMK data
Value of data applied (for ex ante calculations/determinations)	0.169
Justification of the choice of data or description of measurement methods and procedures (to be) applied	It is defined according to "The methodology for accounting of expenses and calculating the cost of products in the integrated production of air separation" and approved by Director of the NLMK TEK in 2002
OA/QC procedures (to be) applied	-
Any comment	Please see Annex 2

Data/Parameter	$BSEC_{ASB}$
Data unit	MWh/1000 m^3 of POE
Description	Baseline specific electricity consumption at ASB-1 and ASB-2
Time of determination/monitoring	Fixed ex-ante during determination
Source of data (to be) use	NLMK records
Value of data applied (for ex ante calculations/determinations)	0.0072
Justification of the choice of data or description of measurement methods and procedures (to be) applied	This parameter is used for definition of the electricity consumption at ASB-1 and ASB-2 in baseline and it was calculated based on historical data as average value for 2006-2007
OA/QC procedures (to be) applied	-
Any comment	Please see Annex 2

Data/Parameter	$PSEC_{ACS\_i,y}$
Data unit	MWh/1000 m^3 of compressed air
Description	Specific electricity consumption for air compression at the ACS-1 or ACS-2 in the year *y*
Time of determination/monitoring	Monitored during the crediting period
Source of data (to be) use	NLMK data
Value of data applied (for ex ante calculations/determinations)	ACS-1: 0.020 – for 2008, 0.012 – for 2009, 0.010 – for 2010 0.011 – for 2011-2012 ACS-2: 0.095 – for 2008, 0.094 – for 2009, 0.094 – for 2010-2012
Justification of the choice of data or description of measurement methods and procedures (to be) applied	It is calculated according to formula 6
OA/QC procedures (to be) applied	-
Any comment	-

Data/Parameter	*BSCAC*
Data unit	m^3 of compressed air/ m^3 of POE
Description	Baseline specific compressed air consumption at the Oxygen shop for air separation
Time of determination/monitoring	Fixed ex-ante during determination
Source of data (to be) use	NLMK records
Value of data applied (for ex ante	4.846

calculations/determinations)	
Justification of the choice of data or description of measurement methods and procedures (to be) applied	This parameter is used for definition of the compressed air consumption at the Oxygen shop for air separation in baseline and it was calculated based on historical data as average value for 2006-2007.
OA/QC procedures (to be) applied	-
Any comment	Please see Annex 2

Data/Parameter	$PCAC_{ASB\_i,y}$
Data unit	1000 m^3
Description	Compressed air consumption at ASPs of ASB-1 or ASB-2 in year *y*
Time of determination/monitoring	Monitored during the crediting period
Source of data (to be) use	NLMK data
Value of data applied (for ex ante calculations/determinations)	ASPs of ASB-1: 1,986,321 – for 2008, 5,287,623 – for 2009, 5,095,720 – for 2010 5,548,663 – for 2010-2012 ASPs of ASB-2: 1,563,394 – for 2008, 4,467,614 – for 2009, 5,880,685 – for 2010 5,082,017 – for 2010-2012
Justification of the choice of data or description of measurement methods and procedures (to be) applied	It is measured by standardized flow meters
OA/QC procedures (to be) applied	It is ordinary procedure of NLMK. Please see Table D.2 for more detail information
Any comment	-

Data/Parameter	$PCAO_{NW\_i,y}$
Data unit	1000 m^3
Description	Compressed air output into the network of NLMK from ACS-1 or ACS-2 in year *y*
Time of determination/monitoring	Monitored during the crediting period
Source of data (to be) use	NLMK data
Value of data applied (for ex ante calculations/determinations)	ACS-1: 180,141 – for 2008, 503,889 – for 2009, 596,150 – for 2010-2012 ACS-2: 404,729 – for 2008, 849,449 – for 2009, 826,258 – for 2010-2012
Justification of the choice of data or description of	It is measured by standardized flow meters

measurement methods and procedures (to be) applied	
OA/QC procedures (to be) applied	It is ordinary procedure of NLMK. Please see Table D.2 for more detail information
Any comment	-

Data/Parameter	$EF_{steam,y}$
Data unit	tCO_2/GJ
Description	CO_2 emission factor for steam (heat) consumption
Time of determination/monitoring	Monitored during the crediting period
Source of data (to be) use	NLMK data
Value of data applied (for ex ante calculations/determinations)	0.176 – for 2008, 0.192– for 2009, 0.193 – for 2010-2012
Justification of the choice of data or description of measurement methods and procedures (to be) applied	It is calculated according to formula 13
OA/QC procedures (to be) applied	-
Any comment	-

Data/Parameter	$BSSC_{ASB}$
Data unit	GJ/1000 m^3 of POE
Description	Baseline specific steam consumption at ASB-1 and ASB-2
Time of determination/monitoring	Fixed ex-ante during determination
Source of data (to be) use	NLMK records
Value of data applied (for ex ante calculations/determinations)	0.138
Justification of the choice of data or description of measurement methods and procedures (to be) applied	This parameter is used for definition of the steam consumption at ASB-1 and ASB-2 in baseline and it was calculated based on historical data as average value for 2006-2007
OA/QC procedures (to be) applied	-
Any comment	Please see Annex 2

Data/Parameter	$PSSC_{ACS\_1y}$
Data unit	GJ/1000 m^3
Description	Specific steam consumption for air compression at the ACS-1 in the year *y*
Time of determination/monitoring	Monitored during the crediting period
Source of data (to be) use	NLMK data
Value of data applied (for ex ante	1.060 – for 2008, 1.153 – for 2009,

calculations/determinations)	1.200 – for 2010 1.177 – for 2010-2012
Justification of the choice of data or description of measurement methods and procedures (to be) applied	It is calculated according to formula 12
OA/QC procedures (to be) applied	-
Any comment	-

Subproject 2. Reconstruction of two continues casting machines No 6 and 7 at the Basic Oxygen Furnace shop No 2

There are two ways of casting steel: in the mold and the continuous casting of steel.

The continuous casting of steel is more effective technology and the casting of steel into molds was not considered as possible technology for reconstruction of the casting steel shop.

Therefore the plausible future scenarios of subproject 2 are following:
Scenario 1: Continuation of a situation existing prior to the project;
Scenario 2: Reconstruction of two continues casting machines No 6 and 7 at the Basic Oxygen Furnace shop No 2.

These scenarios are described below in more detail.

1) Continuation of a situation existing prior to the project (the BOF shop No 2 is operated without any reconstruction)

Liquid steel from the base oxygen furnaces of BOF shop No 2 is poured at old continues casting machines including two old CCMs No 6 and 7, but excluding CCM No 8. Waste of steel is about 14.04%. It corresponds to the annual average value before the project implementation (2005-2007). All equipment is maintained with routine and capital repairs and they will be operated further without any constraints. There are no legal or other requirements that enforce NLMK to stop or to reconstruct the furnaces. And the additional investment is not required for this scenario. Thus, scenario 1 is feasible and plausible.

2) Reconstruction of two continues casting machines No 6 and 7 at the Basic Oxygen Furnace shop No 2.

The completed reconstruction of new CCMs as described in Section A.4.2 is realized. The steel output from CCMs is not changed. However the steel waste after project implementation is reduced from 14.04 to 10.4% and quality of steel became higher. As result the liquid steel and energy resources consumption for liquid steel production are reduced too. However, as is shown in Section B.2 this scenario is not economically attractive. Therefore it is a not the most plausible scenario.

Conclusions

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

For subproject 2 the IPCC default value of emission factor for BOF steel production (1.46 tCO_2 per tonne of steel) was used in the calculation of both the project and the baseline emissions (formula 12 in Section D.1.1.2 and formula 27 in Section D.1.1.4, respectively). This emission factor is less than the local emission factor (about 1.68 tCO_2 per tonne of steel in 2006) that reduces ERUs by approximately 15%. This is very conservative assumption and covers any uncertainties of the subproject.

All the old CCMs are the same productivity. The maximum achieved productivity of each CCMs is 1,269,373 tonnes of slabs per year (the maximum achieved productivity of CCM No 5 in 2007, please see Table Anx.2.3 of Annex 2). Therefore maximum steel output of CCMs No 5-7 and 9 in the baseline is 5,077,492 tonnes of slabs per year (1,269,373 × 4). It is benchmark value.

However the project productivity of each new CCM is about 2.0 mln. tonnes of slabs per year more than before the project implementation. As indicated above the steel output from CCMs is not changed because the productivities of the base oxygen furnaces of BOF shop No 2 were not changed. However NLMK plans to construct new base oxygen furnace in the future. At the time the Guidance requests that "by assuming that the same level of service as in the project scenario would be offered in the baseline scenario". Therefore for project and baseline emissions calculation the all measured parameters are adjusted to the benchmark value using the coefficient of reduction for subproject 2 ('k_2", please see formula 14 in Section D.1.1.2) in the relevant formulae in Section D.1.1.2 and Section D.1.1.4. When the total steel output in project scenario is less than benchmark value the $k_2 = 1$.

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

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

Data/Parameter	PSO_y
Data unit	tonnes of steel
Description	Steel output from CCMs No 5-7 and 9 of BOF shop No 2 in the year
Time of determination/monitoring	Monitored during the crediting period
Source of data (to be) use	NLMK data
Value of data applied (for ex ante calculations/determinations)	3,999,511– for 2008, 4,243,294– for 2009, 4,902,624– for 2010-2012
Justification of the choice of data or description of measurement methods and procedures (to be) applied	It is measured by weighting
OA/QC procedures (to be) applied	It is an ordinary procedure at NLMK. Please see Table D.2 for more detailed information
Any comment	-

Data/Parameter	$EF_{BOF,y}$
Data unit	tCO_2/tonne of steel
Description	The default IPCC CO_2 emission factor for Basic Oxygen Furnace in year *y*
Time of determination/monitoring	Fixed ex-ante during determination
Source of data (to be) use	Guidelines for National Greenhouse Gas Inventories, Volume 3: Industrial Processes and Product Use, Chapter 4: Metal Industry Emissions, IPCC, 2006
Value of data applied (for ex ante calculations/determinations)	1.46
Justification of the choice of	

data or description of measurement methods and procedures (to be) applied	
OA/QC procedures (to be) applied	It is ordinary procedure of NLMK. Please see Table D.2 for more detail information
Any comment	-

Data/Parameter	*BSWS*
Data unit	kg/tonnes of steel output
Description	Baseline specific waste of steel at CCMs of BOF shop No 2
Time of determination/monitoring	Fixed ex-ante during determination
Source of data (to be) use	NLMK records
Value of data applied (for ex ante calculations/determinations)	14.04
Justification of the choice of data or description of measurement methods and procedures (to be) applied	This parameter is used for definition of the waste of steel at CCMs of BOF shop No 2 in baseline and it was calculated based on historical data as average value for 2005-2007.
OA/QC procedures (to be) applied	-
Any comment	Please see Annex 2

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

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

Step 1. Indication and description of the approach applied
As suggested by Paragraph 2 (c) of the Annex 1 of the Guidance the most recent version of the "Tool for the demonstration and assessment of additionality" approved by the CDM Executive Board is used to demonstrate additionality. At the time of this document completion the most recent version of the "Tool for the demonstration and assessment of additionality" approved by the CDM Executive Board is version 05.2[29] and it is used to demonstrate additionality of the project activity.

Step 2. Application of the approach chosen
The following steps are taken as per "Tool for the demonstration and assessment of additionality" version 05.2 (hereinafter referred to as Tool) for each of subprojects.

Step 1: Identification of alternatives to the project activity consistent with current laws and regulations
The realistic and credible alternatives to the project activity are defined through the following Sub-steps:

Sub-step 1a: Define alternatives to the project activity
The following alternatives to the subproject 1 and 2 were considered before project implementation:

Subproject 1. Construction of new air separation plants at the Oxygen shop

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

Alternative 1: Continuation of a situation existing prior to the project (the Oxygen shop is operated without any reconstruction). Oxygen, nitrogen and other gases are produced at the old ASPs. These installations will be maintained with routine and capital repairs and operated until 2013 at least.

Alternative 2: Construction of new air separation plants at the Oxygen shop No 4, 5 and 9 (the proposed project activity undertaken without being registered as a JI project activity). Construction of new ASPs was stated in 2005. New ASPs No 4, 5 and 9 are commissioned 2008 and 2009. As result of project implementation the electricity and steam consumption are reduced for oxygen, nitrogen and other gases production.

Subproject 2. Reconstruction of two continues casting machines No 6 and 7 at the Basic Oxygen Furnace shop No 2

Alternative 1: Continuation of a situation existing prior to the project (the BOF shop No 2 is operated without any reconstruction). Steel is poured at the old continues casting machines. These installations will be maintained with routine and capital repairs and operated until 2013 at least.

Alternative 2: Reconstruction of two continues casting machines No 6 and 7 at the Basic Oxygen Furnace shop No 2 (the proposed project activity undertaken without being registered as a JI project activity). Reconstruction of the CCMs was stated in 2005. CCM No 6 was commissioned in 2008 and CCM No 7 – in 2009. As result of project implementation the steel waste is reduced and quality of steel became higher. Productivity of the BOF shop No 2 has not been changed.

Outcome of Step 1a: The realistic and credible alternatives to the project (subprojects) activity were identified.

Sub-step 1b: Consistency with mandatory laws and regulations
All of the alternatives identified above are consistent with mandatory laws and regulations of the Russian Federation.

Outcome of Step 1b: The realistic and credible alternatives to the project (subprojects) activities are identified in compliance with mandatory legislation and regulations taking into account the enforcement in the Russian Federation.

Step 2. Investment Analysis
The purpose of the investment analysis in the context of additionality is to determine whether the proposed project activity is not:
a) The most economically or financially attractive; or
b) Economically or financially feasible, without the revenue from the sale of emission reductions.

Sub-step 2a: Determine appropriate analysis method
In principle, there are three methods applicable for an investment analysis: simple cost analysis, investment comparison analysis and benchmark analysis.

A simple cost analysis (Option I) shall be applied if the proposed JI project and the alternatives identified in step 1 generate no financial or economic benefits other than JI related income. For proposed JI project the generated benefits are the costs reduction due to the replacement of old equipment by new one. Thus, this analysis method is not applicable.

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

Sub-step 2b: Option II. Apply investment comparison analysis
In principle, the following indicator, such as IRR, NPV, cost benefit ratio, or unit cost of service can be used for investment comparison analysis. For proposed project (subprojects) the revenues are generated due to the reduction of energy resources and raw materials consumption in comparison with the continuation of existing situation. Therefore the NPV is identified as the financial indicator for the project type. In this case if the NPV is negative then the project (subproject) is less financially attractive.

The discount rate is established as government bond rates increased by a suitable risk premiums. From investor's point of view the expected return will consist of the risk-free rate increased by the suitable risk premiums. The risk-free rate taken for this assessment is the German T-bills (governmental bonds) rate[30] cleared inflation[31] at the time of investment decision being made. And the suitable risk premiums will include:

- Systematic market risk. This portion of risk relates to the variability in returns from the equity investments and uncertainty associated with that[32]. The rate used in the assessment reflects investment into a portfolio of steel companies[33]. This risk premium is the minimum possible expected return for the investor that holds a portfolio of existing steel businesses in a developed economy. This risk component can be seen as the basic risk-free rate for the investor in to equity market. Also this risk component can be interpreted as the "risks connected with project participants" as it addresses the issues of being involved into the project realization with different parties etc. while on the other hand there is an option of investing into considerably less risky environment of US stock market. It is conservative assumption for proposed project.
- Country risk[34]. This portion of the risk reflects unique risks of investment being made in Russia. The additional return (premium) is required to cover political uncertainty, ownership risks, profit repatriation risk etc.
- Project specific risk. This risk component can be interpreted as the risk of uncertainty in getting projected cash inflows from the project. The data from the "Methodological recommendations on evaluation of investment projects efficiency" approved by Ministry of Economy of the RF, Ministry of Finance of the RF, State Committee of the RF on Construction, Architecture and Housing Policy of the RF 21.06.1999 N ВК 477" were taken. Value of this risk is 3%. It is minimum value of the risk for investment to the production development based on well-known technology (Table 11.1 of the Methodological recommendations).

The result of discount rate estimation is present in Table B.2.1.

Table B.2.1. Result of discount rate estimation

Indicator	Value for 2005
German interest rate	3.13%

[30] European Central Bank website, Long-Term Interest Rate of Germany, June 2005

[31] European Commission website, Eurostat , Average Inflation Rate of Germany in 2005

[32] Principles of Corporate Finance 7th edition, Richard A. Brealey, Stewart C. Myers, McGraw-Hill Higher Education, 2003 – p. 168

[33] New York University, Leonard N. Sterm School of Business, Costs of Capital by Industry Sector in 2005

[34] New York University, Leonard N. Sterm School of Business, Risk Premiums for Other Markets in 2005

Indicator	Value for 2005
Inflation	1.90%
Risk-free rate	***1.19%***
Systematic market risk	***9.01%***
Country risk Russia	***1.80%***
Project specific risk	***3.00%***
Discount rate	**15.07%**

Sub-step 2c: Calculation and comparison of financial indicators
The financial analysis refers to the time of investment decision-making.

Subproject 1. Construction of new air separation plants at the Oxygen shop
The following assumptions have been used based on the information provided by the enterprise and from other sources:

1. Investment decision: June 2005;
2. Bank of Russia exchange rate is 34.65 RUR/EUR;
3. The project investment cost accounts for of approximately EUR 25.0 million, 18.0 million and 23.3 million (excluding VAT) for ASP No 4, 5 and 9, respectively;
4. The project lifetime is around 20 years;
5. Electricity, steam consumption and etc. at the Oxygen shop are defined in line with the actual parameters of shop (in 2006[35]) and project parameters (for situation after reconstruction);
6. Electricity and steam tariffs are actual tariffs in 2005.
7. After subproject implementation the additional volume of the Kr-Xe mixes is produced (about 1,000 m^3 per year). The average price (about 130 EUR/m^3 of the mixes) is defined based on data from manufacturer[36].
8. In connection with the project implementation old ASP No 9 was dismantled and ASPs No 6 and 8 were stopped and may be dismantled in the future (some equipment was dismantled already). The possible revenues from the sale of scrap are calculated as the multiplication of the total weight of each ASP and the price of scrap in 2005. As there is no information about the weight of old ASPs the value of this parameter is taken as the weight of new ASP N0 9 (244 tonnes[37]). This is a conservative assumption because there is the additional equipment in – the block of air complex purification (about 40 tonnes) in the new ASP. The year of old ASPs dismantling is taken: for ASP No 9 – 2005, for ASPs No 6 and 8 – 2012.

The subproject 1 cash flow focuses on revenue flows generated by electricity and steam savings in comparison with the continuation of existing situation of subproject 1.

The subproject's financial indicator is presented in the Table B.2.2 below.

[35] Actual data before 2006 is not available

[36] http://www.niikm.ru/products/krypton/

[37] "Technical data and the structure of the equipment", Annex 1 of the contract No 643/05757665/13015/MB/406-01.2005-013 dd. 12.08.2005 between "NLMK" and "Kriogenmash"

Table B.2.2. Financial indicators of the subproject 1

Scenario	NPV (EUR thousand)
Base case	-35,679

Cash flow analysis shows NPV is negative. Hence, the subproject 1 cannot be considered as a financially attractive course of action.

Subproject 2. Reconstruction of two continues casting machines No 6 and 7 at the Basic Oxygen Furnace shop No 2
The following assumptions have been used based on the information provided by the enterprise and from other sources:
1. Investment decision: June 2005;
2. Bank of Russia exchange rate is 34.65 RUR/EUR;
3. The project investment cost accounts for of approximately EUR 76.0 million and 64.1 million (excluding VAT) for CCM No 6 and 7, respectively;
4. The project lifetime is around 20 years;
5. Volume of steel waste at CCMs is defined in line with the planned parameters;
6. Slab and scrap prices are actual prices in 2005;
7. Additional revenues from the operating costs reduction based on the growth of high quality steel production (increase of slabs 1-2 classes). For definition of the slab price of the 3 and 4 classes the discount in 10 $ compared with 1 and 2 classes was used.

The cash flow of subproject 2 focuses on revenue flows generated by steel (slabs) savings and on the market position saving in comparison with baseline of subproject 2.

The subproject's financial indicator is presented in the Table B.2.3 below.

Table B.2.3. Financial indicators of the subproject 2

Scenario	NPV (EUR thousand)
Base case	-58,235

Cash flow analysis shows NPV is negative. Hence, the subproject 2 cannot be considered as a financially attractive course of action.

Sub-step 2d: Sensitivity analysis
A sensitivity analysis should be made to show whether the conclusion regarding the financial/economic attractiveness is robust to reasonable variations in the critical assumptions, as it can be seen by application of the Methodological Tool "Tool for the demonstration and assessment of additionality" (Version 05.2).

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

Sensitivity analysis was made for each of subprojects.

Subproject 1. Construction of new air separation plants at the Oxygen shop
Any costs are less 20% of total revenues and in line with the Additionality Tool the sensitivity analysis is not made for this component. Conditions of scenarios are presented below.

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

Scenario 2 is based on the assumption of a 10% investment cost decrease that improves cash flow.

Scenarios 3 and *4* imply the electricity tariff raises/reduces by 10%.

Scenarios 5 and 6 imply the steam (heat) tariff raises/reduces by 10%.

A summary of the results is presented in the Table B.2.4 below.

Table B.2.4: Sensitivity analysis (summary)

Scenario	NPV (EUR thousand)
Scenario 1	-42,132
Scenario 2	-29,226
Scenario 3	-34,310
Scenario 4	-37,048
Scenario 5	-34,229
Scenario 6	-37,129

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

Subproject 2. Reconstruction of two continues casting machines No 6 and 7 at the Basic Oxygen Furnace shop No 2
Conditions of scenarios for sensitivity analysis are presented below.

Scenarios 1 and *2* imply investment cost changes ± 10, respectively.

Scenario 3 and *4* considers the additional revenues from the market position saving changes ± 10, respectively.

A summary of the results is presented in the Table B.2.5 below.

Table B.2.5: Sensitivity analysis (summary)

Scenario	NPV (EUR thousand)
Scenario 1	-69,492
Scenario 2	-46,978
Scenario 3	-53,815
Scenario 4	-62,656

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

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

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

Step 4: Common practice analysis

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

Subproject 1. Construction of new air separation plants at the Oxygen shop
As described in Section A.4.2 the ASPs No 4, 5 and 9 use technology of air complex purification (front-end purification unit – FERU). Earlier such technology was used in installations of small and average productivity only. And at ASPs of big productivity the air clearing was carried out by freezing out[38]. It is explained that the technology of air complex purification was not enough made.

Before 2005 the ASPs of the production by OJSC “Kriogenmash” were operated in Russia. Kriogenmash produced more than 500 ASPs of big productivity. However, at that time the three ASPs of big productivity with FERU only were put into operation (please see the footnote# 38): at Magnitogorsky metallurgical plant (ASP type of KtKA-35-20, put into operation in 2002), at Severstal (AKAr-60/35, 2004) and at NLMK (KAAr-30M, 2004).

These plants were the first of this type. They use not-so-reliable and proven equipment. As results of the installations were much cheaper[39], however, have serious disadvantages (please see the footnote# 38). In additional the first two of them have different productivities: KtKA-35-20 – about 20,000 m^3 of nitrogen per hour and KAr-60/35 – about 60,000 m^3 of nitrogen per hour.

Only three ASPs of big productivity with FERU of more 500 ASPs were operated in Russia and these plants were the first of this type and have serious disadvantages. Thus subproject 1 does not reflect a widely observed and commonly carried out activity.

Subproject 2. Reconstruction of two continues casting machines No 6 and 7 at the Basic Oxygen Furnace shop No 2
New CCMs No 6 and 7 at NLMK used modern equipment allows to reduce the clippings and improve the quality of slabs (to avoid the defects of metal), such as:

- DynaFlex – oscillator for billet and bloom casters to improve surface quality;

[38] Front-End Purification Units for Air Separation Plants Madding by JSC “CRYOGENMASH”, Y. Blaznin, V. Gorokhov, V. Golubev, Technical gases No 4, 2009

[39] http://www.mymetal.ru/?news/industry/details/6261

- SMARTMold – cassette molds for rapid exchange of the copper plates and narrow faces of the mold;
- MoldExpert – strand breakout protection system;
- DynaWidth – for dynamic mold width adjustment during casting operation.

Especially at the CCMs were used by the new systems: DynaGap and DYNACS. "The combination of SMART®Segments with Siemens VAI's DYNACS® Dynamic Cooling Model allows dynamically optimized adjustment of the roller gap and taper during transient casting conditions, and quick and simple remote changing of casting thickness between the casts. This results in improvements of internal quality, especially for pipe and plate grades. The thermal tracking model of DYNACS determines the final point of solidification, and the DynaGap model automatically adjusts the set points for the SMART Segment for an optimum roller gap."[40]

DynaGap and DYNACS[41] are new technology. For example, DynaGap was first used in China in 2003[42], and for the first time in Russia at new CCMs at NLMK. Thus subproject 2 does not reflect a widely observed and commonly carried out activity.

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

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

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

Step 3. Provision of additionality proofs
Supporting documents including the calculation spreadsheets and other proofs will be made available to the accredited independent entity.

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

The subproject boundary shall encompass all anthropogenic emissions by sources of GHGs which are:

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

N_2O and CH_4 emissions
GHG emissions of the proposed subprojects are associated with electricity and steam consumption (for subproject 1) and additional BOF steel production (for subproject 2). All of these processes are related to fuels combustion. For stationary fuel combustion the CO_2 emission is more than 99.9% and, respectively, N_2O and CH_4 emissions are less than 0.1%. For example, in accordance with the IPCC Guidelines for

[40] http://www.industry.siemens.com/datapool/industry/industrysolutions/metals/simetal/en/SMART-Segment-Dyna-Gap-Soft-Reduction-en.pdf

[41] http://www.rudmet.ru/news/139/

[42] http://www.indas.ru/content/library/metalsmining12008.pdf

National Greenhouse Gas Inventories[43] for natural gas the default CO_2 emission factor is 56,100 $kgCO_2/TJ$, the default N_2O emission factor is 0.1 kgN_2O/TJ and the default CH_4 emission factor is 1.0 $kgCH_4/TJ$. Global Warming Potential of N_2O is 310 and CH_4 is 21. Then the share of total N_2O and CH_4 emissions is: 100%×(21×1.0+310×0.1)/(56,100+21×1.0+310×0.1) = 0.093%. Therefore N_2O and CH_4 emissions have not been taken into account for simplicity and conservatism.

Leakages

The potential leakages are associated with:

- Fugitive CH_4 emissions associated with fuel extraction, processing, transportation and distribution of fuel for electricity and steam generation and BOF steel production;
- Technical transmission and distribution losses of electricity in the grid;
- Technical distribution losses of steam at NLMK.

Both subprojects enable to decrease electricity and steam consumption or steel production (fuel consumption for steel production, correspondingly). It means that leakages decrease too. Therefore these emissions have not been taken into account for simplicity and conservatism.

Project boundary

Subproject 1. Construction of new air separation plants at the Oxygen shop

All emissions of subproject 1 relate to emissions from electricity and steam consumption at Oxygen shop:

- Electricity consumption at the Central compressor station (CCS);
- Electricity consumption at the Air dewatering station (ADS) and Dewatered air compression station (DACS) of Oxygen station No 2 (OS-2);
- Electricity and steam consumption at the Air compression station of OS-1 (ACS-1);
- Electricity consumption at the Air compression station of OS-2 (ACS-2);
- Electricity and steam consumption at the Air separation branch of OS-1 (ASB-1);
- Electricity and steam consumption at the Air separation branch of OS-2 (ASB-2);
- Electricity consumption at the Oxygen and nitrogen compression branch of OS-1 (ONCB-1);
- Electricity consumption at the Oxygen and nitrogen compression branch of OS-2 (ONCB-2).

Scheme of emissions sources and subproject 1 boundary are presented on Figure B.3.1.

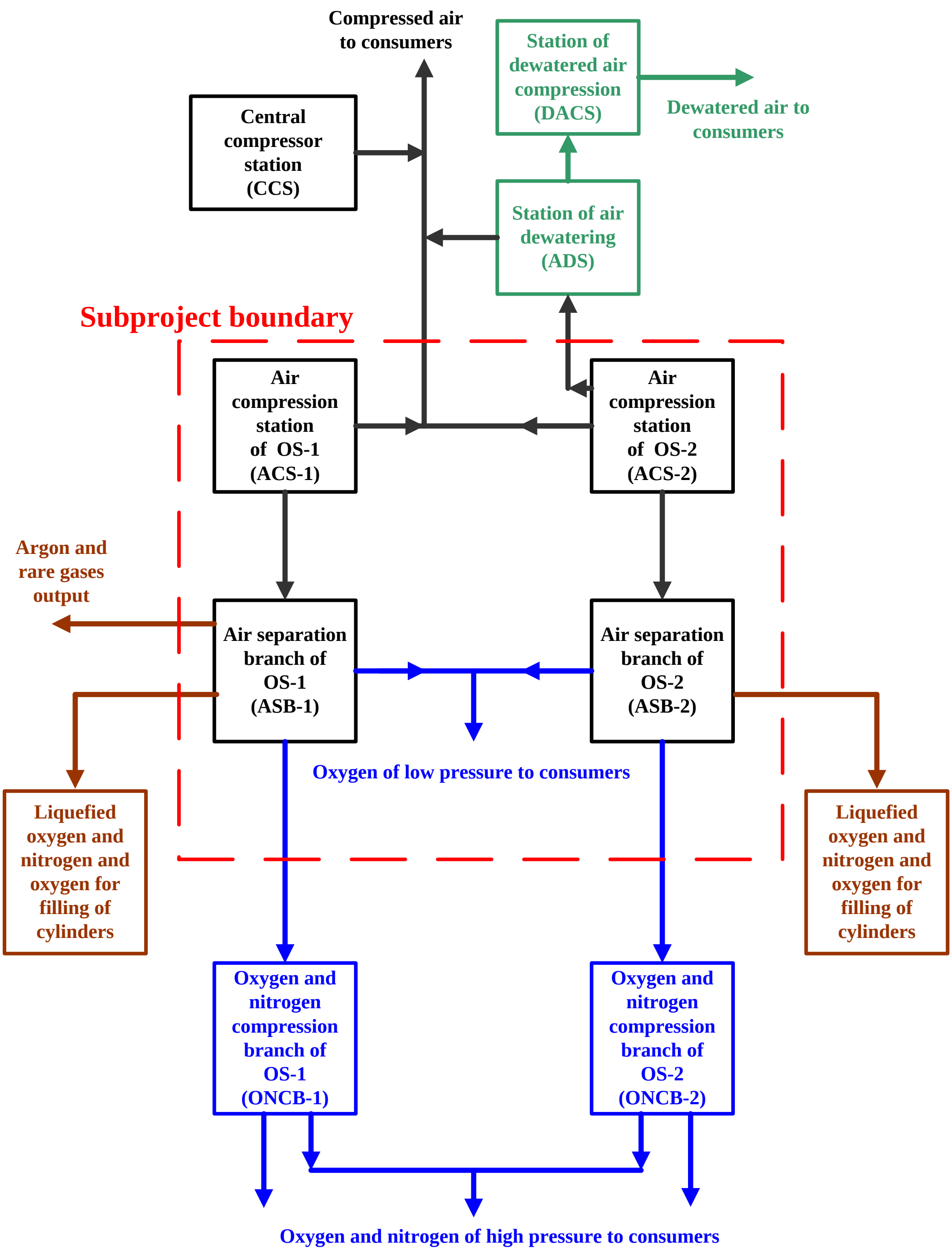
An overview of all emission sources of subproject 1 is given in Table B.3.1 below.

[43] Guidelines for National Greenhouse Gas Inventories, Volume 2: Energy, Chapter 2: Stationary Combustion, Table 2.2, IPCC, 2006

Table B.3.1: Sources of emissions

№	Source	Gas	Included/ excluded	Justification/Explanation
1	Electricity consumption at CCS	CO_2	Excluded	Subproject implementation is not affect to the project and baseline emissions
2	Electricity consumption at ADS and DACS of OS-2	CO_2	Excluded	
3	Electricity and steam consumption at ACS-1	CO_2	Included	Electricity and steam consumption is decreased in the project scenario in comparison with baseline
4	Electricity consumption at the ACS-2	CO_2	Included	
5	Electricity and steam consumption at ASB-1	CO_2	Included	
6	Electricity and steam consumption at the ASB-2	CO_2	Included	
7	Electricity consumption at the ONCB-1	CO_2	Excluded	Subproject implementation is not affect to the project and baseline emissions
8	Electricity consumption at the ONCB-2	CO_2	Excluded	
9	N_2O and CH_4 emissions	N_2O and CH_4	Excluded	N_2O and CH_4 emissions have not been taken into account for simplicity and conservatism. Please see Section B.3 above

Figure B.3.1: Sources of emissions and subproject boundary



Source: Data provided by NLMK

Subproject 2. Reconstruction of two continues casting machines No 6 and 7 at the Basic Oxygen Furnace shop No 2

All emissions of subproject 2 relate to emissions from steel production at BOF shop No 2 and electricity and gas consumption at continue casting machines (CCM).

Electricity and natural gas consumption at CCMs (No 5-9) of BOF shop No 2 are presented in Table B.3.2.

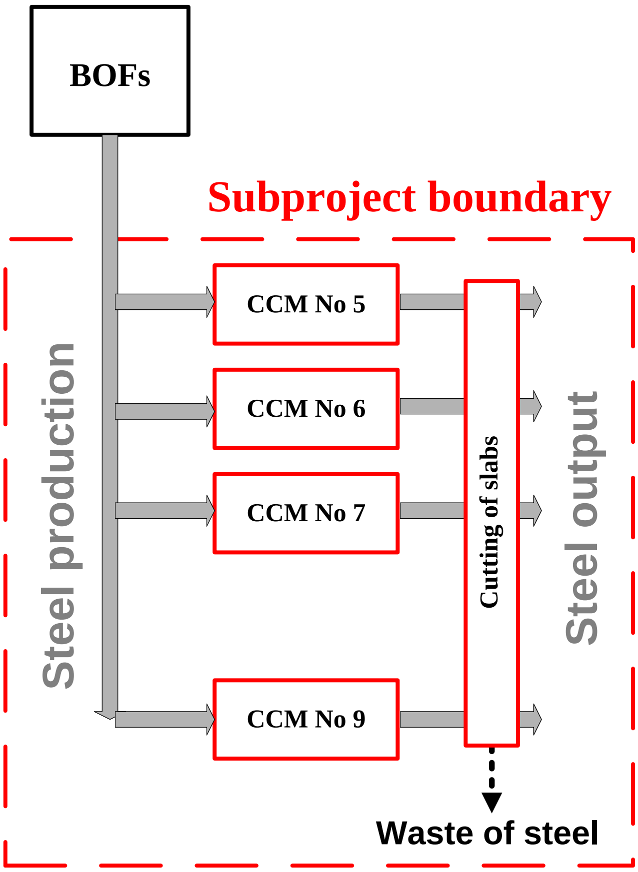
Table B.3.2: Electricity and natural gas consumption at CCMs of BOF shop No 2

Parameter	Unit	2005	2006	2007	2008	2009	2010	Average
Steel output	tonnes	4,922,692	5,411,225	5,282,075	4,951,745	5,263,578	5,666,204	**5,254,261**
Electricity consumption	MWh	63,521	69,108	67,013	59,879.69	66,397.12	80,143.30	**67,060**
Specific electricity consumption	MWh/ tonnes	0.013	0.013	0.013	0.012	0.013	0.014	**0.013**
Natural gas consumption	1000 m^3	8,226	8,293	8,156	8,835	8,303	10,252	**8,716**
Specific natural gas consumption	m^3/ tonnes	1.67	1.53	1.54	1.78	1.58	1.81	**1.66**

As shown in Table B.3.2 the specific electricity and natural gas consumption are practically equal before and after subproject implementation. Therefore these parameters have not been taken into account for simplicity.

The emission sources within the project boundary (CCMs No 8 is excluded) are also shown in Figure B.3.2 below.

Figure B.3.2: Sources of emissions and project boundary



Source: Data provided by NLMK

An overview of all emission sources of subproject 2 is given in Table B.3.3 below.

Table B.3.3: Sources of emissions

№	Source	Gas	Included/ excluded	Justification/Explanation
1	Electricity consumption	CO_2	Excluded	Subproject implementation is not affect to the project and baseline emissions
2	Natural gas consumption	CO_2	Excluded	
3	Steel production	CO_2	Included	Steel production is decreased in the project scenario in comparison with baseline
4	N_2O and CH_4 emissions	N_2O and CH_4	Excluded	N_2O and CH_4 emissions have not been taken into account for simplicity and conservatism. Please see Section B.3 above

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

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

Date of completion of the baseline study: 22/12/2011

Global Carbon BV.
Global Carbon BV is a project participant. The contact information is presented in Annex 1.

SECTION C. Duration of the project / crediting period

C.1. Starting date of the project:

The proposed JI project consists of two subprojects. Equipment for these subprojects will be installed and commissioned in the following order:

- Subproject 1: From June 2005 to March 2009;
- Subproject 2: From June 2005 to April 2008;

The contracts of equipment delivery signed:

Subproject 1:

- ASP No 4: the contract No 276/05757655/461475 dated 09/06/2005;
- ASP No 5: the contract No 276/05757655/461485 dated 09/06/2005;
- ASP No 9: the contract No 643/05757655/13015/MB/406-01.2005-013 dated 12/08/2005.

Subproject 2:

- CCM No 6: the contract No 040/05757655/13015/461415 dated 10/06/2005;
- CCM No 7: the contract No 040/05757655/13015/461425 dated 10/06/2005.

Therefore the starting date of the subproject 1 is 09/06/2005 and of the subproject 2 is 10/06/2005 therefore starting date of the proposed project is 09/06/2005.

C.2. Expected operational lifetime of the project:

For all proposed measures the lifetime of equipment will be at least 20 years. Thus operational lifetime of the project will be 20 years or 240 months.

C.3. Length of the crediting period:

The earliest date of the equipment operation commencement (CCM No 6 of the subproject 2) of the proposed project is 04 February 2008. Please see Tables A.4.2.4 and A.4.2.6 in Section A.4.2.

Therefore the start of crediting period is 04/02/2008.

Length of crediting period: 4 years and 11 months or 59 months.

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

SECTION D. Monitoring plan

D.1. Description of monitoring plan chosen:

In this project a JI specific approach regarding monitoring is used. As elaborated in Section B.3, the project activity affects the emissions related to the fuel combustion, electricity consumption and heat generation and consumption. To establish the baseline emissions and to monitor the project emissions, these emissions will be monitored. The following assumptions for calculation of both baseline and project emissions for each of subprojects were used:

Identical for all of subprojects:

- The lifetime of equipment extends to 2020. It means that project lifetime covers the crediting period;
- Production level (the oxygen and nitrogen production for subproject 1 and the steel output for subproject 2) is the same in the project and baseline scenario. It will not allow possibility ER calculating due to the production reducing.

Individual for each of subprojects:

Subproject 1. Construction of new air separation plants at the Oxygen shop

- Emission factors of electricity and steam consumption are calculated based on the actual data and used for both the project and baseline emissions calculation. It allows correctly to calculate emissions from electricity and heat consumption for each year of the monitoring period;
- The fuel consumption for blowing production at NLMK CHPP is excluded from the definition of emission factors for electricity and heat generation at NLMK CHPP. The values of fuel consumption for blowing production, electricity and heat generation is calculated in accordance with national rules and based on the measured total fuel consumption at NLMK CHPP. It allows correctly to calculate the emission factors of electricity and steam consumption;
- For definition of electricity and steam consumption for compressed air production consumed at ASBs the specific electricity and steam consumption factors (MWh and GJ per m^3 of compressed air production) are used because some of compressed air volume produced at ACSs is delivered into NLMK network (not on ASBs). These parameters are defined based on the actual data and the total compressed air production at ACS-1 or ACS-2. It allows correctly to define the values of electricity and steam consumption for compressed air production consumed at ASBs in both the project and the baseline;
- The term of process oxygen equivalent (POE) is used for calculation of some baseline specific factors (the baseline specific compressed air consumption at the Oxygen shop for air separation, the baseline specific electricity consumption at ASB-1 and ASB-2 and the baseline specific steam consumption at ASB-1 and ASB-2). These factors are defined based on historical data and set ex-ante for the length of the crediting period. It allows correctly defining the values of compressed air, electricity and heating consumption at ASB-1 and ASB-2 in the baseline because the configuration of ASB-1 and volume of the process and tonnage oxygen gases were changed. Also please see Section B.1 and Annex 2.

- The volume of produced gases in POE is calculated based on the conversion factors for each gas of air separation. These conversion factors were defined based on "The methodology for accounting of expenses and calculating the cost of products in the integrated production of air separation"[44] and approved by Director of the NLMK TEK in 2002 (also please see Annex 2). It allows correctly defining the values of compressed air, electricity and heating consumption at ASB-1 and ASB-2 in the baseline as described above;
- The volumes of argon and rare gases production do not use for definition of the volume of produced gases in POE and, respectively, compressed air consumption in the baseline. It allows conservatively defining the values of energy resources consumption (compressed air, electricity and steam) in the baseline.

Subproject 2. Reconstruction of two continues casting machines No 6 and 7 at the Basic Oxygen Furnace shop No 2

- The default IPCC CO_2 emission factor for Basic Oxygen Furnace is used because this emission factor is less than the emission factor for Basic Oxygen Furnace at NLMK. It is conservative assumption (please see the explanation in Section B.1) and allows to simplify the monitoring;
- The baseline specific steel waste is set ex-ante for the length of the crediting period. It is defined on based historical data (please see Annex 2) and allows correctly to calculate the value of steel waste in the baseline.

General remarks:

- Social indicators such as number of people employed, safety records, training records, etc, will be available to the Verifier if required;
- Environmental indicators such as NO_x and other will be available to the Verifier if required;
- Monitored data required for verification and issuance will be kept for two years after the end of the crediting period or the last issuance of ERUs.
- For the greenhouse gas emissions only the CO_2 emissions are taken into account. In the baseline volume of the CH_4 and N_2O emission more than project, because their exception is conservative. See section B.3.

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

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

[44] "The methodology for Accounting of Expenses and Calculating the Cost of Products in the Integrated Production of Air Separation", Scientific-Research Institute of Technical-Economic Research, 1975

ID number *(Please use numbers to ease cross-referencing to D.2.)*	Data variable	Source of data	Data unit	Measured (m), calculated (c), estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment
P1	k_1	Calculated under project activity	-	C	Annually	100%	Electronic and paper	-
P2	POE_y	Calculated under project activity	1000 m^3 of POE	C	Annually	100%	Electronic and paper	-
P3	PO_y	Annual report	1000 m^3 of process oxygen	M	Continuously	100%	Electronic and paper	-
P4	$KOEF_{PO}$	Please see Annex 2	m^3 of POE / m^3 of process oxygen	E	Fixed ex ante	100%	Electronic and paper	-
P5	TO_y	Annual report	m^3 of tonnage oxygen	M	Continuously	100%	Electronic and paper	-
P6	$KOEF_{TO}$	Please see Annex 2	m^3 of POE / m^3 of tonnage oxygen	E	Fixed ex ante	100%	Electronic and paper	-
P7	N_y	Annual report	1000 m^3 of nitrogen	M	Continuously	100%	Electronic and paper	-
P8	$KOEF_N$	Please see Annex 2	m^3 of POE / m^3 of nitrogen	E	Fixed ex ante	100%	Electronic and paper	-
P9	PE_y	Calculated under project activity	tCO_2	C	Annually	100%	Electronic and paper	-
P10	PE_{sp_1y}	Calculated under project activity	tCO_2	C	Annually	100%	Electronic and paper	-
P11	PE_{sp_2y}	Calculated under project activity	tCO_2	C	Annually	100%	Electronic and paper	-
P12	$PE_{elec,\ y}$	Calculated under project activity	tCO_2	C	Annually	100%	Electronic and paper	-
P13	$PE_{steam,\ y}$	Calculated under project activity	tCO_2	C	Annually	100%	Electronic and paper	-
P14	$PEC_{ASB,y}$	Annual and	MWh	M	Continuously	100%	Electronic and	-

D.1.1.1. Data to be collected in order to monitor emissions from the project, and how these data will be archived:								
ID number *(Please use numbers to ease cross-referencing to D.2.)*	Data variable	Source of data	Data unit	Measured (m), calculated (c), estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment
		monthly reports[45]					paper	
P15	$PCAC_{ASB\_1,\,y}$	Annual report	1000 m^3	M	Continuously	100%	Electronic and paper	-
P16	$PSEC_{ACS\_1y}$	Calculated under project activity	MWh/1000 m^3	C	Annually	100%	Electronic and paper	-
P17	$PCAC_{ASB\_2,\,y}$	Annual report	1000 m^3	M	Continuously	100%	Electronic and paper	-
P18	$PSEC_{ACS\_2y}$	Calculated under project activity	MWh/1000 m^3	C	Annually	100%	Electronic and paper	-
P19	$PEC_{ACS\_i,y}$	Annual report	MWh	M	Continuously	100%	Electronic and paper	*i* is equal *1* or *2*
P20	$PCAO_{NW\_i,y}$	Annual report	1000 m^3	M	Continuously	100%	Electronic and paper	
P21	$EF_{ELaver,y}$	Calculated under project activity	tCO_2/MWh.	C	Annually	100%	Electronic and paper	-
P22	$EF_{grid,y}$	Please see Annex 2	tCO_2/MWh	E	Fixed ex ante	100%	Electronic and paper	Electricity grid GHG emission factor for JI projects in Russian Regional Energy System “Centre”.
P23	$EF_{el\_CHP,y}$	Calculated under	tCO_2/MWh	C	Annually	100%	Electronic and	-

[45] Hereinafter: annual and monthly reports are automatically formed based on the measured parameters into the automatic system of the supervisory control “Energo”. As subproject did not start from the beginning of 2008 the data for this year was used from monthly reports. .

D.1.1.1. Data to be collected in order to monitor emissions from the project, and how these data will be archived:								
ID number *(Please use numbers to ease cross-referencing to D.2.)*	Data variable	Source of data	Data unit	Measured (m), calculated (c), estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment
		project activity					paper	
P24	$w_{grid,y}$	Calculated under project activity	-	C	Annually	100%	Electronic and paper	**-**
P25	$w_{CHP,y}$	Calculated under project activity	-	C	Annually	100%	Electronic and paper	**-**
P26	$FC_{eg,\ i,y}$	Annual report on consumption, production and procurement of fuel in the JSC "NLMK"	t.c.e	E	Annually	100%	Electronic and paper	It is automatically calculated according to national rules in the ASSC “Energo”[46] based on measured NLMK CHPP fuel consumption
P27	$EG_{CHPP,y}$	Annual report on consumption, production and procurement of fuel in the JSC "NLMK"	MWh	E	Annually	100%	Electronic and paper	It is automatically calculated in the ASSC “Energo” based on measured NLMK CHPP generation and auxiliary consumption.

[46] Automatic system of the supervisory control “Energo”

D.1.1.1. Data to be collected in order to monitor emissions from the project, and how these data will be archived:								
ID number *(Please use numbers to ease cross-referencing to D.2.)*	Data variable	Source of data	Data unit	Measured (m), calculated (c), estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment
P28	$EF_{fuel\_i,y}$	IPCC	tCO_2/GJ	E	Fixed ex ante	100%	Electronic and paper	Guidelines for National Greenhouse Gas Inventories, Volume 2: Energy, Chapter 2: Stationary Combustion (corrected chapter as of April 2007), IPCC, 2006
P29	$EC_{grid,y}$	Annual report	MWh	E	Annually	100%	Electronic and paper	It is automatically calculated in the ASSC "Energo" based on measured electricity consumption at NLMK from grid and transferred electricity to third-party consumers
P30	PSC_{ASB}	Annual report	GJ	M	Continuously	100%	Electronic and paper	-
P31	$PSSC_{ACS\_1y}$	Calculated under	GJ/1000 m^3	C	Annually	100%	Electronic and	**-**

D.1.1.1. Data to be collected in order to monitor emissions from the project, and how these data will be archived:								
ID number *(Please use numbers to ease cross-referencing to D.2.)*	Data variable	Source of data	Data unit	Measured (m), calculated (c), estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment
		project activity					paper	
P32	$EF_{steam,y}$	Calculated under project activity	tCO_2/GJ	C	Annually	100%	Electronic and paper	**-**
P33	$PSC_{ACS\_1,y}$	Annual report	GJ	M	Continuously	100%	Electronic and paper	-
P34	$FC_{hg,\ i,y}$	Annual report on consumption, production and procurement of fuel in the JSC "NLMK"	t.c.e	E	Annually	100%	Electronic and paper	It is automatically calculated according to national rules in the ASSC “Energo” based on measured NLMK CHPP fuel consumption
P35	$HG_{CHPP,y}$	Annual report on consumption, production and procurement of fuel in the JSC "NLMK"	GJ	E	Annually	100%	Electronic and paper	It is automatically calculated in the ASSC “Energo” based on measured steam generation and steam consumption for blowing production
P36	k_2	Calculated under project activity	-	C	Annually	100%	Electronic and paper	**-**

D.1.1.1. Data to be collected in order to monitor emissions from the project, and how these data will be archived:								
ID number *(Please use numbers to ease cross-referencing to D.2.)*	Data variable	Source of data	Data unit	Measured (m), calculated (c), estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment
P37	PSO_y	Annual report	tonnes	M	Continuously	100%	Electronic and paper	-
P38	PSW_y	Annual report	tonnes	M	Continuously	100%	Electronic and paper	-
P39	$EF_{BOF,y}$	IPCC	tCO_2/tonne	E	Fixed ex ante	100%	Electronic and paper	Guidelines for National Greenhouse Gas Inventories, Volume 3: Industrial Processes and Product Use, Chapter 4: Metal Industry Emissions, IPCC, 2006

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

As indicated in Section B.1 for project and baseline emissions calculation the all measured parameters are adjusted to the benchmark value using the coefficient of reduction for subproject 1 - ‘k_1”. This coefficient is defined as:

$$k_1 = \begin{cases} k_1 = 1, \_if\_POE_y \prec 3{,}446{,}031\_thousand\_m^3\_of\_POE \\ k_1 = \dfrac{3{,}446{,}031}{POE_y}, \_if\_POE_y \geq 3{,}446{,}031\_thousand\_m^3\_of\_POE \end{cases} \quad (1)$$

Where

POE_y - is the air separation gases production of the process oxygen equivalent (POE) based on measured volumes of gases at the Oxygen shop in year *y* (1000 m^3 of POE);

3,446,031 - is benchmark level for subproject 1 according to conservative assumption in Section B.1 of the PDD (1000 m^3 of POE).

POE_y is calculated as follows:

$$POE_y = PO_y \times KOEF_{PO} + TO_y \times KOEF_{TO} + N_y \times KOEF_N \qquad (2)$$

Where:

PO_y - is the process oxygen production at the Oxygen shop in year *y* (1000 m^3);

$KOEF_{PO}$ - is the conversion factor from the m^3 of process oxygen to the POE (m^3 of POE / m^3 of process oxygen). Please see Annex 2;

TO_y - is the tonnage oxygen production at the Oxygen shop in year *y* (1000 m^3 of tonnage oxygen);

$KOEF_{TO}$ - is the conversion factor from the m^3 of tonnage oxygen to the POE (m^3 of POE / m^3 of tonnage oxygen). Please see Annex 2;

N_y - is the nitrogen production at the Oxygen shop in year *y* (1000 m^3 of nitrogen);

$KOEF_N$ - is the conversion factor from the m^3 of nitrogen to the POE (m^3 of POE / m^3 of nitrogen). Please see Annex 2.

The annual project emissions (PE_y) are calculated as follows:

$$PE_y = \sum_{i=1}^{2} PE_{sp\_i,y} \qquad (3)$$

Where:

PE_y - is the project emission in the year *y* (tCO_2);

$PE_{sp\_i,y}$ - are the project emissions of subprojects 1 and 2 in the year *y* (tCO_2);

The annual project emissions of subproject 1 are:

$$PE_{sp\_1,y} = PE_{elec,\ y} + PE_{steam,\ y} \qquad (4)$$

Where:

$PE_{elec,\ y}$ - are the subproject 1 emissions associated with electricity consumption at the Oxygen shop in the year *y* (tCO_2);

$PE_{steam,\ y}$ - are the subproject 1 emissions associated with steam consumption at the Oxygen shop in the year *y* (tCO_2);

$PE_{elec,\ y}$ is calculated as follows:

$$PE_{elec,\ y} = k_1 \times (PEC_{ASB,y} + PCAC_{ASB\_1,\ y} \times PSEC_{ACS\_1,y} + PCAC_{ASB\_2,\ y} \times PSEC_{ACS\_2,y}) \times EF_{ELaver,y} \quad (5)$$

Where:

$PEC_{ASB,y}$ - is the electricity consumption at ASB-1 and ASB-2 in the year *y* (MWh);

$PCAC_{ASB\_1,\ y}$ - is the compressed air consumption at ASB-1 in year *y* (1000 m^3);

$PSEC_{ACS\_1y}$ - is the specific electricity consumption for air compression at ACS-1 in the year *y* (MWh/1000 m^3);

$PCAC_{ASB\_2,\ y}$ - is the compressed air consumption at ASB-2 in year *y* (1000 m^3);

$PSEC_{ACS\_2y}$ - is the specific electricity consumption for air compression at ACS-2 in the year *y* (MWh/1000 m^3);

$EF_{ELaver,y}$ - is the weighted average CO_2 emission factor for electricity consumption (tCO_2/MWh).

$PSEC_{ACS\_1y}$ or $PSEC_{ACS\_2y}$ are obtained as:

$$PSEC_{ACS\_i,y} = PEC_{ACS\_i,y} / (PCAC_{ASB\_i,\ y} + PCAO_{NW\_i,y}) \quad (6)$$

Where:

$PEC_{ACS\_i,y}$ - is the electricity consumption for air compression at ACS in the year *y* (MWh);

$PCAC_{ASB\_i,\ y}$ - is the compressed air consumption at ASB-1 and ASB-2 in year *y* (1000 m^3);

$PCAO_{NW\_i,y}$ - is the compressed air output into the network of NLMK from ACS-1 and ACS-2 in year *y* (1000 m^3);

i - is equal *ACS-1* or *ACS-2*.

$EF_{ELaver,y}$ is obtained as:

$$EF_{ELaver,y} = w_{grid,y} \times EF_{grid,y} + w_{CHP,y} \times EF_{el\_CHP,y} \quad (7)$$

Where:

$w_{grid,y}$ - is part of electricity consumption from the grid at NLMK in the year *y* (MWh);

$EF_{grid,y}$ - is the CO_2 emission factor for electricity consumption, (tCO_2/MWh). It is an ex-ante fixed value, see Annex 2;

$w_{CHP,y}$ - is part of electricity consumption from the NLMK CHPP in the year *y* (MWh);

$EF_{el\_CHP,y}$ - is the CO_2 emission factor for electricity generation at the NLMK CHPP in the year *y* (tCO_2/MWh).

$EF_{el\_CHP,y}$ is obtained as:

$$EF_{el\_CHP,y} = \frac{\sum_i 29{,}308 \times FC_{eg,\ i,y} \times EF_{fuel\_i,y}}{EG_{CHPP,y}} \quad (8)$$

Where:

$FC_{eg,\ i,y}$ - is the total volume of fuel type *i* combusted the NLMK CHPP for electricity generation in year *y* (t.c.e);

$EG_{CHPP,y}$ - is the electricity which is generated at NLMK CHPP in project scenario in comparison with the baseline in year *y* (MWh).

$w_{grid,y}$ and $w_{CHP,y}$ are obtained as:

$$w_{grid,y} = \frac{EC_{grid,y}}{(EC_{grid,y} + EG_{CHPP,y})} \quad (9)$$

$$w_{CHP,y} = \frac{EG_{CHPP,y}}{(EC_{grid,y} + EG_{CHPP,y})} \quad (10)$$

Where:

$EC_{grid,y}$ - is the total electricity consumption at NLMK from electricity grid in year *y* (MWh).

$PE_{steam,\ y}$ is calculated as follows:

$$PE_{steam,\ y} = k_1 \times (PSC_{ASB} + PCAC_{ASB\_1,\ y} \times PSSC_{ACS\_1,y}) \times EF_{steam,y} \quad (11)$$

Where:

PSC_{ASB} - is total steam consumption at the ASB-1 and ASB-2 in the year *y* (GJ);

$PCAC_{ASB\_1,\,y}$ - is the compressed air consumption at ASB-1 in year *y* (1000 m^3);

$PSSC_{ACS\_1y}$ - is the specific steam consumption for air compression at the ACS-1 in the year *y* (GJ/1000 m^3);

$EF_{steam,y}$ - is the CO_2 emission factor for steam (heat) consumption (tCO_2/GJ).

$PSSC_{ACS\_1y}$ is obtained as:

$$PSSC_{ACS\_1,y} = PSC_{ACS\_1,y}/(PCAC_{ASB\_1,\,y} + PCAO_{NW\_1,y}) \qquad (12)$$

Where:

PSC_{ACS_1y} - is the steam consumption for air compression at ACS-1 in the year *y* (GJ);

$PCAC_{ASB\_1,\,y}$ - is the compressed air consumption at ASB-1 in year *y* (1000 m^3);

$PCAO_{NW\_1y}$ - is the compressed air output into the network of NLMK from ACS-1 in year *y* (1000 m^3);

$EF_{steam,y}$ is obtained as:

$$EF_{steam,y} = \frac{\sum_i 29{,}308 \times FC_{hg,i,y} \times EF_{fuel\_i,y}}{HG_{CHPP,y}} \qquad (13)$$

Where:

$FC_{hg,\,i,y}$ - is the total volume of fuel type *i* combusted at the NLMK CHPP for heat (steam) generation in year *y* (t.c.e);

$HG_{CHPP,y}$ - is the heat energy which is generated at the NLMK CHPP in year *y*, (GJ);

29,308 - is the conversion factor from tonne of coal equivalent to GJ (GJ/t.c.e).

The annual project emissions of subproject 2 are:
For subproject 2, as indicated in Section B.1, for project and baseline emissions calculation the all measured parameters are adjusted to the benchmark value using the coefficient of reduction - ‘k_2”. This coefficient is defined as:

$$k_2 = \begin{cases} k_2 = 1,\_if\_PSO_y \prec 5{,}077{,}492\_tonnes\_of\_steel \\ k_2 = \dfrac{5{,}077{,}492}{PSO_y},\_if\_POE_y \geq 5{,}040{,}000\_tonnes\_of\_steel \end{cases} \quad (14)$$

Where
PSO_y - is the steel output from CCMs of BOF shop No 2 in the year *y*, (tonnes);
5,040,000 - is benchmark level according to conservative assumption in Section B.1 of the PDD (tonnes of steel).

$$PE_{sp\_2,y} = k_2 \times (PSO_y + PSW_y) \times EF_{BOF,y} \quad (15)$$

Where:
PE_{sp_2y} - is the subprojects 2 emission in the year *y*, (tCO_2);
PSW_y - is the waste of steel at CCMs of BOF shop No 2 in the year *y*, (tonnes);
$EF_{BOF,y}$ - is the default IPCC CO_2 emission factor for Basic Oxygen Furnace in year *y* (tCO_2/tonne of steel).

D.1.1.3. Relevant data necessary for determining the baseline of anthropogenic emissions of greenhouse gases by sources within the project boundary, and how such data will be collected and archived:

ID number *(Please use numbers to ease cross-referencing to D.2.)*	Data variable	Source of data	Data unit	Measured (m), calculated (c), estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment
B1	BE_y	Calculated under project activity	tCO_2	C	Annually	100%	Electronic and paper	-
B2	BE_{sp_1y}	Calculated under project activity	tCO_2	C	Annually	100%	Electronic and paper	-

D.1.1.3. Relevant data necessary for determining the baseline of anthropogenic emissions of greenhouse gases by sources within the project boundary, and how such data will be collected and archived:								
B3	BE_{sp_2y}	Calculated under project activity	tCO_2	C	Annually	100%	Electronic and paper	-
B4	$BE_{elec,\ y}$	Calculated under project activity	tCO_2	C	Annually	100%	Electronic and paper	-
B5	$BE_{steam,\ y}$	Calculated under project activity	tCO_2	C	Annually	100%	Electronic and paper	-
B6	k_1	Calculated under project activity	-	C	Annually	100%	Electronic and paper	It is calculated according to formula 1. Also please see “P1” in Table D.1.1.1
B7	$BEC_{ASB,y}$	Calculated under project activity	MWh	C	Annually	100%	Electronic and paper	-
B8	$BEC_{ACS\_1,y}$	Calculated under project activity	MWh	C	Annually	100%	Electronic and paper	-
B9	$BEC_{ACS\_2,y}$	Calculated under project activity	MWh	C	Annually	100%	Electronic and paper	-
B10	$EF_{ELaver,y}$	Calculated under project activity	tCO_2/MWh	C	Annually	100%	Electronic and paper	It is calculated according to formula 7. Also please see “P13” in Table D.1.1.1
B11	POE_y	Calculated under project activity	1000 m^3 of POE	C	Annually	100%	Electronic and paper	It is calculated according to formula 2. Also please see “P2” in Table D.1.1.1
B12	$BSEC_{ASB}$	Please see Annex 2	MWh/1000 m^3 of POE	E	Fixed ex ante	100%	Electronic and paper	-

D.1.1.3. Relevant data necessary for determining the baseline of anthropogenic emissions of greenhouse gases by sources within the project boundary, and how such data will be collected and archived:									
B13	$BCAC_{ACS\_i,y}$	Calculated under project activity	1000 m^3	C	Annually	100%	Electronic and paper	*i* is equal *1* or *2*
B14	$PSEC_{ACS\_i,y}$	Calculated under project activity	MWh/1000 m^3	C	Annually	100%	Electronic and paper	*i* is equal *1* or *2*. It is calculated according to formula 6. Also please see "P16" and "P18" in Table D.1.1.1
B15	$BCAC_{total,y}$	Calculated under project activity	1000 m^3	C	Annually	100%	Electronic and paper	-
B16	$PART_{ASC\_i,y}$	Calculated under project activity	-	C	Annually	100%	Electronic and paper	*i* is equal *1* or *2*
B17	$BSCAC$	Please see Annex 2	1000 m^3/1000 m^3	E	Fixed ex ante	100%	Electronic and paper	-
B18	$PCAC_{ASB\_i,y}$	Annual report	1000 m^3	M	Continuously	100%	Electronic and paper	Also please see "P15" and "P17" in Table D.1.1.1
B19	$PCAO_{NW\_i,y}$	Annual report	1000 m^3	M	Continuously	100%	Electronic and paper	Also please see "P20" in Table D.1.1.1
B20	$BSC_{ASB,y}$	Calculated under project activity	GJ	C	Annually	100%	Electronic and paper	-
B21	$BSC_{ACS\_1,y}$	Calculated under project activity	GJ	C	Annually	100%	Electronic and paper	-
B22	$EF_{steam,y}$	Calculated under project activity	tCO_2/GJ	C	Annually	100%	Electronic and paper	It is calculated according to formula 13. Also please see "P32" in Table D.1.1.1
B23	$BSSC_{ASB}$	Please see Annex 2	GJ/1000 m^3 of POE	E	Fixed ex ante	100%	Electronic and paper	-

D.1.1.3. Relevant data necessary for determining the baseline of anthropogenic emissions of greenhouse gases by sources within the project boundary, and how such data will be collected and archived:

B24	$PSSC_{ACS\_1,y}$	Calculated under project activity	GJ/1000 m^3	C	Annually	100%	Electronic and paper	It is calculated according to formula 12. Also please see "P31" in Table D.1.1.1
B25	k_2	Calculated under project activity	-	C	Annually	100%	Electronic and paper	It is calculated according to formula 14. Also please see "P36" in Table D.1.1.1
B26	PSO_y	Annual report	tonnes	M	Continuously	100%	Electronic and paper	Also please see "P37" in Table D.1.1.1
B27	$BSWS$	Please see Annex 2	kg/tonnes of steel output	E	Fixed ex ante	100%	Electronic and paper	-
B28	$EF_{BOF,y}$	IPCC	tCO_2/tonne	E	Fixed ex ante	100%	Electronic and paper	Guidelines for National Greenhouse Gas Inventories, Volume 3: Industrial Processes and Product Use, Chapter 4: Metal Industry Emissions, IPCC, 2006

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

The annual baseline emissions (BE_y) are calculated as follows:

$$BE_y = \sum_{i=1}^{2} BE_{sp\_i,y} \qquad (16)$$

Where:

BE_y - are the baseline emissions in the year *y*, (tCO_2);

$BE_{sp\_i,y}$ - are the annual baseline emissions of subproject 1 and 2 in the year *y*, (tCO_2);

The annual baseline emissions of subproject 1 are:

$$BE_{sp\_1y} = BE_{elec,\ y} + BE_{steam,\ y} \qquad (17)$$

Where:

$BE_{elec,\ y}$ - are the baseline emissions of subproject 1 associated with electricity consumption at Oxygen shop in the year *y*, (tCO_2);

$BE_{steam,\ y}$ - are the baseline emissions of subproject 1 associated with steam consumption at Oxygen shop in the year *y*, (tCO_2);

$BE_{elec,\ y}$ is calculated as follows:

$$BE_{elec,\ y} = k_1 \times (BEC_{ASB,y} + BEC_{ACS\_1,\ y} + BEC_{ACS\_2,\ y}) \times EF_{ELaver,y} \qquad (18)$$

Where:

k_1 - is the coefficient of reduction for subproject 1. It is calculated according to formula 1;

$BEC_{ASB,y}$ - is total baseline electricity consumption at the ASB-1 and ASB -2 in the year *y* (MWh);

$BEC_{ACS\_1,y}$ - is total baseline electricity consumption at the ACS-1 in the year *y* (MWh);

$BEC_{ACS\_2,y}$ - is total baseline electricity consumption at the ACS-2 in the year *y* (MWh);

$EF_{ELaver,y}$ - is the weighted average CO_2 emission factor for electricity consumption, (tCO_2/MWh). It is calculated according to formula 7.

$BEC_{ASB,y}$ is calculated as follows:

$$BEC_{ASB,\ y} = POE_y \times BSEC_{ASB} \qquad (19)$$

Where:

POE_y - is the air separation gases production of the process oxygen equivalent (POE) at the Oxygen shop in year *y* (1000 m^3 of POE). It is calculated according to formula 2;

$BSEC_{ASB}$ - is the baseline specific electricity consumption at ASB-1 and ASB -2 (MWh/1000 m^3 of POE). It is an ex-ante fixed value, please see Annex 2.

$BEC_{ACS\_1,y}$ and $BEC_{ACS\_2,y}$ are calculated as follows:

$$BEC_{ACS\_i,y} = BCAC_{ACS\_i,y} \times PSEC_{ACS\_i,y} \qquad (20)$$

Where:

$BCAC_{ACS\_i,y}$ - is the baseline compressed air consumption at the ACS-1 or ACS-2 in year *y* (1000 m^3);

$PSEC_{ACS\_i,y}$ - is the specific electricity consumption for air compression at the ACS-1 or ACS-2 in the year *y* (MWh/1000 m^3). It is calculated according to formula 6;

ACS_i - is the ACS-1 or ACS-2.

$BCAC_{ACS\_i,y}$ is calculated as follows:

$$BCAC_{ACS\_i,y} = BCAC_{total,y} \times PART_{ACS\_i,y} \qquad (21)$$

Where:

$BCAC_{total,y}$ - is the baseline total compressed air consumption for air separation gases production production in year *y* (1000 m^3);

$PART_{ACS\_i,y}$ - is the part of compressed air consumption at ACS in the year *y* (fraction);

i - is the ACS-1 or ACS-2.

$BCAC_{total,y}$ is calculated as follows:

$$BCAC_{total,y} = POE_y \times BSCAC \qquad (22)$$

Where:

$BSCAC$ - is the baseline specific compressed air consumption at the Oxygen shop for air separation (m^3 of compressed air / m^3 of POE). It is an ex-ante fixed value, please see Annex 2.

$PART_{ACS\_i,y}$ is obtained as:

$$PART_{ACS\_i} = (PCAC_{ASB\_i,y} + PCAO_{NW\_i,y}) / \sum_{i=1}^{2} (PCAC_{ASB\_i,y} + PCAO_{NW\_i,y}) \qquad (23)$$

Where:

$PCAC_{ASB\_i,y}$ - is the compressed air consumption at ASB-1 or ASB-2 in year *y* (1000 m^3);

$PCAO_{NW\_i,y}$ - is the compressed air output into the network of NLMK from ACS-1 or ACS-2 in year *y* (1000 m^3);

i - is equal *1* or *2*.

$BE_{steam,y}$ is calculated as follows:

$$BE_{steam,y} = k_1 \times (BSC_{ASB,y} + BSC_{ACS\_1,y}) \times EF_{steam,y} \qquad (24)$$

Where:

$BSC_{ASB,y}$ - is baseline total steam consumption at ASB-1 and ASB-2 in the year *y* (GJ);

BSC_{ACS_1y} - is the baseline steam consumption for air compression at the ACS-1 in the year *y* (GJ);

$EF_{steam,y}$ - is the CO_2 emission factor for steam (heat) consumption (tCO_2/GJ). It is calculated according to formula 13.

$BSC_{ASB,y}$ is calculated as follows:

$$BSC_{ASB,y} = POE_y \times BSSC_{ASB} \qquad (25)$$

Where:

$BSSC_{ASB}$ - is the baseline specific steam consumption at ASB-1 and ASB-2 (GJ/1000 m^3 of POE). It is an ex-ante fixed value, please see Annex 2.

BSC_{ACS_1y} is calculated as follows:

$$BSC_{ACS\_1y} = BCAC_{ACS\_1y} \times PSSC_{ACS\_1y} \qquad (26)$$

Where:

$BCAC_{ACS\_1y}$ - is the baseline compressed air consumption at the ASC-1 in year *y* (1000 m^3). It is calculated according to formula 21.

$PSSC_{ACS\_1y}$ - is the specific steam consumption for air compression at the ACS-1 in the year *y* (GJ/1000 m^3). It is calculated according to formula 12.

The annual baseline emissions of subproject 2 are:

$$BE_{sp\_2,y} = k_2 \times PSO_y \times (1 + BSWS/1000) \times EF_{BOF,y} \quad (27)$$

Where:

k_2 - is the coefficient of reduction for subproject 2. It is calculated according to formula 14;

BE_{sp_2y} - is the baseline emission of subprojects 2 in the year *y*, (tCO_2);

PSO_y - is the steel output from CCMs No 5-7 and 9 of BOF shop No 2 in the year *y*, (tonnes);

$BSWS$ - is the specific waste of steel at CCMs of BOF shop No 2 in baseline, (kg/tonnes of steel output). It is an ex-ante fixed value, see Annex 2;

$EF_{BOF,y}$ - is the default IPCC CO_2 emission factor for Basic Oxygen Furnace in year *y* (tCO_2/tonne of steel).

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

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

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

Not applicable

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

Not applicable

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

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

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

Not applicable

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

Not applicable

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

$$ER_y = BE_y - PE_y \quad (26)$$

Where:

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

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

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

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

The main relevant Russian Federation environmental regulations:

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

According to national requirements, emissions connected with the subproject operation have to be measured once a year or once every three years. Frequency of measuring is described in the Volume of Maximum Allowable Emissions approved by Rostekhnadzor RF (Russian Federal Service for Ecological, Technical and Atomic Supervision) and Rospotrebnadzor (Federal Service on Surveillance for Consumer rights protection and human well-being). The Control of emission sources schedule is approved by Rostekhnadzor annually. NLMK will systematically collect pollution data that may have negative impact on the local environment. The accredited physical-chemical laboratory of NLMK and a special licensed entity measure emission from sources at NLMK. Data collection and archiving is done by Environmental Protection department. Collected and archived data will be stored for more than five years in hardcopy and electronically.

NLMK has ISO 14000:2004 certificate.

D.2. Quality control (QC) and quality assurance (QA) procedures undertaken for data monitored:		
Data *(Indicate table and ID number)*	Uncertainty level of data (high/medium/low)	Explain QA/QC procedures planned for these data, or why such procedures are not necessary.
P14, P19	low	The electricity consumption is determined by standardized electricity meters. The data from meters are automatically and regularly transferred to the automatic system of the supervisory control "Energo" and achieved. Energy Saving Centre will extract them from this system, treat and achieve them for monitoring purposes.
P15, P17, P19, B18, B19	low	The compressed air consumption and output is determined by gas flow meters. The gas flow meter to be installed will provide necessary inaccuracy. This type of meter is based on the method of variable differential pressure on restriction according to GOST R 8.586-2005. The data from meters are automatically and regularly transferred to the automatic system of the supervisory control "Energo" and achieved. Energy Saving Centre will extract them from this system, treat and achieve them for monitoring purposes.

D.2. Quality control (QC) and quality assurance (QA) procedures undertaken for data monitored:		
P30, P33	low	The steam consumption and output is determined by gas flow meters. The gas flow meter to be installed will provide necessary inaccuracy. This type of meter is based on the method of variable differential pressure on restriction according to GOST R 8.586-2005. The data from meters are automatically and regularly transferred to the automatic system of the supervisory control “Energo” and achieved. Energy Saving Centre will extract them from this system, treat and achieve them for monitoring purposes.
P3, P5, P7	low	The nitrogen, process and tonnage oxygen production are determined by gas flow meters. The gas flow meter to be installed will provide necessary inaccuracy. This type of meter is based on the method of variable differential pressure on restriction according to GOST R 8.586-2005. The data from meters are automatically and regularly transferred to the automatic system of the supervisory control “Energo” and achieved. Energy Saving Centre will extract them from this system, treat and achieve them for monitoring purposes.
P37, B26	low	The steel output is measured by a weighing machine of the information-measuring system of metal tracking (“SSM-3”). The data is automatically treated and achieved into the system. The system is certificated by Federal Agency for Technical Regulation and Metrology and registered in the State Register of Measuring. BOF shop No 2 will extract data from this system and transferred them to the automatic system of the supervisory control “Energo” in the electronic form. Energy Saving Centre will extract them from this system, treat and achieve them for monitoring purposes.
P38	low	The waste of steel is automatically calculated into SSM-3 based on measured length of slab clippings. BOF shop No 2 will extract data from this system and transferred them to Energy Saving Centre. It treats and achieves data for monitoring purposes.

Internal QC and QA procedure

The data was automatically or manually (by the personal of departments) transferred to the automatic system of the supervisory control "Energo". The "Regulation of interaction departments in operation the automatic system of the supervisory control "Energo" (hereafter – the Regulation) approved by Order of the President of NLMK» No 242 dd. 25.03.2011 regulates this procedure at the NLMK. The Regulation is defined the order and the frequency of internal audits and control measures for all measuring parameters at the NLMK including project and baseline parameters of the proposed project.

Also Balance Energy Commission of NLMK (“Provision for Balance Energy Commission of OJSC “NLMK” approved by Order of the President of NLMK» No 242 dd. 25.03.2011) considers every month reports of NLMK departments and corrects data if necessary.

Appendix 5 "Methodology for adjusting the data in the automatic system of the supervisory control Energo" for planned and emergency shutdowns of measuring energy resources and power" of the Regulation is defined the troubleshooting procedures for all measuring parameters at the NLMK including project and baseline parameters of the proposed project.

Energy Saving Centre will be kept all data in the electronic and paper form for monitoring purposes.

Calibration procedure

Calibration of the metering devices is made in accordance with the calibration schedule. Supervision of calibration is performed by the Central metrological laboratory of NLMK (CML). Usually the metering devices for internal accounting are calibrated by the CML. The CML is accredited in accordance with the national standards and regulations in force.

In accordance with national rules the measuring devices for commercial accounting are calibrated by an independent entity which has a state licence. For proposed project they are steel output and waste of steel measurement.

Original of the metering device certificate is kept at the shop where the metering device is installed. For monitoring purposes the copies of certificates will be kept at Energy Saving Centre.

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

Division of responsibilities for Monitoring Plan implementation and Monitoring Report preparation is presented in the Table D.3.1.

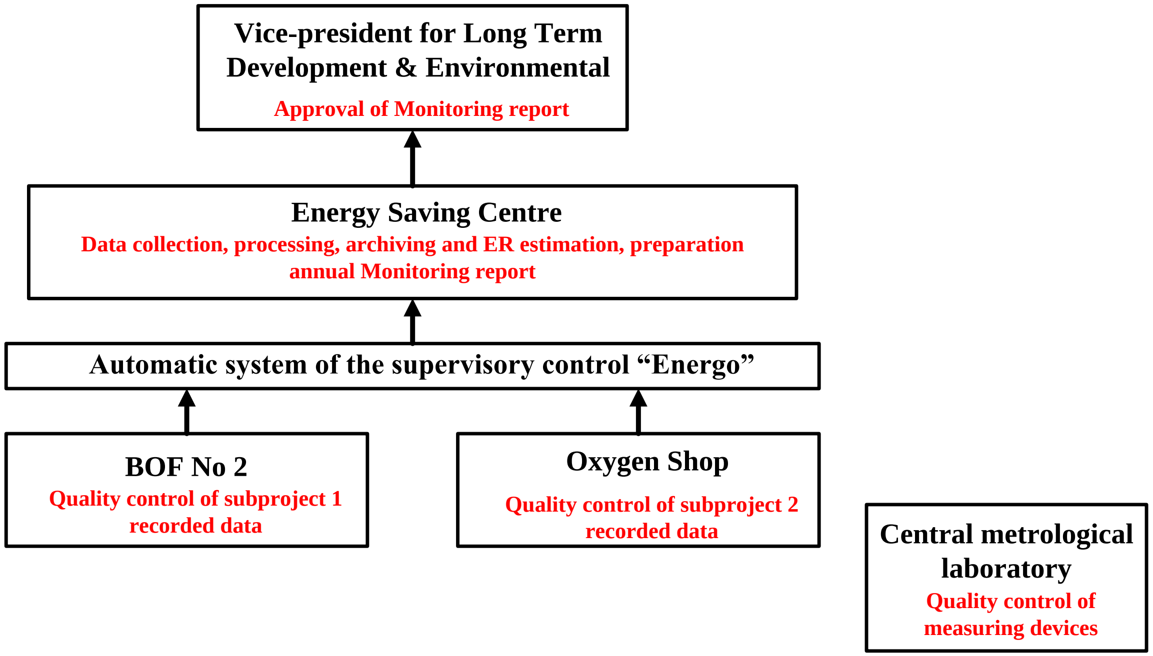
Table D.3.1: Division of responsibilities for Monitoring Plan implementation and Monitoring Report preparation

N	Responsible	Task
1	NLMK: • Central metrological laboratory; • Oxygen Shop; • BOF Shop No 2; • Energy Saving Centre • Vice-president for Long Term Development & Environmental	Quality control of measuring devices; Quality control of the subproject 1 recorded data; Quality control of the subproject 2 recorded data; Collection, data processing, archiving, and preparation of Monitoring report; Approval of Monitoring report
3	Global Carbon BV	Staff training on monitoring procedures and reporting;

N	Responsible	Task
		ERU calculation and preparation of annual monitoring report

The scheme of the operational and management structure in implementing the monitoring plan is presented in Figure D.3.1.

Figure D.3.1: The organisational structure of the Monitoring plan implementation



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

Name of person/entity determining the monitoring plan:

- OJSC "NLMK",

OJSC “NLMK” is a project participant. The contact information is presented in Annex 1.

- Global Carbon BV,

Global Carbon BV is a project participant. The contact information is presented in Annex 1.

SECTION E. Estimation of greenhouse gas emission reductions

E.1. Estimated project emissions:

Subproject 1: Construction of new air separation plants at the Oxygen shop

The initial data after subproject 1 implementation for 2008-2010 are presented in Table E.1.1.

Table E.1.1: Initial data of subproject 1

Parameter	Unit	2008[47]	2009	2010
Compressed air production and consumption				
Total compressed air output into network from ACS-1	1000 m^3	180,141	503,889	596,150
Total compressed air output into network from ACS-2	1000 m^3	404,729	849,449	826,258
Compressed air consumption at ASPs of ASB-1	1000 m^3	1,986,321	5,287,623	5,095,720
Compressed air consumption at ASPs of ASB-2	1000 m^3	1,563,394	4,467,614	5,880,685
Part of compressed air consumption at ASPs of ASB-1	-	**0.560**	**0.542**	**0.464**
Part of compressed air consumption at ASPs of ASB-2	-	**0.440**	**0.458**	**0.536**
Electricity and steam consumption at ACS-1 for compressed air production				
Electricity consumption	MWh	44,343	70,779	56,331
Specific electricity consumption for air compression at ACS-1	**MWh/1000 m^3**	**0.020**	**0.012**	**0.010**
Steam consumption	GJ	2,296,806	6,679,914	6,831,214
Specific steam consumption for air compression at the ACS-1	**GJ/1000 m^3**	**1.060**	**1.153**	**1.200**
Electricity consumption at ACS-2 for compressed air production				
Electricity consumption	MWh	186,871	500,012	630,208
Specific electricity consumption for air compression at ACS-2	**MWh/1000 m^3**	**0.095**	**0.094**	**0.094**
Electricity and steam consumption at ASB-1 and ASB-2				
Electricity consumption	MWh	8,369	24,777	24,891
Steam consumption	GJ	59,756	301,006	282,610

Source: Data provided by NLMK

For project emission estimation of subproject 1 the actual data were used for 2008-2010, respectively, and data of 2010 – for 2011-2012. Data and calculation of the weighted average CO_2 emission factor for electricity consumption and the CO_2 emission factor for steam (heat) consumption are presented in Table Anx.2.6 (please see Annex 2).

The used data and results of calculation of emissions within the crediting period are presented in Table E.1.2.

Table E.1.2: Estimated project emissions of subproject 1 within the crediting period

Parameter	Unit	2008	2009	2010	2011	2012
Electricity and steam consumption at ACS-1 for compressed air production consumed during air separation						
Compressed air consumption at ASPs of ACS-1	1000 m^3	1,986,321	5,287,623	5,095,720	5,548,663	5,548,663
Specific electricity consumption for air compression at ACS-1	MWh/1000 m^3	0.020	0.012	0.010	0.011	0.011

[47] The first new ASP started in August 2008 therefore data for period from August to December 2008 was used

Parameter	Unit	2008	2009	2010	2011	2012
Electricity consumption	**MWh**	**40,656**	**64,621**	**50,431**	**61,362**	**61,362**
Specific steam consumption for air compression at the ACS-1	GJ/1000 m^3	1.060	1.153	1.200	1.177	1.177
Steam consumption	**GJ**	**2,105,827**	**6,098,730**	**6,115,733**	**6,529,577**	**6,529,577**
Electricity consumption at ACS-2 for compressed air production consumed during air separation						
Compressed air consumption at ASPs of ASB-2	1000 m^3	1,563,394	4,467,614	5,880,685	5,082,017	5,082,017
Specific electricity consumption for air compression at ACS-2	MWh/1000 m^3	0.0949	0.0940	0.0940	0.0940	0.0940
Electricity consumption	**MWh**	**148,442**	**420,131**	**552,570**	**477,716**	**477,716**
Electricity and steam consumption at ASB-1 and ASB-2						
Electricity consumption	**MWh**	**8,369**	**24,777**	**24,891**	**24,891**	**24,891**
Steam consumption	**GJ**	**59,756**	**301,006**	**282,610**	**282,610**	**282,610**
Project emissions calculation						
Total electricity consumption	**MWh**	**197,468**	**509,529**	**627,892**	**563,970**	**563,970**
Average emission factor for electricity	tCO_2/MWh	1.112	1.219	1.184	1.184	1.184
Project emission from electricity consumption	**tCO_2**	**219,598**	**621,036**	**743,358**	**667,681**	**667,681**
Total steam consumption	**GJ**	**2,165,583**	**6,399,737**	**6,398,342**	**6,812,187**	**6,812,187**
Emission factor for heat generation	tCO_2/GJ	0.176	0.192	0.193	0.193	0.193
Project emission from heat consumption	**tCO_2**	**380,065**	**1,226,326**	**1,236,400**	**1,316,371**	**1,316,371**
Annual project emission	**tCO_2**	**599,663**	**1,847,362**	**1,979,758**	**1,984,052**	**1,984,052**
Total project emission for 2008-2012	**tCO_2**	**8,394,887**				

Project emissions of subproject 1 for the time frame after the crediting period are similar for 2010-2012. They are presented in Table E.1.3.

Table E.1.3: Estimated project emissions of subproject 1 after the crediting period

Parameter	Unit	2013	2014	2015	2016	2017	2018	2019	2020
Project emission	tCO_2	1,984,052	1,984,052	1,984,052	1,984,052	1,984,052	1,984,052	1,984,052	1,984,052
Total 2013 - 2020	tCO_2	15,872,415							

Subproject 2: Reconstruction of two continues casting machines No 6 and 7 at the Basic Oxygen Furnace shop No 2

The initial data of BOF No 2 operation (after subproject 2 implementation) for 2008-2010 are presented in Table E.1.4.

Table E.1.4: Initial data of subproject 2

Parameter		Unit	2008	2009	2010
CCM No 5	Steel output	tonnes	999,587	954,906	806,022
	Waste of steel	tonnes	17,847	11,394	8,644
CCM No 6	Steel output	tonnes	1,413,862	1,840,839	1,522,606
	Waste of steel	tonnes	15,763	23,446	15,394
CCM No 7	Steel output	tonnes	671,741	550,090	1,736,286
	Waste of steel	tonnes	10,639	5,756	22,182
CCM No 9	Steel output	tonnes	914,320	897,459	837,710

Parameter		Unit	2008	2009	2010
	Waste of steel	tonnes	5,963	6,566	4,743
Total	**Steel output**	**tonnes**	**3,999,511**	**4,243,294**	**4,902,624**
	Waste of steel	**tonnes**	**50,212**	**47,161**	**50,962**

Source: Data provided by NLMK

For project emission estimation of subproject 1 the actual data were used for 2008-2010, respectively, and data of 2010 – for 2011-2012.

The used data and results of calculation of emissions within the crediting period are presented in Table E.1.5.

Table E.1.5: Estimated project emissions of subproject 2 within the crediting period

Parameter	Unit	2008	2009	2010	2011	2012
Steel output	tonnes	3,999,511	4,243,294	4,902,624	4,902,624	4,902,624
Waste of steel	tonnes	50,212.3	47,161.3	50,962.3	50,962	50,962
Steel production	tonnes	4,049,723	4,290,456	4,953,586	4,953,586	4,953,586
Emission factor for Blast oxygen furnace steel production	tCO_2/t steel	1.46	1.46	1.46	1.46	1.46
Total project emission	**tCO_2**	**5,912,595**	**6,264,065**	**7,232,236**	**7,232,236**	**7,232,236**
Total project emission for 2008-2012	**tCO_2**	**33,873,369**				

Project emissions of subproject 2 for the time frame after the crediting period are similar for 2010-2012. They are presented in Table E.1.6.

Table E.1.6: Estimated project emissions of subproject 2 after the crediting period

Parameter	Unit	2013	2014	2015	2016	2017	2018	2019	2020
Project emission	tCO_2	7,232,236	7,232,236	7,232,236	7,232,236	7,232,236	7,232,236	7,232,236	7,232,236
Total 2013 - 2020	tCO_2	57,857,889							

The estimations of total project emissions within and after crediting period are presented in Table E.1.7 and E.1.8, respectively. This is sum of subproject 1 and 2 emissions.

Table E.1.7: Estimated total project emission within the crediting period

Parameter	Unit	2008	2009	2010	2011	2012
Project emissions	tCO_2	6,512,259	8,111,427	9,211,994	9,216,288	9,216,288
Total 2008 - 2012	tCO_2	42,268,256				

Table E.1.8: Estimated total project emission after the crediting period

Parameter	Unit	2013	2014	2015	2016	2017	2018	2019	2020
Project emission	tCO_2	9,216,288	9,216,288	9,216,288	9,216,288	9,216,288	9,216,288	9,216,288	9,216,288
Total 201 -2020	tCO_2	73,730,304							

E.2. Estimated leakage:

Not applicable.

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

Table E.3.1: Estimated total project emission within the crediting period

Parameter	Unit	2008	2009	2010	2011	2012
Project emissions	tCO_2	6,512,259	8,111,427	9,211,994	9,216,288	9,216,288
Total 2008 - 2012	tCO_2	42,268,256				

Table E.3.2: Estimated total project emission after the crediting period

Parameter	Unit	2013	2014	2015	2016	2017	2018	2019	2020
Project emission	tCO_2	9,216,288	9,216,288	9,216,288	9,216,288	9,216,288	9,216,288	9,216,288	9,216,288
Total 201 -2020	tCO_2	73,730,304							

E.4. Estimated baseline emissions:

Subproject 1: Construction of new air separation plants at the Oxygen shop

The initial data after subproject 1 implementation for 2008-2010 are presented in Table E.4.1.

Table E.4.1: Initial data after subproject 1 implementation

Parameter	Unit	2008[48]	2009	2010
Air separation gases production				
Process oxygen production (95%)	1000 m^3	241,783	938,962	1,073,944
Conversion factor from the $m^3$of process oxygen to the POE	$m^3$of PO/$m^3$of POE	1.000	1.000	1.000
Tonnage oxygen production (99.5%)	1000 m^3	303,352	651,567	697,824
Conversion factor from the $m^3$of tonnage oxygen to the POE	$m^3$of TO/$m^3$of POE	1.640	1.640	1.640
Nitrogen production (99.5-99.9%)	1000 m^3	469,917	1,447,214	1,388,458
Conversion factor from the $m^3$of nitrogen to the POE	$m^3$of N_2/$m^3$of POE	0.169	0.169	0.169
Total process oxygen equivalent production	**1000 $m^3$of POE**	**818,696**	**2,252,112**	**2,453,024**

For baseline emission estimation of subproject 1 the actual data were used for 2008-2010, respectively, and data of 2010 – for 2011-2012.

The used data and results of calculation of emissions within the crediting period are presented in Table E.4.2.

[48] The first new ASP started in August 2008 therefore data for period from August to December 2008 was used

Table E.4.2: Estimated baseline emissions of subproject 1 within the crediting period

Parameter	Unit	2008	2009	2010	2011	2012
Air separation gases production	1000 m^3 of POE	818,696	2,252,112	2,453,024	2,453,024	2,453,024
Baseline specific compressed air consumption at ASB-1 and ASB-2	m^3/ m^3 of POE	4.846	4.846	4.846	4.846	4.846
Total compressed air consumption for air separation gases production	1000 m^3	3,967,709	10,914,574	11,888,270	11,888,270	11,888,270
Part of compressed air consumption at ASPs of ASB-1	-	0.560	0.542	0.464	0.522	0.522
Part of compressed air consumption at ASPs of ASB-2	-	0.440	0.458	0.536	0.478	0.478
Electricity and steam consumption at ACS-1 for compressed air production consumed during air separation						
Compressed air consumption at ASPs of ACS-1	1000 m^3	2,220,219	5,916,017	5,519,047	6,205,059	6,205,059
Specific electricity consumption for air compression at ACS-1	MWh/1000 m^3	0.020	0.012	0.010	0.011	0.011
Electricity consumption	**MWh**	**45,444**	**72,301**	**54,621**	**68,621**	**68,621**
Specific steam consumption for air compression at the ACS-1	GJ/1000 m^3	1.060	1.153	1.200	1.177	1.177
Steam consumption	**GJ**	**2,353,797**	**6,823,519**	**6,623,797**	**7,302,014**	**7,302,014**
Electricity consumption at ACS-2 for compressed air production consumed during air separation						
Compressed air consumption at ASPs of ASB-2	1000 m^3	1,747,490	4,998,557	6,369,223	6,369,223	6,369,223
Specific electricity consumption for air compression at ACS-2	MWh/1000 m^3	0.0949	0.0940	0.0940	0.0940	0.0940
Electricity consumption	**MWh**	**165,922**	**470,060**	**598,475**	**598,716**	**598,716**
Electricity and steam consumption at ASB-1 and ASB-2						
Baseline specific electricity consumption at ASB-1 and ASB-2	MWh/1000 m^3 of POE	0.0072	0.0072	0.0072	0.0072	0.0072
Electricity consumption	**MWh**	**5,911**	**16,261**	**17,711**	**17,711**	**17,711**
Baseline specific steam consumption at ASB-1 and ASB-2	GJ/1000 m^3 of POE	0.1379	0.1379	0.1379	0.1379	0.1379
Steam consumption	**GJ**	**112,938**	**310,677**	**338,392**	**338,392**	**338,392**
Baseline emissions calculation						
Total electricity consumption	**MWh**	**217,277**	**558,622**	**670,806**	**685,048**	**685,048**
Average emission factor for electricity	tCO_2/MWh	1.112	1.219	1.184	1.184	1.184
Baseline emission from electricity consumption	**tCO_2**	**241,628**	**680,872**	**794,164**	**811,025**	**811,025**
Total steam consumption	**GJ**	**2,466,736**	**7,134,195**	**6,962,190**	**7,640,406**	**7,640,406**
Emission factor for heat generation	tCO_2/GJ	0.176	0.192	0.193	0.193	0.193
Baseline emission from heat consumption	**tCO_2**	**432,918**	**1,367,064**	**1,345,357**	**1,476,414**	**1,476,414**
Annual baseline emission	**tCO_2**	**674,546**	**2,047,936**	**2,139,521**	**2,287,439**	**2,287,439**
Total baseline emission for 2008-2012	**tCO_2**	**9,436,881**				

Baseline emissions of subproject 1 for the time frame after the crediting period are similar for 2010-2012. They are presented in Table E.4.3. Data and calculation of the weighted average CO_2 emission factor for electricity consumption and the CO_2 emission factor for steam (heat) consumption are presented in Table Anx.2.6 (please see Annex 2).

Table E.4.3: Estimated baseline emissions of subproject 1 after the crediting period

Parameter	Unit	2013	2014	2015	2016	2017	2018	2019	2020
Baseline emission	tCO_2	2,287,439	2,287,439	2,287,439	2,287,439	2,287,439	2,287,439	2,287,439	2,287,439
Total 2013 - 2020	tCO_2	18,299,513							

Subproject 2: Reconstruction of two continues casting machines No 6 and 7 at the Basic Oxygen Furnace shop No 2

Table E.4.3: Estimated baseline emissions of subproject 2 within the crediting period

Parameter	Unit	2008	2009	2010	2011	2012
Steel output	tonnes	3,999,511	4,243,294	4,902,624	4,902,624	4,902,624
Baseline specific waste of steel	kg/tonnes	14.04	14.04	14.04	14.04	14.04
Waste of steel	tonnes	56,146.6	59,568.9	68,824.8	68,824.8	68,824.8
Steel production	tonnes	4,055,657	4,302,863	4,971,449	4,971,449	4,971,449
Emission factor for Blast oxygen furnace steel production	tCO_2/t steel	1.46	1.46	1.46	1.46	1.46
Total baseline emission	**tCO_2**	**5,921,259**	**6,282,181**	**7,258,315**	**7,258,315**	**7,258,315**
Total baseline emission for 2008-2012	**tCO_2**	**33,978,386**				

Baseline emissions of subproject 2 for the time frame after the crediting period are similar for 2010-2012. They are presented in Table E.4.4.

Table E.4.4: Estimated baseline emissions of subproject 2 after the crediting period

Parameter	Unit	2013	2014	2015	2016	2017	2018	2019	2020
Baseline emission	tCO_2	7,258,315	7,258,315	7,258,315	7,258,315	7,258,315	7,258,315	7,258,315	7,258,315
Total 2013 - 2020	tCO_2	58,066,523							

The estimations of total project emissions within and after crediting period are presented in Table E.4.5 and E.4.6, respectively.

Table E.4.5: Estimated total baseline emission within the crediting period

Parameter	Unit	2008	2009	2010	2011	2012
Baseline emission	tCO_2	6,595,805	8,330,117	9,397,837	9,545,755	9,545,755
Total 2008 - 2012	tCO_2	43,415,268				

Table E.4.6: Estimated total baseline emission after the crediting period

Parameter	Unit	2013	2014	2015	2016	2017	2018	2019	2020
Baseline emission	tCO_2	9,545,755	9,545,755	9,545,755	9,545,755	9,545,755	9,545,755	9,545,755	9,545,755
Total 2013 - 2020	tCO_2	76,366,036							

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

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

Reductions	Unit	2008	2009	2010	2011	2012
Annual reductions	tCO_2	83,546	218,689	185,842	329,467	329,467
Total 2008 - 2012	tCO_2	1,147,011				

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

Reductions	Unit	2013	2014	2015	2016	2017	2018	2019	2020
Annual reductions	tCO_2	329,467	329,467	329,467	329,467	329,467	329,467	329,467	329,467
Total 2008 - 2012	tCO_2	2,635,732							

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

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

Year	Estimated project emissions (tonnes of CO_2 equivalent)	Estimated leakage (tonnes of CO_2 equivalent)	Estimated baseline emissions (tonnes of CO_2 equivalent)	Estimated emission reductions (tonnes of CO_2 equivalent)
Year 2008	6,512,259	0	6,595,805	83,546
Year 2009	8,111,427	0	8,330,117	218,689
Year 2010	9,211,994	0	9,397,837	185,842
Year 2011	9,216,288	0	9,545,755	329,467
Year 2012	9,216,288	0	9,545,755	329,467
Total (tonnes of CO_2 equivalent)	42,268,256	0	43,415,268	1,147,011

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

Year	Estimated project emissions (tonnes of CO_2 equivalent)	Estimated leakage (tonnes of CO_2 equivalent)	Estimated baseline emissions (tonnes of CO_2 equivalent)	Estimated emission reductions (tonnes of CO_2 equivalent)
Year 2013	9,216,288	0	9,545,755	329,467
Year 2014	9,216,288	0	9,545,755	329,467
Year 2015	9,216,288	0	9,545,755	329,467
Year 2016	9,216,288	0	9,545,755	329,467
Year 2017	9,216,288	0	9,545,755	329,467
Year 2018	9,216,288	0	9,545,755	329,467
Year 2019	9,216,288	0	9,545,755	329,467
Year 2020	9,216,288	0	9,545,755	329,467
Total (tonnes of CO_2 equivalent)	73,730,304	0	76,366,036	2,635,732

SECTION F. Environmental impacts

F.1. Documentation on the analysis of the environmental impacts of the project, including transboundary impacts, in accordance with procedures as determined by the host Party:

The necessity of an Environmental Impact Assessment (EIA) in Russia is regulated by the Federal Law “On the Environmental Expertise” and consists of two stages: EIA (OVOS –in Russian abbreviation) and state environmental expertise (SEE). Significant changes into this procedure were made by the Law in Amendments to the Construction Code which came into force on the 1st of January 2007. This Law reduced the scope of activities subject to SEE transferred them to the so called State Expertise (SE) done in line with the Article 49 of the Construction Code of the Russian Federation. In line with the Construction code the Design Document should contain the Section “Environment Protection” (EP). Compliance with the environmental regulations (so called technical regulation in Russian on Environmental Safety) should be checked during the process of SE.

According to this law the EIA was prepared and SEE was made for each of subprojects.

Subproject 1

The subproject was realized in two stages. For each stage the EP was prepared as a separate volume of Design Document:

- Design Document. 259955-PZ. Volume 2. “Environment Protection”: “OJSC “Novolipetsk steel”. Oxygen shop. Reconstruction of Oxygen station No 1. Construction air separation plants No 4 and 5”, OJSC “Lipetsk GIPROMEZ”, 2006.
- Design Document. 259954-PZ. Volume 2. “Environment Protection”: “OJSC “Novolipetsk steel”. Oxygen shop. Reconstruction of Oxygen station No 1. Construction air separation plant No 9”, OJSC “Lipetsk GIPROMEZ”, 2006.

Technical process of air separation does not impact to the environment negatively because the products of the process are the components of air. Some pollutants are generated during construction works and there are sources of noises during operation. The project implementation provides for utilization of the pollutants and equipment for reduction of noises.

Design Documents were approved by the Federal State Institution “The Agency of state expertise across Lipetsk area” in February 2007[49] and in July 2008[50].

The main conclusion of Expert Committee is “Design Document… is corresponding to normative documents and recommended to approval”.

Subproject 2

The subproject was realized in two stages. For each stage the EP was prepared as a separate volume of Design Document:

- “Design Document. 281112-PZ. Volume 3. “OJSC “Novolipetsk steel”. Basic Oxygen Furnace shop No 2. Reconstruction of the CCM No 6”, OJSC “Lipetsk GIPROMEZ”, 2006.

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[49] Positive Conclusion on the Design Document “OJSC “Novolipetsk steel”. Oxygen shop. Reconstruction of Oxygen station No 1. Construction air separation plants No 4 and 5” by FSI “The Agency of state expertise across Lipetsk area”, dd. 12 February 2007, № 192-06-3.

[50] Positive Conclusion on the Design Document “OJSC “Novolipetsk steel”. Oxygen shop. Reconstruction of Oxygen station No 1. Construction air separation plant No 9” by FSI “The Agency of state expertise across Lipetsk area”, dd. 03 July 2007, № 82-07-3.

- "Design Document. 281391- PZ and 281589- PZ. Volume 3. "OJSC "Novolipetsk steel". Basic Oxygen Furnace shop No 2. Reconstruction of the CCM No 7", OJSC "Lipetsk GIPROMEZ", 2006.

The modern equipment is used in the subproject. As a result of the subproject implementation the concentration of ferrous oxide in fume extraction is decreased fifteen times less. And environmental conditions do not become worse.

Design Documents were approved by the Federal State Institution "The Main Agency of the State expertise" (FGU "Glavgosexpertiza" in Russian abbreviation) in June 2007[51] and in January 2008[52].

The main conclusion of Expert Committee is "Design Document… is corresponding to normative documents and recommended to approval".

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

The project implementation enables to decrease some pollutants. Nevertheless, as indicated in Section F.1, the Section "Environment Protection" of the Design Document of the each project was prepared and the Design Documents were approved by the Federal State Institution "The Main Agency of the State expertise".

[51] Positive Conclusion of State Expertise on the "Design Document. OJSC "Novolipetsk steel". Basic Oxygen Furnace shop No 2. Reconstruction of the CCM No 6" by FGU "Glavgosexpertiza", dd. 29 June 2007, № 415 - 07/GGE-4904/02

[52] Positive Conclusion of State Expertise on the "Design Document. OJSC "Novolipetsk steel". Basic Oxygen Furnace shop No 2. Reconstruction of the CCM No 7" by FGU "Glavgosexpertiza", dd. January 2008, № 028 - 08/GGE-5192/02

SECTION G. Stakeholders' comments

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

Proposed subprojects were submitted and approved by Administration of Lipetsk and other local stakeholders.

Subproject 1:

- Decree of Lipetsk Administration Head No 2745-r dd. 22/05/2006 and 29/05/2006;
- Positive sanitary-and-epidemiologic conclusion by Federal Supervision Service on Consumer Rights Protection and Human (ROSPOTREBNADZOR) across (No 48.20.01.000.T.001106.08.06 dd. 23 August 2006).

Subproject 2:

- Permission of the Administration of Lipetsk (Decree No 2246 dd. 15 November 2006);
- Positive conclusions from Lipetsk Center of Hygiene and Epidemiology of Federal Supervision Service on Consumer Rights Protection and Human Wellbeing (No 48.20.02.000.T.000004.01.07 dd. 11 February 2007)

The series of public hearings are not obligatory for these types of project. Nevertheless NLMK published the project information on the NLMK website: http://www.nlmk.ru/media_centre/press_releases/.

No comments were received on the proposed projects.

Annex 1

CONTACT INFORMATION ON PROJECT PARTICIPANTS

Organisation:	OJSC "Novolipetsk Steel"
Street/P.O.Box:	Metallurgists square
Building:	2
City:	Lipetsk town
State/Region:	Russian Federation, Lipetsk area
Postal code:	398040
Country:	Russian Federation
Phone:	+7 4742 445 010
Fax:	+7 4742 441 111
E-mail:	info@nlmk.ru
URL:	www.nlmk.ru
Represented by:	
Title:	Head of Environmental Protection
Salutation:	
Last name:	Chizhikova
Middle name:	Maximovna
First name:	Valentina
Department:	
Phone (direct):	+7 4742 440 941
Fax (direct):	
Mobile:	+7 909 219 00 87
Personal e-mail:	Chizhikova_vm@nlmk.ru

Organisation:	Global Carbon BV (Ltd.)
Street/P.O.Box:	Graadt van Roggenweg 328
Building:	Building D
City:	Utrecht
State/Region:	
Postal code:	3531 AH
Country:	The Netherlands
Phone:	+31 30 298 2310
Fax:	+31 70 891 0791
E-mail:	info@global-carbon.com
URL:	www.global-carbon.com
Represented by:	
Title:	Director
Salutation:	
Last name:	de Klerk
Middle name:	
First name:	Lennard
Department:	
Phone (direct):	+31 30 298 2310
Fax (direct):	+31 70 891 0791
Mobile:	
Personal e-mail:	focalpoint@global-carbon.com

Annex 2

BASELINE INFORMATION

Subproject 1. Construction of new air separation plants at the Oxygen shop

The main gases of air separation are oxygen and nitrogen of low pressure. Other (argon and rare gases) gases are insignificant and consequently are not considered in the proposed subproject.

The three types of ASP were operated at the Oxygen shop before the subproject implementation:

- ASPs for oxygen production;
- ASPs for nitrogen production;
- ASPs for combined oxygen and nitrogen production.

Also the ASPs were produced the two types of oxygen: process oxygen (95% of the oxygen content) and tonnage oxygen (99.5%). It means that the different energy resources are used for different air separation gases production.

After subproject implementation the new ASPs for combined oxygen and nitrogen production were put into operation. These ASPs replace two old ASPs for oxygen production (No 6 and 9) and old ASP for nitrogen production (No 8). Also the process oxygen from the new ASPs replaces some volume of tonnage oxygen from existing ASPs.

For energy efficiency analysis of ASPs operation the conversion factors for each gas of air separation are used at NLMK. These conversion factors are defined based on "The methodology for accounting of expenses and calculating the cost of products in the integrated production of air separation"[53] and approved by Director of the NLMK TEK in 2002. The values of conversion factors are presented in Table Anx.2.1.

Table Anx.2.1: The values of conversion factors

Conversion factor	Unit	Value
Process oxygen	m^3 of process oxygen equivalent (POE) / m^3 of process oxygen	1.0
Tonnage oxygen	m^3 of POE / m^3 of tonnage oxygen	1.64
Nitrogen	m^3 of POE / m^3 of nitrogen	0.169

The precommissioning works at the new ASPs were started in 2008. The data of compressed air production and consumption balance is kept since 2006. Therefore the data for 2006-2007 was used for calculation average baseline parameters. The main parameters of the Oxygen Shop before the subproject 1 implementation for 2006-2007 and its average values are presented in Table Anx.2.2.

Table Anx.2.2: The main parameters of the Oxygen Shop and its average values

Parameter	Unit	2006	2007	Average
Air separation gases production				
Process oxygen production (95%)	1000 m^3	1,036,250	1,063,448	-

[53] "The methodology for Accounting of Expenses and Calculating the Cost of Products in the Integrated Production of Air Separation", Scientific-Research Institute of Technical-Economic Research, 1975

Parameter	Unit	2006	2007	Average
Conversion factor from the m3 of process oxygen to the POE	$m^3$of POE / $m^3$of PO	1.000	1.000	-
Tonnage oxygen production (99.5%)	1000 m^3	612,341	683,218	-
Conversion factor from the m3 of tonnage oxygen to the POE	$m^3$of POE / $m^3$of TO	1.640	1.640	-
Nitrogen production (99.5-99.9%)	1000 m^3	805,574	794,517	-
Conversion factor from the m3 of nitrogen to the POE	$m^3$of POE / $m^3$of N_2	0.169	0.169	-
Total process oxygen equivalent production	1000 m^3	2,176,630	2,318,199	4,494,829
Compressed air production and consumption				
Compressed air consumption at ASPs of ASB-1	1000 m^3	4,464,173	5,214,231	-
Compressed air consumption at ASPs of ASB-2	1000 m^3	6,103,904	6,001,311	-
Total compressed air consumption for air separation gases production	1000 m^3	10,568,077	11,215,542	21,783,619
Baseline specific compressed air consumption at ASB-1 and ASB-2	**m^3/m^3 of POE**	4.855	4.838	**4.846**
Electricity and steam consumption at ASB-1 and ASB-2				
Electricity consumption	MWh	16,389	16,064	32,454
Baseline specific electricity consumption at ASB-1 and ASB-2	**MWh/1000 m^3 of POE**	0.008	0.007	**0.007**
Steam consumption	GJ	315,065	304,992	620,057
Baseline specific steam consumption at ASB-1 and ASB-2	**GJ/1000 m^3 of POE**	0.145	0.132	**0.138**

Source: Data provided by NLMK

The average values of the specific compressed air consumption at ASB-1 and ASB-2 ($BSCAC$), the specific electricity consumption at ASB-1 and ASB-2 ($BSEC_{ASB}$) and the specific steam consumption at ASB-1 and ASB-2 ($BSSC_{ASB}$) are used for calculation of the baseline and the project emissions in the formulae in Section D. They are ex-ante for period 2008-2012.

Subproject 2. Reconstruction of two continues casting machines No 6 and 7 at the Basic Oxygen Furnace shop No 2

The reconstructed CCM No 6 is started in 2008. Therefore the data for 2005-2007 was used for calculation average baseline parameters. The main parameters of the CCMs (excluding CCM No 8) of BOF shop No 2 before implementation of subproject 2 for 2005-2007 and its average values are presented in Table Anx.2.3.

Table Anx.2.3: The main parameters of the CCMs of BOF shop No 2 and its average values

Parameter		Unit	2005	2006	2007	Average
CCM No 5	Steel output	tonnes	1,045,539	1,137,753	1,269,373	
	Waste of steel	tonnes	15,518	20,007	21,937	
CCM No 6	Steel output	tonnes	952,201	1,066,294	481,545	
	Waste of steel	tonnes	12,437	15,705	5,989	
CCM No 7	Steel output	tonnes	1,025,349	1,096,120	1,247,456	
	Waste of steel	tonnes	13,096	17,273	19,296	
CCM No 9	Steel output	tonnes	832,141	989,721	1,063,320	
	Waste of steel	tonnes	11,279	11,432	7,394	

Parameter		Unit	2005	2006	2007	Average
Total	**Steel output**	**tonnes**	**3,855,229**	**4,289,888**	**4,061,694**	**12,206,811**
	Waste of steel	**tonnes**	**52,330**	**64,418**	**54,616**	**171,364**
Baseline specific waste of steel		**kg/tonnes**	**13.57**	**15.02**	**13.45**	**14.04**

Source: Data provided by NLMK

The average value of the specific waste of steel ($BSWS$) is used for calculation of the baseline of subproject 2 emissions in the formulae in Section D. They are ex-ante for period 2008-2012.

Default fuel emission factors

The default fuel emission factors are presented in the Table Anx.2.4.

Table Anx.2.4: The default fuel emission factors

Fuel type	Default emission factor[54]
	tCO_2/GJ
Natural gas	0.0561
Heavy fuel oil	0.0774
Coke oven gas	0.0444
Blast furnace gas	0.2596

The default IPCC CO_2 emission factor for Basic Oxygen Furnace steel production is presented in the Table Anx.2.5.

Table Anx.2.5: The default fuel emission factors

Emission factor	Unit	Default emission factor[55]
Basic Oxygen Furnace steel production	tCO_2/tonne of steel	1.46

Standardized electricity grid emission factor

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

Standardized CO_2 emission factors were elaborated for Russian power systems in the Study commissioned by "Carbon Trade and Finance SICAR S.A." [56.] This Study was based on the latest approved CDM "Tool to calculate the emission factor for an electricity system" available at the time of the Study development (version 01.1). The Study was verified by Bureau Veritas Certification (BVC) in 2008. BVC confirmed an applicability of the Tool and the emission factor calculation accuracy.

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[54] Guidelines for National Greenhouse Gas Inventories, Volume 2: Energy, Chapter 2: Stationary Combustion (corrected chapter as of April 2007), IPCC, 2006

[55] Guidelines for National Greenhouse Gas Inventories, Volume 3: Industrial Processes and Product Use, Chapter 4: Metal Industry Emissions, IPCC, 2006

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

According to the Tool, operating, build and combined margin emission factors were calculated for seven regional Russian electricity systems (RESs). Within these RESs no major transmission constraints exist, while they operate at the same time relatively "independently" from each other (i.e. electricity exchange between regional systems is rather insignificant).

For the PDD at hand, emission related characteristics of the relevant regional electricity system, RES "Center", the largest unified power system of the national energy system of Russia, were taken into account.

The Study recommends using of the Operating Margin Emission Factor for the case of reduction of power consumption from the electricity grid. The Operating Margin Emission Factor of RES "Centre" was defined using Simple OM method. The value of this factor is used as the CO_2 emission factor for electricity consumption for calculation project and baseline emissions and is presented below:

$EF_{grid} = EF_{CO2,ELEC}$ = 0.526 tCO_2/MWh.

This is ex-ante for period 2008-2012.

Calculation emission factors for electricity and heat consumption

These emission factors were calculated according to formulae 5 and 11 (please Section D). The initial data and results of calculation are presented in Table Anx.2.6.

Table Anx.2.6: The initial data and results of emission factors calculation

Parameter	Unit	2008	2009	2010
Electricity output	**MWh**	**2,001,374**	**1,870,000**	**2,041,321**
NLMK's CHPP heat output	**Gcal**	**3,407,723**	**3,301,895**	**3,444,817**
	GJ	**14,268,135**	**13,825,032**	**14,423,448**
Fuel consumption for electricity generation				
Natural gas consumption for electricity generation	t.c.e	183,610	238,731	249,199
Blast furnace gas consumption for electricity generation	t.c.e	430,576	434,533	475,072
Coke oven gas consumption for electricity generation	t.c.e	289,818	145,417	159,820
Heavy fuel oil consumption for electricity generation	t.c.e	1,921	4,643	1,069
Natural gas consumption for electricity generation	GJ	5,381,412	6,996,955	7,303,764
Blast furnace gas consumption for electricity generation	GJ	12,619,753	12,735,725	13,923,897
Coke oven gas consumption for electricity generation	GJ	8,494,288	4,262,021	4,684,161
Heavy fuel oil consumption for electricity generation	GJ	56,301	136,086	31,340
Fuel consumption for heat generation				
Natural gas consumption for heat generation	t.c.e	128,020	171,391	166,101
Blast furnace gas consumption for heat generation	t.c.e	269,720	292,913	312,075
Coke oven gas consumption for heat generation	t.c.e	179,889	97,152	102,264
Heavy fuel oil consumption for heat generation	t.c.e	1,828	3,898	1,255
Natural gas consumption for heat generation	GJ	3,752,132	5,023,303	4,868,241
Blast furnace gas consumption for heat generation	GJ	7,905,220	8,584,980	9,146,609
Coke oven gas consumption for heat generation	GJ	5,272,360	2,847,423	2,997,255

Parameter	Unit	2008	2009	2010
Heavy fuel oil consumption for heat generation	GJ	53,564	114,255	36,794
Electricity from grid				
Electricity consumption from grid	**MWh**	**2,966,975**	**2,344,462**	**2,771,943**
Grid electricity emission factor	tCO_2/MWh	0.526	0.526	0.526
NLMK CHPP				
Emission factor for electricity				
Natural gas consumption for electricity generation	GJ	5,381,412	6,996,955	7,303,764
Natural gas emission factor	tCO_2/GJ	0.0561	0.0561	0.0561
Emission from natural gas burning	**tCO_2**	**301,897**	**392,529**	**409,741**
Heavy fuel oil consumption for electricity generation	GJ	56,301	136,086	31,340
Heavy fuel oil emission factor	tCO_2/GJ	0.0774	0.0774	0.0774
Emission from heavy fuel oil burning	**tCO_2**	**4,358**	**10,533**	**2,426**
Coke oven gas consumption for electricity generation	GJ	8,494,288	4,262,021	4,684,161
Coke oven gas emission factor	tCO_2/GJ	0.0444	0.0444	0.0444
Emission from coke oven gas burning	**tCO_2**	**377,146**	**189,234**	**207,977**
Blast furnace gas consumption for electricity generation	GJ	12,619,753	12,735,725	13,923,897
Blast furnace gas emission factor	tCO_2/GJ	0.2600	0.2600	0.2600
Emission from blast furnace gas burning	**tCO_2**	**3,281,136**	**3,311,288**	**3,620,213**
Total emission associated with electricity generation	tCO_2	3,964,537	3,903,584	4,240,357
Electricity output	MWh	2,001,374	1,870,000	2,041,321
CO_2 emission factor for electricity generation at NLMK CHPP	tCO_2/MWh	1.981	2.087	2.077
Part of electricity consumption from the grid at NLMK	-	0.597	0.556	0.576
Part of electricity consumption from the CHPP at NLMK	-	0.403	0.444	0.424
Average emission factor for electricity	**tCO_2/MWh**	**1.112**	**1.219**	**1.184**
Emission factor for heat				
Natural gas consumption for heat generation	GJ	3,752,132	5,023,303	4,868,241
Natural gas emission factor	tCO_2/GJ	0.0561	0.0561	0.0561
Emission from natural gas burning	**tCO_2**	**210,495**	**281,807**	**273,108**
Heavy fuel oil consumption for heat generation	GJ	53,564	114,255	36,794
Heavy fuel oil emission factor	tCO_2/GJ	0.0774	0.0774	0.0774
Emission from heavy fuel oil burning	**tCO_2**	**4,146**	**8,843**	**2,848**
Coke oven gas consumption for heat generation	GJ	5,272,360	2,847,423	2,997,255
Coke oven gas emission factor	tCO_2/GJ	0.0444	0.0444	0.0444
Emission from coke oven gas burning	**tCO_2**	**234,093**	**126,426**	**133,078**
Blast furnace gas consumption for heat generation	GJ	7,905,220	8,584,980	9,146,609
Blast furnace gas emission factor	tCO_2/GJ	0.2600	0.2600	0.2600
Emission from blast furnace gas burning	**tCO_2**	**2,055,357**	**2,232,095**	**2,378,118**
Total emission associated with heat	tCO_2	2,504,090	2,649,171	2,787,153
NLMK's CHPP heat output	GJ	14,268,135	13,825,032	14,423,448
Emission factor for heat generation	**tCO_2/GJ**	**0.176**	**0.192**	**0.193**

Summary table of baseline key elements used in calculation of baseline emissions is presented below.

Table Anx.2.7: The baseline key elements used in calculation of baseline emissions

Parameter (variable) name	Conventional sign	Data source	Unit	Value
Weighted average CO_2 emission factor for electricity consumption	$EF_{ELaver,y}$	Table Anx.2.6 of Annex 2	tCO_2/MWh	1.112 – for 2008, 1.219 – for 2009, 1.184 – for 2010-2012
Process oxygen production at the Oxygen shop	PO_y	The actual data for 2008-2010 is used. For 2011-2012 the data of 2010 is used. Please see Section E.1, Table E.1.1.	1000 m^3 of process oxygen	241,783 – for 2008, 938,962 – for 2009, 1,073,944 – for 2010-2012
Conversion factor from the m^3 of process oxygen to the POE	$KOEF_{PO}$	Table Anx.2.1 of Annex 2	m^3 of POE / m^3 of process oxygen	1.0
Tonnage oxygen production at the Oxygen shop	TO_y	The actual data for 2008-2010 is used. For 2011-2012 the data of 2010 is used. Please see Section E.1, Table E.1.1.	1000 m^3 of tonnage oxygen	303,352 – for 2008, 651,567 – for 2009, 697,824 – for 2010-2012
Conversion factor from the m^3 of tonnage oxygen to the POE	$KOEF_{TO}$	Table Anx.2.1 of Annex 2	m^3 of POE / m^3 of tonnage oxygen	1.64
Nitrogen production at the Oxygen shop	N_y	The actual data for 2008-2010 is used. For 2011-2012 the data of 2010 is used. Please see Section E.1, Table E.1.1.	1000 m^3 of nitrogen	469,917 – for 2008, 1,447,214 – for 2009, 1,388,458 – for 2010-2012
Conversion factor from the m^3 of nitrogen to the POE	$KOEF_N$	Table Anx.2.1 of Annex 2	m^3 of POE / m^3 of nitrogen	0.169
Baseline specific electricity consumption at ASB-1 and ASB-2	$BSEC_{ASB}$	Table Anx.2.2 of Annex 2	MWh/1000 m^3 of POE	0.0072
Specific electricity consumption for air compression at the ACS-1 or ACS-2	$PSEC_{ACS\_i,y}$	The actual data for 2008-2010 is used for calculation. For 2011-2012 the data of 2010 is used. Please see Section E.1, Table E.1.2.	MWh/1000 m^3 of compressed air	ACS-1: 0.020 – for 2008, 0.012 – for 2009, 0.010 – for 2010 0.011 – for 2011-2012 ACS-2: 0.095 – for 2008, 0.094 – for 2009, 0.094 – for 2010-2012
Baseline specific compressed air consumption at the Oxygen shop for air separation	$BSCAC$	Table Anx.2.2 of Annex 2	m^3 of compressed air/ m^3 of POE	4.846
Compressed air consumption at ASB-1 or ASB-2	$PCAC_{ASB\_i,y}$	The actual data for 2008-2010 is used. For 2011-2012 the data of 2010 is used. Please see Section E.1, Table E.1.2.	1000 m^3	ASPs of ASB-1: 1,986,321 – for 2008, 5,287,623 – for 2009, 5,095,720 – for 2010 5,548,663 – for 2010-2012 ASPs of ASB-2:

Parameter (variable) name	Conventional sign	Data source	Unit	Value
				1,563,394 – for 2008, 4,467,614 – for 2009, 5,880,685 – for 2010 5,082,017 – for 2010-2012
Compressed air output into the network of NLMK from ACS-1 or ACS-2	$PCAO_{NW\_i,y}$	The actual data for 2008-2010 is used. For 2011-2012 the data of 2010 is used. Please see Section E.1, Table E.1.2.	1000 m^3	ACS-1: 180,141 – for 2008, 503,889 – for 2009, 596,150 – for 2010-2012 ACS-2: 404,729 – for 2008, 849,449 – for 2009, 826,258 – for 2010-2012
CO_2 emission factor for steam (heat) consumption	$EF_{steam,y}$	Table Anx.2.2 of Annex 2	tCO_2/GJ	0.176 – for 2008, 0.192 – for 2009, 0.193 – for 2010-2012
Baseline specific steam consumption at ASB-1 and ASB-2	$BSSC_{ASB}$	Table Anx.2.2 of Annex 2	GJ/1000 m^3 of POE	0.138
Specific steam consumption for air compression at the ACS-1	$PSSC_{ACS\_1y}$	The actual data for 2008-2010 is used for calculation. For 2011-2012 the data of 2010 is used. Please see Section E.1, Table E.1.2.	GJ/1000 m^3	1.060 – for 2008, 1.153 – for 2009, 1.200 – for 2010 1.177 – for 2010-2012
Steel output from CCMs of BOF shop No 2	PSO_y	The actual data for 2008-2010 is used for emission factor calculation. For 2011-2012 the emission factor in 2010 is used. Please see Section E.1, Table E.1.2.	tonnes of steel	3,999,511– for 2008, 4,243,294– for 2009, 4,902,624– for 2010-2012
The default IPCC CO_2 emission factor for Basic Oxygen Furnace	$EF_{BOF,y}$	Guidelines for National Greenhouse Gas Inventories, Volume 3: Industrial Processes and Product Use, Chapter 4: Metal Industry Emissions, IPCC, 2006	tCO_2/tonne of steel	1.46
Baseline specific waste of steel at CCMs of BOF shop No 2	$BSWS$	Table Anx.2.3 of Annex 2	kg/tonnes of steel output	14.04

Annex 3

MONITORING PLAN

See Section D for monitoring plan.