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

CONTENTS

Annexes

SECTION A. General description of the project

A.1. Title of the project:

"Implementation of energy efficiency projects at OJSC "Novolipetsk Steel", Lipetsk area, Russia".

Sectoral scope 1, 4, 9: Energy industries, Manufacturing industries, Metal production.

PDD version 3.1.

14 March 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 by 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. Reconstruction of heating furnaces No 4 and 5 at the Hot Sheet-Rolling Shop (Hot-rolling mill 2000);

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

2. Commissioning the hydrogen production installations based on steam reforming of natural gas technology (Gas Shop).

Situation existing prior to the project

Subproject 1. Reconstruction of heating furnaces No 4 and 5 at the Hot Sheet-Rolling Shop
There are five heating furnaces operating at the Hot Sheet-Rolling Shop (further in the text – HSRS) of NLMK. The steel (slabs) is heated in these furnaces before the rolling process. The heating furnaces No 1-5 were commissioned in the period from 1970-1979. The furnaces are maintained with routine and capital repairs and they can be operated further without any constraints. The fuel of the furnaces is a mixture of natural, blast furnace and coke oven gases (only natural and blast furnace gases are used as fuel at the furnaces from 2006). Some heat of exhaust gases after the furnaces is utilized in heat-recovery boilers. Also the metal structure of the furnaces is cooled using the cooling evaporation system with useful heat output into the heating system of NLMK. The steam from the heat-recovery boilers and the cooling evaporation system is saturated and has 1.3 MPa of pressure. However the consumption of the steam is less than generation, especially in a period from the spring to the autumn and the some amount of steam is released into the atmosphere.

Before the project implementation all of the furnaces had obsolete burners without a burning automatic regulation system and no effective construction of a gate system. Besides, the existing slab loading/unloading system of furnaces does not enable to use progressive technology of hot slab-delivery system in full. Therefore these furnaces have higher specific fuel consumption per tonne of steel and higher waste of steel during heating process in comparison with modern heating furnaces. The technical parameters of the furnaces at the shop before the project implementation are presented in Annex 2.

Subproject 2. Commissioning the hydrogen plant based on steam reforming of natural gas technology
Hydrogen is used in some processes of cold-rolled steel production. It is produced at the installations of two hydrogen stations by electrolysis of water. Hydrogen station No 1 consists of twelve electrolysers (type FV-500M) and hydrogen station No 2 is a sectioned installation with twelve cells (BEU-250).

In this technology the electricity and heat (steam) are consumed for hydrogen production. The technical parameters of the hydrogen stations before the project implementation are presented in Annex 2.

Baseline scenario

Baseline scenarios for all of subprojects are the continuation of a situation existing prior to the project. It means an equipment of existing installations will be maintained with routine and capital repairs and operated until 2013 at least.

NLMK is implementing an energy saving program from 2000 onwards. As result, heat consumption (including steam with 1.3 MPa of pressure) decreases. Therefore the amount of this steam released into the atmosphere is increased.

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

Project scenario

Subproject 1. Reconstruction of heating furnaces No 4 and 5 at the Hot Sheet-Rolling Shop
For the reconstruction of furnaces No 4 and 5 the new modern energy-saving measures were realized at the furnaces. As a result, the fuel consumption per tonne of steel and the slab residence time were decreased. Each of reconstructed furnaces can heat steel with less fuel consumption. Also waste of steel is decreased after the subproject implementation. It means that the steel output (steel volume after heating) is required less blast oxygen furnace (BOF) steel volume and, respectively, less expenditure of energy in comparison with baseline. However the heat output from heat-recovery boilers was reduced with the reduction of fuel

consumption. Also the cooling evaporation systems of furnaces No 4 and 5 were dismantled and heat generation was stopped. Heat amount necessary for customers supply[2] is generated at NLMK's combined heat and power plant (NLMK CHPP). Furnace No 5 was commissioned in June 2004 and Furnace No 4 – in May 2008. They be used in the first place and therefore they replaced the steel output volume of old furnaces No 4 and 5 and furnaces No 1-3 partly in comparison with baseline scenario.

Subproject 2. Commissioning the hydrogen plant based on steam reforming of natural gas technology
The new plant of hydrogen production was commissioned in December 2004. It is using the steam reforming of natural gas technology for hydrogen production. The new installations partly replace the hydrogen production at the two old hydrogen stations which use method of water electrolysis. It means that significant less electricity consumption is required for hydrogen production. However the old hydrogen stations are operated and they produce some hydrogen if the amount of hydrogen from new installations is not enough.

Brief history of the project

Subproject 1. Reconstruction of heating furnaces No 4 and 5 at the Hot Sheet-Rolling Shop
NLMK prepared the feasibility study of the reconstruction of heating furnace No 5 in 2001 and heating furnace No 4 in 2003. Technical project documentation of the reconstruction was prepared by "Heurbel" company (Belgium). "Novokramatorsky Machine Building plant" (Ukraine) and HLMK's Repair plant implemented the reconstruction of heating furnaces No 5 (for 2002-2003) and 4 (for 2003-2007).

Subproject 2. Commissioning the hydrogen plant based on steam reforming of natural gas technology
In 2004 NLMK commissioned new hydrogen plant (three lines of hydrogen production) based on steam reforming of natural gas technology. This plant is developed Haldor Topsoe A/S (Denmark). Construction works were implemented by CJSC "Kislorodmash" (Russia) for 2003-2004.

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

[2] This amount is not equal to the amount of heat generating at the heat-recovery boilers and the cooling evaporation systems of furnaces No 4 and 5 in the baseline because some amount of steam is released into the atmosphere. Please see above the description of baseline scenario.

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, 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 1. The coordinates of NLMK are 52°57'N, 39°62'E and coordinates of:

- Subproject 1 are 52°55'N, 39°63'E;
- Subproject 2 are 52°57'N, 39°64'E.

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

Subproject 1. Reconstruction of heating furnaces No 4 and 5 at the Hot Sheet-Rolling Shop
The main goals of this subproject are the increase of thermal efficiency of the furnaces and the reduction of the waste of steel. The reconstruction of the furnaces includes:

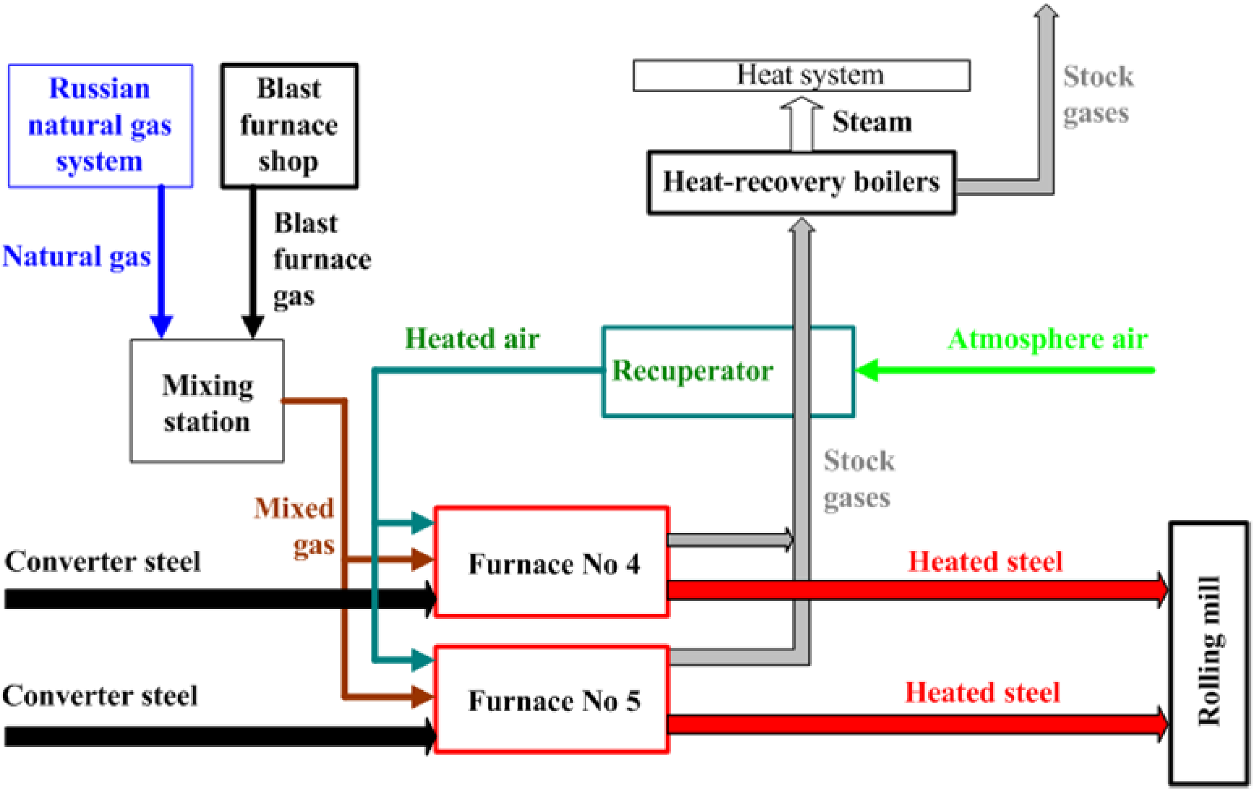
- Installation of recuperative heaters enables to utilize the heat from the exhaust gases for the input air heating. – The temperature of input air is higher than before the project implementation and, respectively, the fuel consumption is reduced because some energy is not spent for heating of inflowing air;
- Implementation of new foundations, a new thermal insulation, metal structure of the furnaces and installation of the sole hydraulic movement system. – It reduces the heat loses of furnaces through the walls, doors and roofs and decreases fuel consumption for steel heating;
- Installation of the unstressed system of the load/unload slabs to the furnaces enables to use new modern energy-saving hot load/unload of slabs technology. – The temperature of the loading slabs is higher when using hot load/unload of slabs technology and the less energy is spent for heating of slabs. However the hot slabs have less strength and the using of the previous system does not allow loading such slabs to the furnaces without any damages. Therefore slabs had less temperature and more fuel is spent for its heating;
- Replacement of burners and installation of complete automation system of fuel burning process. – The application of new burners and burning automatic system allow to use the heat of fuel more efficiently. It provides the effective heating slabs and heating process regulation with the maintenance of the slab surface temperature is not above 1290 C (a minimum of steel waste).

The actions from the second to the fourth are reduced the residence time of slabs in the furnaces. In addition it decreases the waste of steel.

The new cooling system of furnace metal structure by chemically refined water (closed cycle) was installed instead of the cooling evaporation system. The cooling evaporation systems at furnaces No 4 and 5 were demolished.

The scheme of the interaction of processes in the heating furnaces is presented in Figure A.4.2.1.

Figure A.4.2.1: The scheme of the interaction of processes in the heating furnaces



The technical parameters of the furnaces are presented in Table A.4.2.1.

Table A.4.2.1: Technical parameters of the new heating furnaces

N	Parameter	Unit	Value	
			For transformer steel	For carbon steel
1	Capacity	tonnes/h	180	320
2	Runtime factor	-	0.9	
3	Fuel	-	Mixture of natural, blast furnace and coke oven gases	
4	NCV of fuel (not less)	GJ/1000 m^3	18.4[3]	
5	Specific fuel consumption	GJ/t steel	1.35	1.24
6	Waste of steel	%	2.5	0.7

Source: Data provided by NLMK

The dates of subproject 1 implementation main stages are presented in Table A.4.2.2.

[3] Here and further "m^3" is standard cubic meter (for 20^0 C and 101,3 kPa)

Table A.4.2.2: The dates of subproject 1 implementation main stages

N	Stage	Furnace No5	Furnace No4
1	Furnace stop	August 2000	September 2003
2	Construction works	June 2002 – November 2003	September 2003 – September 2007
3	Starting-up works	November 2003 – June 2004	September 2007 – May 2008
4	Commission	June 2004	May 2008

Source: Data provided by NLMK

Subproject 2. Commissioning the hydrogen plant based on steam reforming of natural gas technology
The new hydrogen plant by «Haldor Topsoe» company production was commissioned in 2005. It includes the installation of:

- four natural gas compressors;
- one air (a Combustion Air Blower) compressor;
- water system to demineralise process water,
- desulphurization block;
- three steam reforming lines of natural gas (Saturator, HTCR (Haldor Topsoe Convection Reformer) Reformer, Shift Reactor),
- absorption block (PSA – Pressure Swing Adsorption);
- hydrogen recipients;
- control equipment.

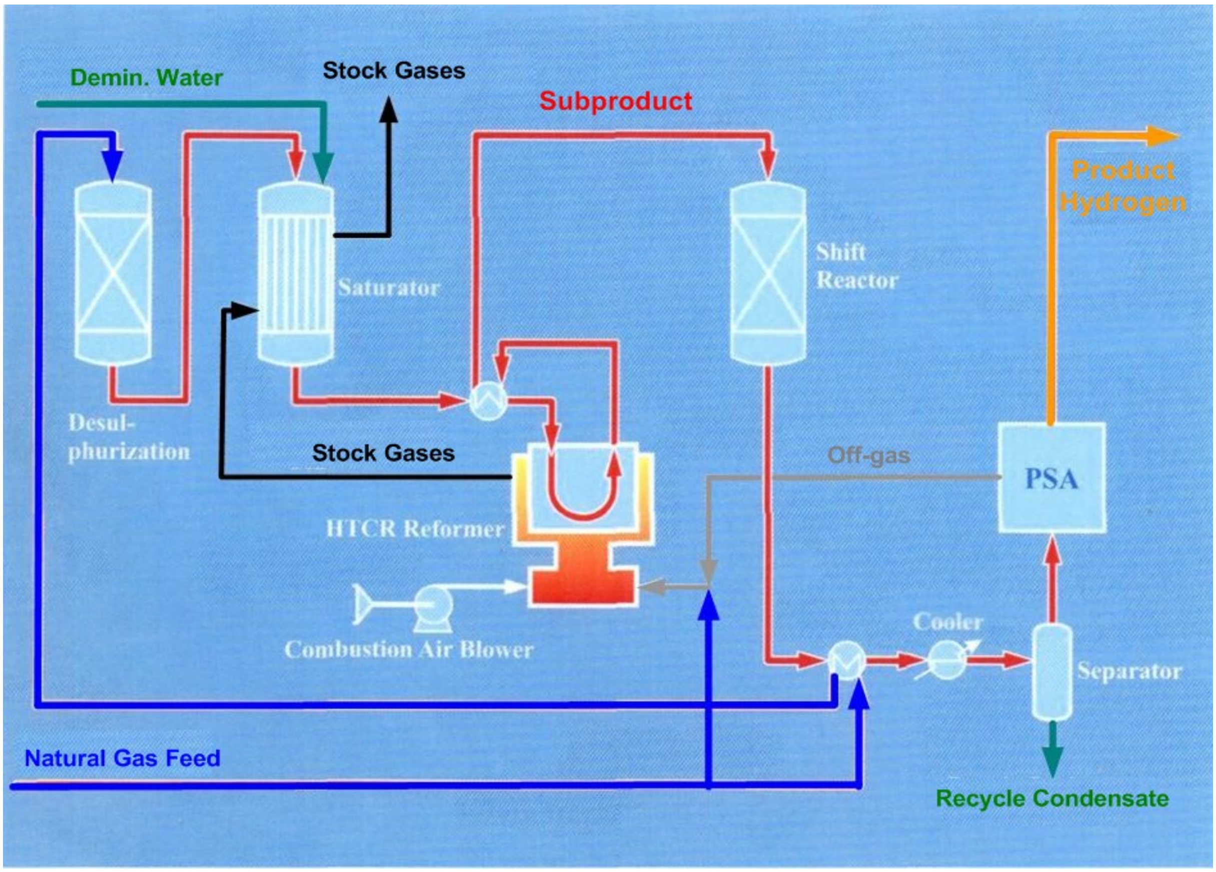
Sulphur is recovered from natural gas in the Desulphurization Block. After that natural gas is preheated up to 450 C and mixed with steam in Saturator. Obtained mixture is moved into HTCR Reformer. HTCR Reformer is a kiln with special tubes for the reforming process over a special catalyst. The main reactions are presented below:

$$CH_4 + H_2O \leftrightarrow CO + 3H_2$$
$$CO + H_2O \leftrightarrow CO_2 + H_2$$

Then reaction products are cooled (steam condensation) and separated Hydrogen is submitted to consumers and other products (off-gas) are burned with natural gas in the HTCR Reformer. In this technology the process gas and steam (from demineralised water) are heated mainly by flue gas. Therefore the thermal efficiency for reforming is increased to 80% and the export of steam is eliminated.

Hydrogen station scheme is presented in Figure A.4.2.2.

Figure A.4.2.2: Hydrogen station scheme



Source: Data provided by NLMK

The technical parameters of the hydrogen plant are presented in Table A.4.2.3.

Table A.4.2.3: Technical parameters of the hydrogen plant

N	Parameter	Unit	Value
1	Capacity (total)	m^3/h	6,000
2	Specific natural gas consumption per 1000 m^3 of hydrogen production	m^3/ 1000 m^3	407.5

Source: Data provided by NLMK

The dates of subproject 2 implementation main stages are presented in Table A.4.2.4.

Table A.4.2.4: The dates of subproject 2 implementation main stages

N	Stage	Furnace No5
1	Construction works	October 2002 – November 2004
2	Starting-up works	November 2004 – December 2004
3	Commission	December 2004

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. The necessary trainings concerning monitoring process (including the personnel certification by Roctechnadzor – Russian reviewing authority) are prescribed in the existing quality management systems at NLMK. 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 fuel and electricity consumption reduction and associated with them the CO_2 emission reduction. It means that the operating costs are decreased. However the project 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 project implementation was begun during non good financial and marketing situation for metallurgical industry and 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. Reconstruction of heating furnaces No 4 and 5 at the Hot Sheet-Rolling Shop
After subproject implementation the specific fuel consumption was reduced from 2.83 GJ/tonne of steel to 2.02 GJ/tonne of steel (actual data for furnaces No 1-5). For burned fuel mixture (natural, blast furnaces gases) and approximately 4.8 mln. tonnes of steel output at the furnaces No 1-5 per year it means approximately 306 thous. tonnes of CO_2 emission reduction per year.

Also the waste of steel was decreased from 2.2% to 1.4% (actual data for furnaces No 1-5). It means that in project scenario about 39 thous. tonnes of BOF steel are produced less than in baseline. Thereby emission reduction is more than 55 thous. tonnes of CO_2 per year (IPCC default emission factor for basic oxygen furnace steel production is 1.46 tCO_2 per tonne of steel).

However after the demounting of the cooling evaporation systems which were at the old furnaces the heat generation was stopped by approximately 500 thous. GJ per year (for 2011). It means that this heat will be generated at NLMK's CHPP. Emission factor of heat generation at the CHPP is 0.184 tCO_2/GJ. Therefore the additional GHG emission will be about 91 thous. tonnes of CO_2 per year.

Therefore total emission reduction of subproject 1 is about 270 thous. tonnes of CO_2 per year.

Subproject 2. Commissioning the hydrogen plant based on steam reforming of natural gas technology
The natural gas and electricity are used for hydrogen production at new plant. The specific natural gas consumption and the specific electricity consumption are 15.66 GJ and 0.13 MWh per 1000 m^3 of hydrogen, respectively. The emission factor of new hydrogen plant is 1.03 CO_2 per1000 m^3 of hydrogen (for average electricity emission factor is 1.146 CO_2/MWh, please see Section E for more detail information).

This hydrogen replaces hydrogen of old electrolysis stations. The electricity and steam are used for hydrogen production at new plant The emission factor of old hydrogen stations is 10.84 CO_2 per 1000 m^3 of hydrogen (the specific electricity consumption and the specific steam consumption are 5.48 MWh and 3.93 GJ per1000 Nm^3 of hydrogen, respectively and emission factor for heat generation is 0.184 tCO_2/GJ).

For the hydrogen production is about 41.4 thous. m^3 of hydrogen per year the emission reduction of subproject 2 is approximately 282 thous. tonnes of CO_2 per year.

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

	Years
Length of the crediting period	5
Year	Estimate of annual emission reductions in tonnes of CO_2 equivalent
2008	496,440
2009	309,700
2010	538,132
2011	552,686
2012	567,240
Total estimated emission reductions over the crediting period (tonnes of CO_2 equivalent)	2,464,199
Annual average of estimated emission reductions over the crediting period (tonnes of CO_2 equivalent)	492,840

	Years
Period after 2012, for which emission reductions are estimated	8
Year	Estimate of annual emission reductions in tonnes of CO_2 equivalent
2013	567,240
2014	567,240
2015	567,240
2016	567,240
2017	567,240
2018	567,240
2019	567,240
2020	567,240
Total estimated emission reductions over the period indicated (tonnes of CO_2 equivalent)	4,537,924

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

A.5. Project approval by the Parties involved:

The project was approved by the Parties involved:
Russia (Host party) – the Letter of approval from the Ministry of Economic Development is dated 17 January 2011 No D07-15.
The Netherlands (Sponsor party) – the Letter of approval from the NL Agency of Ministry of Economic Affairs is dated 08 September 2010.

SECTION B. Baseline

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

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

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

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

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

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

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

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

The project was considered for 2001 (subproject 1 – October 2001 and subproject 2 – October 2002). The following key factors that affect the baseline are taken into account:

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. Therefore there is not special legislation for the metal industry in Russia. However any project must be approved by a local

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

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

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

administration (permission for construction) and by a local conservancy. Also the most of metallurgical plants in Russia are the big 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)**. In the beginning of 2002 in Russia the metal production decreased. It was related to the reduction of the metal demand within Russia and in the world (more 50% of metal production at the Russian metallurgical plants is supplied to other countries). Financial indicators of metallurgical plants decreased as a result[7]. Then the USA, European Union and other countries introduced the restrictive measures against the metal import from the Russian metallurgical companies[8]. The situation was changed at the end of 2002 only and in the beginning of 2003 the metal demand was beginning to grow;

c) **Availability of capital (including investment barriers).** After default which was in Russia in 1998 there was the high level of inflation. It was 18.6% in 2001 and 15.1% in 2002 (Bank of Russia data[9]). As result a capital is available but high bank rate (the interbank offered rate was more than 20%[10]), high country investment risk and other risks make unprofitable of new equipment introduction in Russia;

d) **Local availability of technologies/techniques, skills and know-how and availability of best available technologies/techniques in the future.** All technologies applied in 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**. The natural gas and electricity prices were regulated by Russian Government in 2001-2002. In Russia they were lower than world market price. In 2002 the tariff of natural gas price was approximately 26 EUR/1000 m^3 and the tariff of electricity was approximately 16 EUR/MWh. However the Government planned to increase the tariffs. The growth of tariffs should have been approximately 15-25% a year (it also includes inflation). Electricity and natural gas are widely used and available in the Centre part of Russia and they are produced domestically. Blast furnace and coke oven gases are produced and utilized at the different shops of NLMK

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

The baselines for each of subproject will be the most plausible future scenario on the basis of conservative assumptions and key factors described above. The basic principle applied is that the saleable steel output (subproject 1), and hydrogen production (subproject 2) are identical in the project and the baseline scenario.

Step 2. Application of the approach chosen

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7 Magazine "Eurasian Metals", "Activities for the Metallurgy Industry Development until 2010", Chapter 2

8 Magazine "Eurasian Metals", "Activities for the Metallurgy Industry Development until 2010", Chapter 4

9 Bank of Russia, Quarterly Inflation Review, 2004, Quarter 4, page 3

10 Bank of Russia website, Moscow InterBank Offered Rate, October 2001

Subproject 1. Reconstruction of heating furnaces No 4 and 5 at the Hot Sheet-Rolling Shop

The reconstruction of the furnaces provides to use the existing foundations and some metal structure. The new furnaces construction was not considered before the project implementation (base year of this subproject is 2001) because it increase the investment cost (new foundations and metal structure) significantly in comparison with reconstruction. Therefore the two future plausible scenarios were only at that time:

- Continuation of a situation existing prior to the project;
- Reconstruction of furnaces No 4 and 5.

Reconstruction of furnaces No 4 and 5 consists of some measures (please see Section A.4.2). Theoretically a partly reconstruction (e.g. without the automation system of fuel burning process) could be considered as a future scenario. However it is not plausible because the efficiency of other measures is reduced as a result. Therefore the completed reconstruction of furnaces No 4 and 5 as described in Section A.4.2 is considered as plausible future scenario.

The plausible future scenarios of subproject 1 are presented below:
Scenario 1: Continuation of a situation existing prior to the project;
Scenario 2: Reconstruction of heating furnaces No 4 and 5.

These scenarios are described below in more detail.

1) Continuation of a situation existing prior to the project

The heating furnaces No 1-5 are maintained at regular intervals and larger repairs. The fuel of the furnaces is a mixture of natural and blast furnace gases. Some heat of exhaust gases from the furnaces was utilized in heat-recovery boilers. Also the metal structure of furnaces is cooled by the use of the cooling evaporation system with useful heat output (steam with 1.3 MPa of pressure) into the heating system of NLMK. However the consumption of this steam is less than generation, especially in a period from the spring to the autumn and the some amount of steam is deflated into the atmosphere. NLMK is implementing energy saving program from 2000. As result, heat consumption (including steam with 1.3 MPa of pressure) decrease. Therefore the amount of this steam is deflated into the atmosphere more and more. There are no legal or other requirements that enforce NLMK to stop or to reconstruct furnaces. In the non-stable situation at the metal market the additional investment is not required for this scenario. Thus, scenario 1 is feasible and plausible.

2) Reconstruction of heating furnaces No 4 and 5

The completed reconstruction of furnaces No 4 and 5 as described in Section A.4.2 is realized. It has no any technical barriers and the applied technologies are well-known. Each of reconstructed furnaces can heat steel with less fuel consumption. Also waste of steel is decreased after the reconstruction. It means that for the steel output (steel volume after heating) is required less BOF steel volume and, respectively, less expenditure of energy in comparison with situation before the reconstruction. The heat output from heat-recovery boilers was reduced with the reduction fuel consumption. Also the cooling evaporation systems of furnaces No 4 and 5 were dismantled and heat generation was stopped. Heat amount necessary for customers supply is generated at NLMK CHPP. 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.

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	$FC_{sp1,i,y}$
Data unit	1000 m^3
Description	Amount of fossil fuel *i* (natural gas, blast furnace gas and coke even gas) consumed in the heating furnaces
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)	-
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	$NCV_{i,y}$
Data unit	GJ/1000 m^3
Description	Net calorific value of fossil fuel type *i* in year *y*
Time of determination/monitoring	Monitored during the crediting period
Source of data (to be) use	NLMK data (for blast furnace gas and coke even gas) and Fuel supplier data (for natural gas)
Value of data applied (for ex ante calculations/determinations)	-
Justification of the choice of data or description of measurement methods and procedures (to be) applied	Natural gas: Official natural gas certificate of fuel supplier Blast furnace gas and coke even gas: It is calculated based on the gas composition which is measured by gas analyzer
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	$EF_{fuel\_i,y}$
Data unit	tCO_2/GJ
Description	CO_2 emission factor of fossil fuel type *i* 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 2: Energy, Chapter 2: Stationary Combustion (corrected chapter as of April 2007), IPCC, 2006
Value of data applied (for ex ante calculations/determinations)	Please see Table Anx.2.4 in Annex 2
Justification of the choice of data or description of	-

measurement methods and procedures (to be) applied	
OA/QC procedures (to be) applied	-
Any comment	It includes the emission factor for natural gas ($EF_{NG,y}$)

Data/Parameter	$PS_{sp1,\ PJ,\ y}$
Data unit	Tonnes
Description	Volume of steel is heated (steel output) in the furnaces at the HSRS 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)	-
Justification of the choice of data or description of measurement methods and procedures (to be) applied	It is measured by volume-to-mass conversion method.
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	$SFC_{sp1,BL}$
Data unit	GJ/tonne of steel
Description	Specific fuel consumption
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)	2.83
Justification of the choice of data or description of measurement methods and procedures (to be) applied	This parameter is used for definition of the fuel consumption in baseline and it was calculated based on historical data as average value for 1997-l999.
OA/QC procedures (to be) applied	-
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	$SWM_{sp1,BL}$
Data unit	Tonne/tonne of steel
Description	Specific waste of steel of the furnaces per tonne of steel is heated in the furnaces at the HSGJ
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)	0.022
Justification of the choice of data or description of measurement methods and procedures (to be) applied	This parameter is used for definition of the steel waste in baseline and it was calculated based on historical data as average value for 1997-l999.
OA/QC procedures (to be) applied	-
Any comment	

Data/Parameter	$WM_{sp1,PJ}$
Data unit	Tonnes
Description	Volume of steel waste at the furnaces of HSRS in project 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)	-
Justification of the choice of data or description of measurement methods and procedures (to be) applied	It is measured by weight method
OA/QC procedures (to be) applied	It is ordinary procedure of NLMK. Please see Table D.2 for more detail information
Any comment	-

Subproject 2. Commissioning the hydrogen plant based on steam reforming of natural gas technology
There are two well-known technologies for hydrogen production commercially:
- Electrolysis of water;
- Steam reforming of natural gas.

Other technologies are used for hydrogen production in a small value or do not have any working installations and such installations can not consider as a plausible scenario.

Therefore the plausible future scenarios of subproject 2 are presented below:
Scenario 1: Continuation of a situation existing prior to the project;

Scenario 2: Commissioning the hydrogen plant based on steam reforming of natural gas technology.

These scenarios are described below in more detail.

1) Continuation of a situation existing prior to the project

Hydrogen is produced at the installations of two hydrogen stations by electrolysis of water. The electricity and heat (steam) are consumed for hydrogen production. This technology is very simple in operation, does not require big costs for routine and capital repairs and enables to produce hydrogen with a small amount of admixtures. Also in the non-stable situation at the metal market no additional investment is required for this scenario. Thus, scenario 1 is feasible and plausible.

2) Commissioning the hydrogen plant based on steam reforming of natural gas technology

The new plant of hydrogen production was commissioned in 2004. It is using the steam reforming of natural gas technology for hydrogen production. The new installations of new plant partly replace the hydrogen production at the two old hydrogen stations by electrolysis of water. It means that significant less electricity is required for hydrogen production. However the old hydrogen stations are operated and they produce some hydrogen if the amount of hydrogen from new installations is not enough. 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.

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	PH_y
Data unit	1000 m^3
Description	Annual volume of hydrogen is generated at new hydrogen plant 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)	-
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	$EF_{ELEC,aver,y}$
Data unit	tCO_2/MWh
Description	Average CO_2 emission factor for electricity consumption

Time of determination/monitoring	Monitored during the crediting period
Source of data (to be) use	Calculation according to formulae 12
Value of data applied (for ex ante calculations/determinations)	-
Justification of the choice of data or description of measurement methods and procedures (to be) applied	-
OA/QC procedures (to be) applied	-
Any comment	-

Data/Parameter	$EF_{grid,y}$
Data unit	tCO_2/MWh
Description	CO_2 emission factor for electricity consumption
Time of determination/monitoring	Fixed ex-ante during determination
Source of data (to be) use	Development of Grid GHG Emission Factors for Power Systems of Russia (2008). This report was prepared by Carbon Investments Ltd. by order of Carbon Trade & Finance SICAR S.A., and approved by Accredited Independent Entity (AIE) Bureau Veritas
Value of data applied (for ex ante calculations/determinations)	0.526
Justification of the choice of data or description of measurement methods and procedures (to be) applied	-
OA/QC procedures (to be) applied	-
Any comment	-

Data/Parameter	$EF_{el\_CHP,y}$
Data unit	tCO_2/MWh
Description	CO_2 emission factor for electricity generation at NLMK CHPP in project for the year *y*
Time of determination/monitoring	Monitored during the crediting period
Source of data (to be) use	Calculation according to formulae 13
Value of data applied (for ex ante calculations/determinations)	-
Justification of the choice of data or description of measurement methods and procedures (to be) applied	-
OA/QC procedures (to be) applied	-
Any comment	-

Data/Parameter	$SEC_{sp2,BL}$

Data unit	MWh/1000 m^3
Description	Specific electricity consumption per 1000 m^3 of hydrogen for electrolysis installations
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)	5.48
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 in baseline and it was calculated based on historical data as average value for 2001-2003.
OA/QC procedures (to be) applied	-
Any comment	Please see Table Anx.2.2 in Annex 2

Data/Parameter	$EF_{hg,y}$
Data unit	tCO_2/GJ
Description	Average CO_2 emission factor of heat generation at NLMK CHPP in year *y*
Time of determination/monitoring	Monitored during the crediting period
Source of data (to be) use	Calculation according to formulae 6
Value of data applied (for ex ante calculations/determinations)	-
Justification of the choice of data or description of measurement methods and procedures (to be) applied	-
OA/QC procedures (to be) applied	-
Any comment	-

Data/Parameter	$SSC_{sp2,BL}$
Data unit	GJ/1000 m^3
Description	Specific steam consumption per 1000 m^3 of hydrogen for electrolysis installations
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)	3.93
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 in baseline and it was calculated based on historical data as average value for 2001-2003.
OA/QC procedures (to be) applied	-
Any comment	Please see Table Anx.2.2 in 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[11] 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. Reconstruction of heating furnaces No 4 and 5 at the Hot Sheet-Rolling Shop

Alternative 1: Continuation of a situation existing prior to the project. The heating furnaces No 1-5 are maintained with routine and capital repairs. The fuel of the furnaces is a mixture of natural, blast furnace and coke oven gases. Some heat of exhaust gases after the furnaces was utilized in heat-recovery boilers. Also the metal structure of furnaces is cooled by the use of the cooling evaporation system with useful heat output (steam with 1.3 MPa of pressure) into the heating system of NLMK. However the consumption of this steam is less than generation, especially in a period from the spring to the autumn and the some amount of steam is deflated into the atmosphere. NLMK is implementing energy saving program from 2000. As result, heat consumption (including steam with 1.3 MPa of pressure) decrease. Therefore the amount of this steam is deflated into the atmosphere more and more.

Alternative 2: The proposed project activity undertaken without being registered as a JI project activity.
The completed reconstruction of furnaces No 4 and 5 as described in Section A.4.2 is realized. Each of reconstructed furnaces can heat steel with less fuel consumption. Also waste of steel is decreased after the reconstruction. It means that for the steel output (steel volume after heating) is required less BOF steel volume and, respectively, less expenditure of energy in comparison with situation before the reconstruction. The fuel of the furnaces is a mixture of natural, blast furnace and coke oven gases. Some heat of exhaust gases after the furnaces was utilized in heat-recovery boilers. The heat output from heat-recovery boilers was reduced with the reduction fuel consumption. Also the cooling evaporation systems of furnaces No 4 and 5 were dismantled and heat generation was stopped. Heat amount necessary for customers supply is generated at NLMK CHPP.

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

Subproject 2. Commissioning the hydrogen plant based on steam reforming of natural gas technology

Alternative 1: Continuation of a situation existing prior to the project. Hydrogen is produced at the installations of two hydrogen stations by electrolysis of water. These installations will be maintained with routine and capital repairs and operated until 2013 at least. The electricity and heat (steam) are consumed for hydrogen production;

Alternative 2: The proposed project activity undertaken without being registered as a JI project activity. The new plant of hydrogen production was commissioned in 2005. It is produced by «Haldor Topsoe» company and is using the steam reforming of natural gas technology for hydrogen production. However the old hydrogen stations are operated and they produce some hydrogen if the amount of hydrogen from new installations is not enough.

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. The proposed JI project results in additional sales revenues due to saleable steel volume increase and in costs reduction. Thus, this analysis method is not applicable.

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

Sub-step 2b: Option III. Apply benchmark analysis
For proposed project the option of substep 2b 6a of the Tool was used for benchmark definition.

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[12] cleared inflation[13].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[14]. The rate used in the assessment reflects investment into a portfolio of steel companies[15]. 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[16]. 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 BK 477" were taken. Value of this risk is 4%. It is average 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 IRR benchmark estimation is present in Table B.2.1.

Table B.2.1. Result of IRR benchmark estimation

Indicator	Value for 2002
German interest rate	4,46%
Inflation	1,40%
Risk-free rate	***3,10%***
Systematic market risk	***4,07%***
Country risk Russia	***6,00%***
Project specific risk	***4,00%***
IRR benchmark	**17,18%**

If the proposed project (not being implemented as a JI project) has a less favourable indicator, i.e. a lower IRR, than this benchmark, then the project cannot be considered as financially attractive.

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

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[12] European Central Bank website, Long-Term Interest Rate of Germany, October 2002

[13] European Commission website, Eurostat , Average Inflation Rate of Germany in 2002

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

[15] New York University, Leonard N. Sterm School of Business, Costs of Capital by Industry Sector in 2002

[16] New York University, Leonard N. Sterm School of Business, Risk Premiums for Other Markets in 2002

Subproject 1. Reconstruction of heating furnaces No 4 and 5 at the Hot Sheet-Rolling Shop

The following assumptions have been used based on the information provided by the enterprise and from other sources:

1. Investment decision: June 2002, commissioning date: June 2004 for furnace No 5 and May 2008 for furnace No 4;
2. Bank of Russia exchange rate is 26.61 RUR/EUR;
3. The project investment cost accounts for of approximately EUR 30.8 million and 51.0 million (excluding VAT) for furnaces No 5 and 4, respectively;
4. The project lifetime is around 20 years (lifetime of the main equipment);
5. Steel output, waste of steel, fuel consumption and etc. at the HSRS are defined in line with the actual parameters of shop (for situation before reconstruction) and NLMK plans (for situation after reconstruction);
6. Total fuel consumption is natural gas consumption;
7. Cost of BOF steel production is equal to NLMK internal cost;
8. The additional volume of steam (heat) is generated at NLMK CHPP;
9. Heat tariff is equal to NLMK internal cost.

The subproject 1 cash flow focuses on revenue flows generated by fuel savings and BOF steel production reduction and on cost flows generated by steam generation reduction in comparison with baseline of subproject 1.

The project's financial indicators are presented in the Table B.2.2 below.

Table B.2.2. Financial indicators of the subproject 1

Scenario	IRR (%)
Base case	2.50%

Cash flow analysis shows IRR of 2.50%. It is less than the benchmark determined of 17.18%. Hence, the project cannot be considered as a financially attractive course of action.

Subproject 2. Commissioning the hydrogen plant based on steam reforming of natural gas technology

The following assumptions have been used based on the information provided by the enterprise and from other sources:

1. Investment decision: October 2002, commissioning date: December 2004;
2. Bank of Russia exchange rate is 31.30 RUR/EUR;
3. The project investment cost accounts for of approximately EUR 16.7 million (excluding VAT);
4. The project lifetime is around 20 years (lifetime of the main equipment);
5. Production of hydrogen, natural gas, electricity consumption and etc. are defined in line with the actual parameters and NLMK plans;
6. The steam consumed by old hydrogen station is generated at NLMK CHPP;
7. Heat tariff is equal to NLMK internal cost;
8. The electricity tariff is defined as weighted average tariff which takes into tariff of OJSC "Lipetskenergo" (energy company) and NLMK internal cost of electricity generation NLMK CHPP.

The subproject 1 cash flow focuses on revenue flows generated by electricity and steam savings and on cost flows generated by natural gas buying in comparison with baseline of subproject 2.

The project's financial indicators are presented in the Table B.2.3 below.

Table B.2.3. Financial indicators of the subproject 2

Scenario	IRR (%)
Base case	13.35%

Cash flow analysis shows IRR of 13.35%. It is less than the benchmark determined of 17.18%. Hence, the project cannot be considered as a financially attractive course of action.

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

The following 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. Reconstruction of heating furnaces No 4 and 5 at the Hot Sheet-Rolling Shop
Cost from steam generation 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.

Scenario 3 and *4* implies natural gas price raise/reduce by 10%.

Scenario 5 and 6 implies BOF steel production cost raise/reduce by 10%.

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

Table B.2.4: Sensitivity analysis (summary)

Scenario	IRR (%)
Scenario 1	1.32%
Scenario 2	3.88%
Scenario 3	3.18%
Scenario 4	1.81%
Scenario 5	3.28%
Scenario 6	1.70%

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. Commissioning the hydrogen plant based on steam reforming of natural gas technology
Revenues from steam cost savings and cost from natural gas buying 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 for sensitivity analysis are presented below.

Scenario 1 and *2* implies investment cost changes ± 10, respectively.

Scenario 3 considers a 10% electricity tariff growth.

Scenario 4 is based on the assumption of a 10% electricity tariff decrease

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

Table B.2.5: Sensitivity analysis (summary)

Scenario	IRR (%)
Scenario 1	11.80%
Scenario 2	15.20%
Scenario 3	15.11%
Scenario 4	11.54%

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. Reconstruction of heating furnaces No 4 and 5 at the Hot Sheet-Rolling Shop
In 2004-2005 Russian metallurgical company "Seversteel" reconstructed two heating furnaces. However these furnaces have less capacity (120 tonnes of steel per hour) than the heating furnaces at NLMK (320 tonnes of steel per hour). Also the proposed subproject takes into account the individual feature of heating furnaces at NLMK: reconstructed furnaces use new modern energy-saving hot load/unload of slabs technology.

Therefore this subproject can not represent a widely observed practice in the area considered.

Subproject 2. Commissioning the hydrogen plant based on steam reforming of natural gas technology
Usually in Russia hydrogen at metallurgical plants is produced at hydrogen stations by electrolysis of water. Proposed subproject is first which was implemented at a metallurgical plant. Therefore this subproject can not represent a widely observed practice in the area considered.

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

Sub-steps 4a and 4b are satisfied, i.e. similar activities cannot be widely observed. Thus proposed project activity, including subprojects 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 fuels consumption during the steel heating, additional heat generation, additional BOF steel production (for subproject 1) and electricity consumption, natural gas consumption and fuels consumption for heat generation (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 National Greenhouse Gas Inventories[17] 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: $100\%\times(21\times1.0+310\times0.1)/(56{,}100+21\times1.0+310\times0.1) = 0.093\%$. Therefore N_2O and CH_4 emissions are not taken into account for baseline and project emissions calculation.

Leakages
The potential leakages are associated with:
- Fugitive CH_4 emissions associated with fuel extraction, processing, transportation and distribution of natural gas;
- Transmission and distribution of blast furnace gas at NLMK;
- Technical transmission and distribution losses of electricity.

Subproject 1
For subproject 1 fuel consumption (including amount of fuel for additional heat generation) in the project scenario is reduced by 25% in comparison with the baseline scenario. Therefore the fugitive CH_4 emission

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

(for natural gas extraction, processing, transportation and distribution) and the losses of blast furnace gas at NLMK are decreased and therefore leakages are not taken into account. This is conservative.

Subproject 2
For subproject 2, most part of leakages in project scenario is associated with fugitive CH_4 emission (for natural gas consumption) and losses of electricity.

Annual natural gas consumption is approximately 690,000 GJ. Default emission factors for fugitive CH_4 emission is 961 tCH_4/PJ (for Eastern Europe and former USSR)[18] and the Global Warming Potential of CH_4 is 21[19]. And volume of emission is $21 \times 650{,}000 \times 961/10^6 = 13{,}924$ $tCO_{2\text{-eq}}$.

Annual electricity consumption in project scenario is approximately 5,300 MWh. In Russian Federation the electricity losses are 11-13%[20]. The emission factor for electricity consumption is 0.526 tCO_2/MWh (please see Annex 2 of the PDD). And volume of emission is $0.526 \times 5{,}300 \times 11/100 = 307$ tCO_2.

In project scenario the total leakages are 14,231 $tCO_{2\text{-eq}}$.

The most part of leakages in baseline scenario is associated with losses of electricity. Annual electricity consumption in baseline scenario is approximately 243,000 MWh. And leakages amount to $0.526 \times 243{,}000 \times 11/100 = 14{,}059$ tCO_2.

Other leakages are fugitive CH_4 emission (natural gas consumption for heat generation). Annual steam (heat) consumption in baseline at electrolysis installations is about 170,000 GJ. And natural gas consumption for heat generation is 170,000×0.9 (heat generation efficiency)×0,22 (part of natural gas in fuel balance at NLMK CHPP) = 42,558 GJ. Leakages are associated with fugitive CH_4 emission is $21 \times 42{,}558 \times 961/10^6 = 858$ $tCO_{2\text{-eq}}$.

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

Project boundary

Subproject 1. Reconstruction of heating furnaces No 4 and 5 at the Hot Sheet-Rolling Shop
An overview of all emission sources in the steel rolling process of subproject 1 is given in Table B.3.1 below.

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[18] Approved baseline methodology AM0029 "Baseline Methodology for Grid Connected Electricity Generation Plants using Natural Gas", Version 03, CDM – Executive Board, 2008

[19] IPCC AR4. 2007a. The Physical Science Basis. Working Group I Report of the intergovernmental Panel on Climate Change..Editors: Solomon, S., D. Qin, M. Manning, Z. Chen, M. Marquis, K.B. Averyt, M. Tignor and H.L. Miller . Cambridg University Press, Cambridge, United Kingdom and New York, NY, USA.

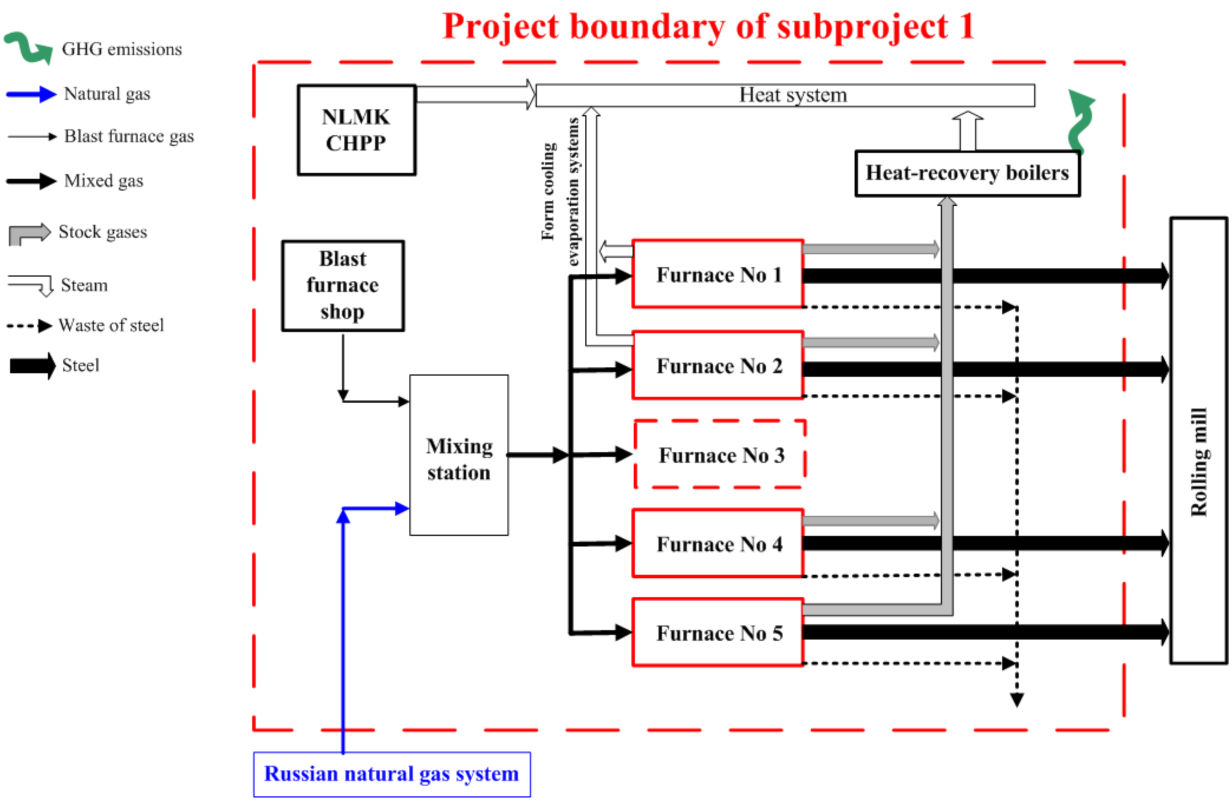
[20] http://www.abok.ru/for_spec/articles/14/2833/tb.htm

Table B.3.1: Sources of emissions

№	Source	Gas	Included/ excluded	Justification/Explanation
1	Fuel consumption during the steel heating	CO_2	Included	• The fossil fuel combustion will decrease.
2	Fuel consumption associated with additional heat generation	CO_2	Included	• There is not in baseline; • In project it is generated by NLMK CHPP
3	Emission associated with additional BOF steel production	CO_2	Included	• There is not in project; • In baseline it is produced at NLMK additionally.

The emission sources within the project boundary are also shown in Figure B.3.1 below.

Figure B.3.1: Sources of emissions and project boundary



Source: Data provided by NLMK

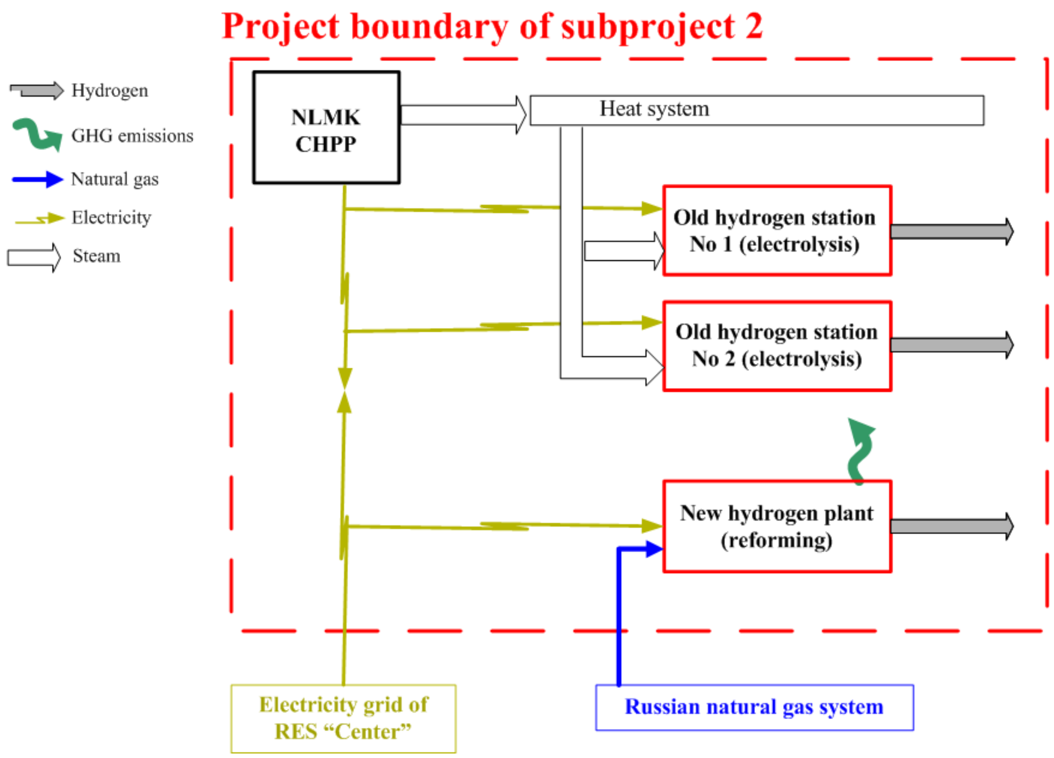
Subproject 2. Commissioning the hydrogen plant based on steam reforming of natural gas technology
An overview of all emission sources of subproject 2 is given in Table B.3.2 below.

Table B.3.2: Sources of emissions

№	Source	Gas	Included/ excluded	Justification/Explanation
1	Electricity consumption	CO_2	Included	• The electricity consumption will decrease.
2	Fuel consumption associated with heat generation	CO_2	Included	• There is not in project; • In baseline it is generated by NLMK CHPP.
3	Natural gas consumption	CO2	Included	• There is in project only, not in baseline.

The emission sources within the project boundary are also shown in Figure B.3.2 below.

Figure B.3.2: Sources of emissions and project boundary



Source: Data provided by NLMK

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

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

Date of completion of the baseline study: 09/07/2010

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 2002 to May 2008;
- Subproject 2: From October 2002 to December 2004;

Therefore the starting date of the project is June 2002.

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:

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

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

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;
- Amounts of fuel consumption for electricity and heat generation at NLMK CHPP are calculated in accordance with national rules and based on the measured total fuel consumption at NLMK CHPP.

Individual for each of subprojects:
Subproject 1. Reconstruction of heating furnaces No 4 and 5 at the Hot Sheet-Rolling Shop
- Steel demand in the market is not influenced by the project (i.e. baseline steel output = project steel output);
- The baseline specific fuel consumption, specific heat generation and specific waste of steel are set ex-ante for the length of the crediting period;
- The default IPCC CO_2 emission factor for Basic Oxygen Furnace is used because the emissions associated with additional BOF steel production is 5% of total baseline emission only and this emission factor is less than the emission factor for Basic Oxygen Furnace at NLMK. It is conservative.

Subproject 2. Commissioning the hydrogen plant based on steam reforming of natural gas technology
- Hydrogen demand at NLMK is not influenced by the project (i.e. baseline hydrogen production = project hydrogen production);
- The baseline specific electricity consumption for electrolysis installations is set ex-ante for the length of the crediting period.

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. 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:								
ID number *(Please use numbers to ease cross-referencing to D.2.)*	Data variable	Source of data	Data unit	Measured (m), calculated (c), estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment
P1	PE_{y}	Calculated under project activity	tCO_2	C	Annually	100%	Electronic	-
P2	$PE_{sp1,\ y}$	Calculated under project activity	tCO_2	C	Annually	100%	Electronic	-
P3	$PE_{sp2,\ y}$	Calculated under project activity	tCO_2	C	Annually	100%	Electronic	-
P4	$PE_{sp1\_f,\ y}$	Calculated under project activity	tCO_2	C	Annually	100%	Electronic	-
P5	$FC_{sp1,\ i,\ y}$	Gas flow meter reading	m^3	M	Continuously	100%	Electronic	-
P6	$NCV_{i,\ y}$	Local estimated or fuel supplier	GJ/1000 m^3	M	Monthly	100%	Electronic	NCV of fuel is estimated continuously (it is calculated based on fuel composition) at NLMK but NCV of natural gas is provided by supplier every month
P7	$EF_{fuel\_i,\ y}$	IPCC	tCO_2/GJ	E	Fixed ex ante	100%	Electronic	Guidelines for National Greenhouse Gas Inventories,

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
								Volume 2: Energy, Chapter 2: Stationary Combustion (corrected chapter as of April 2007), IPCC, 2006
P9	$PE_{sp1\_h,\ y}$	Calculated under project activity	tCO_2	C	Annually	100%	Electronic	-
P10	$HG_{sp1,y}$	Calculated under project activity	GJ	C	Annually	100%	Electronic	-
P11	$PS_{sp1,\ PJ,\ y}$	Weighing machine	Tonnes	M	Continuously	100%	Electronic	-
P12	$SFC_{sp1,\ BL}$	Please see Annex 2	GJ/tonne	E	Fixed ex ante	100%	Electronic	-
P13	$SHG_{sp1,\ BL}$	Please see Annex 2	GJ/GJ	E	Fixed ex ante	100%	Electronic	-
P14	$HG_{sp1,\ PJ,\ y}$	Heat meter	GJ	M	Continuously	100%	Electronic	-
P15	$EF_{hg,y}$	Calculated under project activity	tCO_2/GJ	C	Annually	100%	Electronic	-
P16	$FC_{hg,\ i,y}$	Calculated under project activity	t.c.e[21]	C	Annually	100%	Electronic	It is calculated according to national rules

[21] Tonne of coal equivalent

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
P17	$HG_{CHPP,y}$	Heat meter	GJ	M	Continuously	100%	Electronic	-
P18	HC_{y}	Heat meter	GJ	M	Continuously	100%	Electronic	-
P19	$PE_{sp2\_NG,\ y}$	Calculated under project activity	tCO_2	C	Annually	100%	Electronic	-
P20	$PE_{sp2,EC,\ y}$	Calculated under project activity	tCO_2	C	Annually	100%	Electronic	-
P21	$FC_{sp2,PJ,\ NG,\ y}$	Gas flow meter reading	m^3	M	Continuously	100%	Electronic	-
P22	$EC_{sp2,PJ,\ y}$	Electricity meter reading	MWh	M	Continuously	100%	Electronic	-
P23	$EF_{ELEC,aver,\ y}$	Calculated under project activity	tCO_2/MWh	C	Annually	100%	Electronic	-
P24	$EF_{el\_CHP,y}$	Calculated under project activity	tCO_2/MWh	C	Annually	100%	Electronic	-
P25	$FC_{eg,\ i,y}$	Calculated under project activity	t.c.e	C	Annually	100%	Electronic	It is calculated according to national rules
P26	$EG_{CHPP,y}$	Electricity meter reading	MWh	M	Continuously	100%	Electronic	-
P27	$w_{grid,y}$	Calculated under project activity	-	C	Annually	100%	Electronic	-
P28	$w_{CHP,y}$	Calculated under project activity	-	C	Annually	100%	Electronic	-
P29	$EF_{grid,y}$	Please see Annex 2	tCO_2/MWh	E	Fixed ex ante	100%	Electronic	Electricity grid GHG emission factor for JI projects in

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
								Russian Regional Energy System "Centre".

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

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

$$PE_y = \sum_{i}^{2} PE_{spi,y} \quad (1)$$

Where:

PE_y - are the annual project emissions in the year *y*, (tCO_2);

$PE_{spi,y}$ - are the annual project emissions from subprojects 1 and 2 in the year *y*, (tCO_2);

The annual project emissions from subproject 1 are:

$$PE_{sp1,y} = PE_{sp1\_f,y} + PE_{sp1\_h,y} \quad (2)$$

Where:

$PE_{sp1\_f,y}$ - are the annual subproject 1 emissions associated with fuel combustion in the furnaces in the year *y*, (tCO_2);

$PE_{sp1\_h,y}$ - are the annual subproject 1 emissions associated with additional heat generated at the NLMK CHPP in project scenario in the year *y*, (tCO_2);

$PE_{sp1\_f,y}$ is calculated as follows:

$$PE_{sp1\_f,y} = \sum_{i} FC_{sp1,i,y} \times NCV_{i,y} \times EF_{fuel\_i,y} \quad (3)$$

Where:

$FC_{sp1,\ i,\ y}$	- is the total volume of fuel type *i* combusted in the furnaces at the HSRS in year *y* (m^3);
$NCV_{i,\ y}$	- is the average net calorific value per volume unit of fuel type *i* in the year *y* (GJ/1000 m^3);
$EF_{fuel\_i,\ y}$	- is the default IPCC CO_2 emission factor per unit of energy of fuel *i* in year *y* (tCO_2/GJ).

$NCV_{i,\ y}$ is obtained as:

$$NCV_{i,\ y} = \sum_{m} (NCV_{i,m} \times FC_{sp1,\ i,m,\ y}) / \sum_{i} FC_{sp1,\ i,\ y} \qquad (4)$$

Where:

$NCV_{i,m}$	- is the net calorific value per volume unit of fuel type *i* in the month *m* in year *y* (GJ/m^3);
$FC_{sp1,\ i,m,\ y}$	- is the total volume of fuel type *i* combusted in the furnaces at the HSRS in month *m* in year *y* (m^3);
m	- is the month *m* in year *y*.

$PE_{sp1\_h,\ y}$ is calculated as follows:

$$PE_{sp1\_h,\ y} = HG_{sp1,y} \times EF_{hg,y} \qquad (5)$$

Where:

$EF_{hg,y}$	- is the CO_2 emission factor of heat generation at the NLMK CHPP in year *y*, (tCO_2/GJ);
$HG_{sp1,\ y}$	- is the heat energy which is generated at the NLMK CHPP additionally in project scenario in comparison with the baseline in year *y*, (GJ).

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

$$EF_{hg,\ y} = \frac{\sum_{i} 9,308 \times FC_{hg,\ i,y} \times EF_{fuel\_i,\ y}}{HG_{CHPP,\ y}} \qquad (6)$$

Where:

$FC_{hg,\ i,y}$ - is the total volume of fuel type *i* combusted at the NLMK CHPP for heat 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).

$HG_{sp1,y}$ is obtained as:

$$HG_{sp1,\ y} = PS_{sp1,PJ,\ y} \times SFC_{sp1,BL} \times SHG_{sp1,BL} \times KOEF_{hg,y} - HG_{sp1,PJ,y} \qquad (7)$$

Where:

$PS_{sp1,\ PJ,\ y}$ - is the steel volume is heated (steel output) in the furnaces at the HSRS in year *y* (tonnes);

$SFC_{sp1,\ BL}$ - is the specific fuel consumption per tonne of steel in the baseline (GJ/tonne). It is an ex-ante fixed value, see Annex 2;

$SHG_{sp1,\ BL}$ - is the specific heat generation (utilization) per GJ of burned fuel in baseline (GJ/GJ). It is an ex-ante fixed value, see Annex 2;

$HG_{sp1,\ PJ,\ y}$ - is the heat generation (utilization) at the furnaces of the HSRS in year *y* (tonnes);

$KOEF_{hg,y}$ - is the level of the reduction of steam (1.3 MPa) consumption at NLLMK in comparison with 2002 in year *y* (-);

$KOEF_{hg,y}$ is obtained as:

$$KOEF_{hg,y} = \frac{HC_y}{HC_{2002}} \qquad (8)$$

Where:

HC_y - is the steam (1.3 MPa) consumption at NLLMK in year *y* (GJ);

HC_{2002} - is the steam (1.3 MPa) consumption at NLLMK in 2002 (it is equal to 1,127,339 GJ).

The annual project emissions from subproject 2 are:

$$PE_{sp2,\ y} = PE_{sp2\_NG,\ y} + PE_{sp2,EC,\ y} \qquad (9)$$

Where:

$PE_{sp2\_NG,y}$ - is the annual subproject 2 emissions associated with natural gas consumption for the year *y*, (tCO_2);

$PE_{sp2,EC,y}$ - is the annual subproject 2 emissions associated with electricity consumption for the year *y*, (tCO_2).

$PE_{sp2\_NG,y}$ is obtained as:

$$PE_{sp2,NG,y} = FC_{sp2,PJ,NG,y} \times NCV_{NG,y} \times EF_{NG,y} \qquad (10)$$

Where:

$FC_{sp2,PJ,NG,y}$ - is the annual natural gas consumption in project for the year *y*, (1000 Nm^3);

$NCV_{NG,y}$ - is the average net calorific value per volume unit of natural gas in the year *y* (GJ/1000 Nm^3). It is calculated according to formulae 4;

$EF_{NG,y}$ - is the default IPCC CO_2 emission factor of natural gas in year *y*, (tCO_2/GJ).

$PE_{sp2,EC,y}$ is obtained as:

$$PE_{sp2,EC,y} = EC_{sp2,PJ,y} \times EF_{ELEC,aver,y} \qquad (11)$$

Where:

$EC_{sp2,PJ,y}$ - is the annual electricity consumption in project for the year *y*, (MWh);

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

$EF_{ELEC,aver,y}$ is obtained as:

$$EF_{ELEC,aver,y} = w_{grid,y} \times EF_{grid,y} + w_{CHP,y} \times EF_{el\_CHP,y} \qquad (12)$$

Where:

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

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

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

$$EF_{el\_CHP,y} = \frac{\sum_i 29{,}308 \times FC_{eg,i,y} \times EF_{fuel\_i,y}}{EG_{CHPP,y}} \qquad (13)$$

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).

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	-
B2	$BE_{sp1,y}$	Calculated under project activity	tCO_2	C	Annually	100%	Electronic	-
B3	$BE_{sp2,y}$	Calculated under project activity	tCO_2	C	Annually	100%	Electronic	-
B4	$BE_{sp1\_f,y}$	Calculated under project activity	tCO_2	C	Annually	100%	Electronic	-
B5	$BE_{sp1\_s,y}$	Calculated under project activity	tCO_2	C	Annually	100%	Electronic	-
B6	$FC_{sp1,i,y}$	Fuel flow meter reading	m^3	M	Continuously	100%	Electronic	-

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
B7	$NCV_{i,y}$	Local estimated or fuel supplier	GJ/1000 m^3	M	Monthly	100%	Electronic	-
B8	$EF_{fuel\_i,\ y}$	IPCC	tCO_2/GJ	E	Fixed ex ante	100%	Electronic	Guidelines for National Greenhouse Gas Inventories, Volume 2: Energy, Chapter 2: Stationary Combustion (corrected chapter as of April 2007), IPCC, 2006
B9	$PS_{sp1,\ PJ,\ y}$	Weighing machine	Tonnes	M	Continuously	100%	Electronic	-
B10	$SFC_{sp1,\ BL}$	Please see Annex 2	GJ/tonne of lime	E	Fixed ex ante	100%	Electronic	-

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
B11	$EF_{BOF,\ y}$	IPCC	tCO_2/tonne of steel	E	Fixed ex ante	100%	Electronic	Guidelines for National Greenhouse Gas Inventories, Volume 3: Industrial Processes and Product Use, Chapter 4: Metal Industry Emissions, IPCC, 2006
B12	$SWM_{sp1,BL}$	Please see Annex 2	GJ/tonne of lime	E	Fixed ex ante	100%	Electronic	-
B13	$WM_{sp1,PJ}$	Weighing machine	Tonnes of steel waste	M	Continuously	100%	Electronic	-
B14	$BE_{sp2\_e,\ y}$	Calculated under project activity	tCO_2	C	Annually	100%	Electronic	-
B15	$BE_{sp2\_s,\ y}$	Calculated under project activity	tCO_2	C	Annually	100%	Electronic	-
B16	$EF_{ELEC,aver,\ y}$	Calculated under project activity	tCO_2/MWh	C	Annually	100%	Electronic	-
B17	$SEC_{sp2,BL}$	Please see Annex 2	GJ/tonne of lime	E	Fixed ex ante	100%	Electronic	-
B18	PH_y	Gas flow meter reading	m^3	M	Continuously	100%	Electronic	-

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
B19	$SSC_{sp2,BL}$	Please see Annex 2	GJ/tonne of lime	E	Fixed ex ante	100%	Electronic	-
B20	$EF_{hg,y}$	Calculated under project activity	tCO_2/GJ	C	Annually	100%	Electronic	-

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:

$$BE_y = \sum_{i}^{2} BE_{spi,y} \qquad (14)$$

Where:

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

$BE_{spi,y}$ - are the annual baseline emissions from subproject 1 and 2 for the year *y*, (tCO_2);

The annual baseline emissions from subproject 1 are:

$$BE_{sp1,y} = BE_{sp1\_f,y} + BE_{sp1\_s,y} \qquad (15)$$

Where:

$BE_{sp1\_f,y}$ - are the annual subproject 1 baseline emissions associated with fuel combustion in the furnaces for the year *y*, (tCO_2);

$BE_{sp1\_s,y}$ - are the annual subproject 1 baseline emissions associated with additional BOF steel production in baseline scenario for the year *y*, (tCO_2);

$BE_{sp1\_f,y}$ is calculated as follows:

$$BE_{sp1\_f,\ y} = \sum_i \left(EF_{fuel\_i,\ y} \times \frac{NCV_{i,y} \times FC_{sp1,\ i,y}}{\sum_i (NCV_{i,y} \times FC_{sp1,\ i,y})} \times PS_{sp1,PJ,\ y} \times SFC_{sp1,BL} \right) \qquad (16)$$

Where:

$FC_{sp1,\ i,y}$ - is the total volume of fuel type *i* combusted in the furnaces of HSRS in project in year *y* (m^3);

$NCV_{i,y}$ - is the average net calorific value per volume unit of fuel type *i* in the year *y* (GJ/1000 m^3). It is defined according to Formulae 4;

$EF_{fuel\_i,\ y}$ - is the default IPCC CO_2 emission factor per unit of energy of fuel *i* in year *y* (tCO_2/GJ);

$PS_{sp1,\ PJ,\ y}$ - is the steel volume is heated (steel output) in the furnaces at the HSRS in year *y* (tonnes);

$SFC_{sp1,\ BL}$ - is the specific fuel consumption per tonne of steel in the baseline (GJ/tonne). It is an ex-ante fixed value, see Annex 2.

$BE_{sp1\_s,\ y}$ is calculated as follows:

$$BE_{sp1\_s,\ y} = EF_{BOF,\ y} \times (SWM_{sp1,BL} \times PS_{sp1,PJ,\ y} - WM_{sp1,PJ}) \qquad (17)$$

Where:

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

$SWM_{sp1,BL}$ - is the specific waste of steel of the furnaces per tonne of steel is heated in the furnaces at the HSGJ (tonne/tonne of steel). It is an ex-ante fixed value, see Annex 2;

$WM_{sp1,PJ}$ - is the volume of steel waste at the furnaces of HSRS in project in year *y* (tonnes).

The annual baseline emissions from subproject 2 are:

$$BE_{sp2,y} = BE_{sp2\_e,\ y} + BE_{sp2\_s,\ y} \qquad (18)$$

Where:

$BE_{sp2\_e,\ y}$ - are the annual subproject 2 baseline emissions associated with electricity consumption in the year *y*, (tCO_2);

$BE_{sp2\_s,\ y}$ - are the annual subproject 2 baseline emissions associated with steam consumption in the year *y*, (tCO_2);

$BE_{sp2\_e,y}$ is calculated as follows:

$$BE_{sp2\_e,y} = EF_{ELEC,aver,y} \times SEC_{sp2,BL} \times PH_y \quad (19)$$

Where:

$EF_{ELEC,aver,y}$ - is the weighted average CO_2 emission factor for electricity consumption, (tCO_2/MWh). It is calculated according to formulae 12.

$SEC_{sp2,BL}$ - is the specific electricity consumption per 1000 m^3 of hydrogen for electrolysis installations, (MWh/1000 m^3). It is an ex-ante fixed value, see Annex 2.

PH_y - is the annual volume of hydrogen is generated at new hydrogen plant in the year *y*, (1000 m^3)

$BE_{sp2\_s,y}$ is calculated as follows:

$$BE_{sp2\_s,y} = EF_{hg,y} \times SSC_{sp2,BL} \times PH_y \quad (20)$$

Where:

$EF_{hg,y}$ - is the CO_2 emission factor of heat generation at NLMK CHPP in year *y*, (tCO_2/GJ). It is calculated according to formulae 6;

$SSC_{sp2,BL}$ - is the specific steam consumption per 1000 m^3 of hydrogen for electrolysis installations (GJ/1000 m^3). It is an ex-ante fixed value, see Annex 2.

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):

$$ER_y = BE_y - PE_y \qquad (20)$$

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.
P22, P26	low	The electricity consumption and generation are 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.
P5, P25, B6, B18	medium	In accordance with State Standard the allowed inaccuracy of gas consumption metering is ±0.3-4% (GOST R 8.618-2006). The flow gas 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.
P6, P16, P21, B7	medium	Natural gas: The natural gas supplier's laboratory will carry out the measurement of NCV of gas supplied and issue a certificate. The Power Production Shop will store these certificates and will calculate the weighted average value of the Net Calorific Value at the end of each year and transfer to the automatic system of the supervisory control "Energo". Blast furnace gas: NCV of BFG is calculated based on a gas composition. The Blast Furnace Shop carries out the measurement of gas composition by a gas-analysis system and calculates the weighted average value of the Net Calorific Value and will be transferred to the automatic system of the supervisory control "Energo" Coke oven gas: NCV of COG is calculated based on a gas composition. The Coke Shop carries out the measurement of gas composition by a gas-analysis system and calculates the weighted average value of the Net Calorific Value and will transfer to the automatic system of the supervisory control "Energo". Energy Saving Centre will extract them from this system, treat and achieve them for monitoring purposes.
P11, B9	medium	The produced steel is measured by volume-to-mass conversion method. Information will be calculated by the HSRS and will transfer to the automatic system of the supervisory control "Energo". Energy Saving Centre will extract them from this system, treat and achieve them for monitoring purposes.

P14, P17, P18	medium	Heat generation is measured by standardized heat meters. This method based on the measuring of temperature, pressure of steam and steam flow then they are recalculated to heat generation. The data from meters are automatically and regularly transferred to the computer system and achieved. Energy Saving Centre will extract them from this system, treat and achieve them for monitoring purposes.
B13	medium	The waste of steel is measured by weight method once a year. HSRS will transfer this information to the automatic system of the supervisory control "Energo". Energy Saving Centre will extract them from this system, treat and achieve them for monitoring purposes.

Calibration of the metering devices is made in accordance with the calibration schedule. Supervision of calibration is performed by the Department of heat automatic and measurement. The metering devices are calibrated by an independent entity which has a state licence.

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

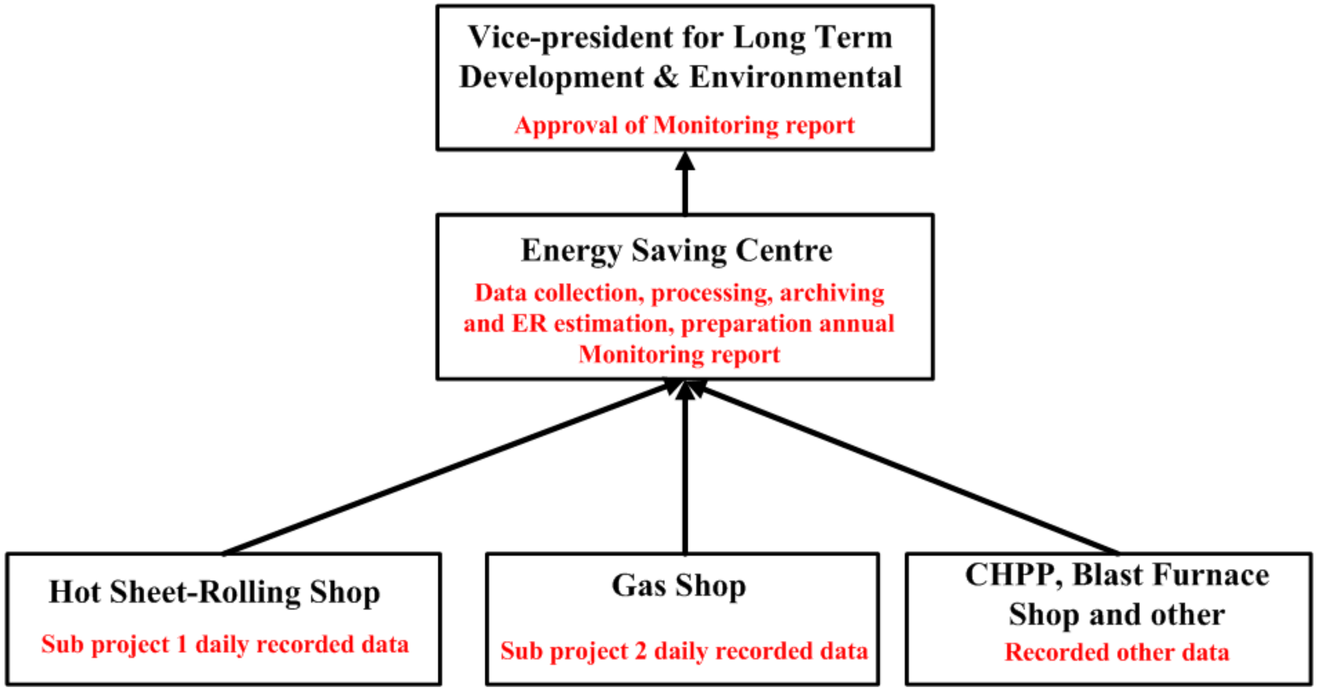
Division of responsibilities for Monitoring Plan implementation and Monitoring Report preparation is presented in the Table D.3.1.

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

N	Responsible	Task
1	NLMK: • Department of heat automatic and measurement; • Hot Sheet-Rolling Shop; • Gas Shop • NLMK CHPP, Blast Furnace Shop, Coke Shop, Power Production Shop • Energy Saving Centre	Quality control of measuring devices; Subproject 1 daily recorded data; Subproject 2 daily recorded data; Recorded other data; Collection, data processing, archiving, and preparation of Monitoring report
3	Global Carbon BV	Staff training on monitoring procedures and reporting; 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: Reconstruction of heating furnaces No 4 and 5 at the Hot Sheet-Rolling Shop

The actual data after subproject 1 implementation for 2008-2009 are presented in Table E.1.1.

Table E.1.1: Actual data of subproject 1

Indictor	Unit	2008	2009	Average
Energy efficiency				
Steel (slabs) output	tonnes of steel	4,786,139	4,760,291	4,773,215
Total fuel consumption	t.c.e[22]	327,553	328,900	328,226
	GJ	9,607,122	9,646,625	9,626,874
Natural gas consumption	t.c.e	292,415	290,805	291,610
	GJ	8,576,530	8,529,305	8,552,918
	%	89.3	88.4	88.8
Blast furnace gas consumption	t.c.e	35,138	38,095	36,616
	GJ	1,030,592	1,117,320	1,073,956
	%	10.7	11.6	11.2
Specific fuel consumption	GJ/t steel	2.007	2.026	**2.017**
Heat output				
Heat output	Gcal	251,246	152,320	201,783
	GJ	1,051,968	637,762	844,865
Specific heat generation	GJ/GJ fuel	0.109	0.066	**0.088**
Waste of steel				
Waste of steel	tonnes	65,658	68,124	66,891
	tonne/tonne of steel	0.0137	0.0143	**0.0140**

Source: Data provided by NLMK

For project emission estimation of subproject 1 the actual data were used for 2008-2009, respectively, and average volume of them – for 2010-2012.

The actual data of steam (1.3 MPa) consumption at NLMK is presented in Table E.1.2.

Table E.1.2: Actual data of steam (1.3 MPa) consumption at NLMK

Steam (1.3 MPa)	Unit	2002	2007	2008	2009
Steam (heat) consumption	Gcal	1,127,339	946,602	896,553	793,302
	-	1.00	0.84	0.80	0.70

And the forecast of steam (1.3 MPa) consumption at NLMK in 2010-2012 is presented in Table E.1.3.

[22] t.c.e – tonne of coal equivalent

Table E.1.3: Forecast of steam (1.3 MPa) consumption at NLMK

Steam (1.3 MPa)	Unit	2010	2011	2012
Steam (heat) consumption	Gcal	751,547	709,792	668,038
	-	0,67	0,63	0,59

The used data and results of calculation of emissions within the crediting period are presented in Table E.1.4.

Table E.1.4: Estimated project emissions of subproject 1 within the crediting period

Indicator	Unit	2008	2009	2010	2011	2012
Emission from fuel burning						
Annual natural gas consumption	GJ	8,576,530	8,529,305	8,552,918	8,552,918	8,552,918
Emission factor of natural gas	tCO_2/GJ	0.0561	0.0561	0.0561	0.0561	0.0561
Subproject 1 emission from natural gas burning	tCO_2	**481,143**	**478,494**	**479,819**	**479,819**	**479,819**
Annual blast furnace gas consumption	GJ	1,030,592	1,117,320	1,073,956	1,073,956	1,073,956
Emission factor of blast furnace gas	tCO_2/GJ	0.2600	0.2600	0.2600	0.2600	0.2600
Subproject 1 emission from blast furnace gas burning	tCO_2	**267,954**	**290,503**	**279,229**	**279,229**	**279,229**
Emission associated with additional heat generation						
Steel (slabs) output	t steel	4,786,139	4,760,291	4,773,215	4,773,215	4,773,215
Specific fuel consumption in baseline	GJ/t steel	2.83	2.83	2.83	2.83	2.83
Specific heat output in baseline	GJ heat/GJ fuel	0.158	0.158	0.158	0.158	0.158
Heat generation in baseline	GJ	1,698,771	1,495,014	1,420,171	1,341,269	1,262,367
Heat generation in project scenario	GJ	1,051,968	637,762	844,865	844,865	844,865
Additional heat generation in project scenario	GJ	646,803	857,252	575,306	496,404	417,501
Emission factor for heat generation at NLMK CHPP[23]	tCO_2/GJ	0.178	0.194	0.184	0.184	0.184
Emission associated with additional heat generation	tCO_2	**114,973**	**166,514**	**106,120**	**91,566**	**77,012**
Total project emission	tCO_2	**864,070**	**935,511**	**865,167**	**850,613**	**836,059**
Total 2008 - 2012	tCO_2	**4,351,421**				

Project emissions of subproject 1 for the time frame after the crediting period are similar for 2010-2012. They are presented in Table E.1.5.

Table E.1.5: Estimated project emissions of subproject 1 after the crediting period

Indicator	Unit	2013	2014	2015	2016	2017	2018	2019	2020
Project emission	tCO_2	836,059	836,059	836,059	836,059	836,059	836,059	836,059	836,059
Total 2013 - 2020	tCO_2	6,688,472							

[23] Please see Annex 2

Subproject 2: Commissioning the hydrogen plant based on steam reforming of natural gas technology

The actual data of new hydrogen plant (after subproject 2 implementation) for 2008-2009 are presented in Table E.1.6.

Table E.1.6: Actual data of subproject 2 for 2008-2009

Indictor	Unit	2008	2009
H_2 output	1000 m^3	42,458	18,553
Electricity consumption	MWh	4,752	3,353
Natural gas consumption	1000 m^3	18,336	8,702
Net calorific value of natural gas	GJ/1000 m^3	35,59	35,59
Natural gas consumption	GJ	652 571	309 717

Source: Data provided by NLMK

This data was used for project emission estimation of subproject 2 for 2008-2009.

However the data of 2009 is not representative therefore the average values of new hydrogen plant parameters for 2005-2007 were used for project emission estimation of subproject 2 for 2010-2012. They are presented in Table E.1.7.

Table E.1.7: Estimation of average values of new hydrogen plant parameters for 2005-2007

Indictor	Unit	2005	2006	2007	Average
H_2 output	1000 m^3	38,282	42,375	43,413	**41,357**
Electricity consumption	MWh	5,489	5,700	4,728	**5,306**
Natural gas consumption	1000 m^3	17,771	18,224	18,584	18,193
Net calorific value of natural gas	GJ/1000 m^3	35.59	35.59	35.59	35.59
Natural gas consumption	GJ	632,493	648,604	661,429	**647,509**

Source: Data provided by NLMK

The used data and results of calculation of emissions within the crediting period are presented in Table E.1.8.

Table E.1.8: Estimated project emissions of subproject 2 within the crediting period

Indictor	Unit	2008	2009	2010	2011	2012
H_2 production	1000 m^3	42,458	18,553	44,300	44,300	44,300
Natural gas consumption	GJ	652,571	309,717	693,593	693,593	693,593
Emission factor of natural gas	tCO_2/GJ	0.0561	0.0561	0.0561	0.0561	0.0561
NG emission	**tCO_2**	**36,609**	**17,375**	**38,911**	**38,911**	**38,911**
Electricity consumption	MWh	4,752	2,380	5,683	5,683	5,683
Average electricity emission factor	tCO_2/MWh	1.112	1.221	1.221	1.221	1.221
Emission from electricity	**tCO_2**	**5,285**	**2,905**	**6,937**	**6,937**	**6,937**
Total project emission	**tCO_2**	**41,894**	**20,280**	**45,847**	**45,847**	**45,847**
Total project emission for 2008-2012	**tCO_2**	**199,716**				

Project emissions of subproject 1 for the time frame after the crediting period are similar for 2010-2012. They are presented in Table E.1.9.

Table E.1.9: Estimated project emissions of subproject 2 after the crediting period

Indicator	Unit	2013	2014	2015	2016	2017	2018	2019	2020
Project emission	tCO_2	45,847	45,847	45,847	45,847	45,847	45,847	45,847	45,847
Total 2013 - 2020	tCO_2	366,776							

The estimations of total project emissions within and after crediting period are presented in Table E.1.10 and E.1.11, respectively. This is sum of subproject 1 and 2 emissions.

Table E.1.10: Estimated total project emission within the crediting period

Indicator	Unit	2008	2009	2010	2011	2012
Project emissions	tCO_2	905,964	955,792	911,015	896,460	881,906
Total 2008 - 2012	tCO_2	4,551,136				

Table E.1.11: Estimated total project emission after the crediting period

Indicator	Unit	2013	2014	2015	2016	2017	2018	2019	2020
Project emission	tCO_2	881,906	881,906	881,906	881,906	881,906	881,906	881,906	881,906
Total 2013 - 2020	tCO_2	7,055,249							

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

Indicator	Unit	2008	2009	2010	2011	2012
Project emissions	tCO_2	905,964	955,792	911,015	896,460	881,906
Total 2008 - 2012	tCO_2	4,551,136				

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

Indicator	Unit	2013	2014	2015	2016	2017	2018	2019	2020
Project emission	tCO_2	881,906	881,906	881,906	881,906	881,906	881,906	881,906	881,906
Total 2013 - 2020	tCO_2	7,055,249							

E.4. Estimated baseline emissions:

Subproject 1: Reconstruction of heating furnaces No 4 and 5 at the Hot Sheet-Rolling Shop

Table E.4.1: Estimated baseline emissions of subproject 1 within the crediting period

Indictor	Unit	2008	2009	2010	2011	2012
Emission from fuel burning						
Steel (slabs) output	t steel	4,786,139	4,760,291	4,773,215	4,773,215	4,773,215
Specific fuel consumption	GJ/t steel	2.83	2.83	2.83	2.83	2.83
Total fuel consumption	GJ	13,545,293	13,472,140	13,508,717	13,508,717	13,508,717
Share of natural gas consumption	-	0.893	0.884	0.888	0.888	0.888
Share of BFG consumption	-	0.107	0.116	0.112	0.112	0.112
Natural gas consumption	GJ	12,092,238	11,911,731	12,001,710	12,001,710	12,001,710
Emission factor of natural gas	tCO_2/GJ	0.0561	0.0561	0.0561	0.0561	0.0561
NG emission	**tCO_2**	**678,375**	**668,248**	**673,296**	**673,296**	**673,296**
Blast furnace gas consumption	GJ	1,453,055	1,560,410	1,507,007	1,507,007	1,507,007
Emission factor of blast furnace gas	tCO_2/GJ	0.2600	0.2600	0.2600	0.2600	0.2600
BFG emission	**tCO_2**	**377,794**	**405,707**	**391,822**	**391,822**	**391,822**
Emission associated with additional BOF steel production						
Specific steel waste in baseline	tonne/ tonne of steel	0.022	0.022	0.022	0.022	0.022
Waste of steel in baseline	tonnes	105,132	104,564	104,848	104,848	104,848
Waste of steel in project	tonnes	65,658	68,124	66,891	66,891	66,891
Additional BOF steel production	GJ	39,474	36,440	37,957	37,957	37,957
Emission factor for BOF steel production	tCO2/t steel	1.46	1.46	1.46	1.46	1.46
Emission associated with additional BOF steel production	**tCO_2**	**57,632**	**53,203**	**55,418**	**55,418**	**55,418**
Total baseline emission	**tCO_2**	**1,113,801**	**1,127,157**	**1,120,535**	**1,120,535**	**1,120,535**
Total baseline emission for 2008-2012	**tCO_2**	**5,602,564**				

Baseline emissions of subproject 1 for the time frame after the crediting period are similar for 2010-2012. They are presented in Table E.4.2.

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

Indicator	Unit	2013	2014	2015	2016	2017	2018	2019	2020
Baseline emission	tCO_2	1,120,535	1,120,535	1,120,535	1,120,535	1,120,535	1,120,535	1,120,535	1,120,535
Total 2013 - 2020	tCO_2	8,964,282							

Subproject 2: Commissioning the hydrogen plant based on steam reforming of natural gas technology

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

Indictor	Unit	2008	2009	2010	2011	2012
H2 production	1000 m^3	42,458	18,553	44,300	44,300	44,300
Specific electricity consumption	MWh/1000 m^3	5.48	5.48	5.48	5.48	5.48
Total electricity consumption	MWh	232,819	101,734	226,781	226,781	226,781
Average electricity emission factor[24]	t CO2/MWh	1.112	1.221	1.146	1.146	1.146
Emission from electricity	**tCO_2**	**258,942**	**124,171**	**259,975**	**259,975**	**259,975**
Specific steam consumption	GJ/1000 m^3	3.93	3.93	3.93	3.93	3.93
Total steam consumption	GJ	166,861	72,913	174,101	174,101	174,101
Emission factor for heat generation at	GJ	0.178	0.194	0.184	0.184	0.184

[24] Please see Annex 2

Indictor	Unit	2008	2009	2010	2011	2012
NLMK's CHPP						
Emission from fuel	**tCO_2**	**29,660**	**14,163**	**32,114**	**32,114**	**32,114**
Total project emission	**tCO_2**	**288,603**	**138,334**	**328,611**	**328,611**	**328,611**
Total project emission for 2008-2012	**tCO_2**	**1,412,771**				

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

Indicator	Unit	2013	2014	2015	2016	2017	2018	2019	2020
Baseline emission	tCO_2	328,611	328,611	328,611	328,611	328,611	328,611	328,611	328,611
Total 2013 - 2020	tCO_2	2,628,888							

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

Indicator	Unit	2008	2009	2010	2011	2012
Baseline emission	tCO_2	1,402,404	1,265,491	1,449,147	1,449,147	1,449,147
Total 2008 - 2012	tCO_2	7,015,335				

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

Indicator	Unit	2013	2014	2015	2016	2017	2018	2019	2020
Baseline emission	tCO_2	1,449,147	1,449,147	1,449,147	1,449,147	1,449,147	1,449,147	1,449,147	1,449,147
Total 2013 - 2020	tCO_2	11,593,173							

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	496,440	309,700	538,132	552,686	567,240
Total 2008 - 2012	tCO_2	2,464,199				

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	567,240	567,240	567,240	567,240	567,240	567,240	567,240	567,240
Total 2008 - 2012	tCO_2	4,537,924							

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	905,964	0	1,402,404	496,440
Year 2009	955,792	0	1,265,491	309,700
Year 2010	911,015	0	1,449,147	538,132
Year 2011	896,460	0	1,449,147	552,686
Year 2012	881,906	0	1,449,147	567,240
Total (tonnes of CO_2 equivalent)	4,551,136	0	7,015,335	2,464,199

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	881,906	0	1,449,147	567,240
Year 2014	881,906	0	1,449,147	567,240
Year 2015	881,906	0	1,449,147	567,240
Year 2016	881,906	0	1,449,147	567,240
Year 2017	881,906	0	1,449,147	567,240
Year 2018	881,906	0	1,449,147	567,240
Year 2019	881,906	0	1,449,147	567,240
Year 2020	881,906	0	1,449,147	567,240
Total (tonnes of CO_2 equivalent)	7,055,249	0	11,593,173	4,537,924

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).

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

Subproject 1
The EIA of heating furnace No 5 was prepared in 2001. Positive conclusion No 49 of the Expert Committee of SEE was approved by Natural Resources Committee across the Lipetsk area of Ministry of Natural Resources of the Russian Federation on 26 March 2002.

The EIA of heating furnace No 4 was prepared in 2005. Positive conclusion No 191 of the Expert Committee of SEE was approved by Russian Federal Service for Ecological, Technical and Atomic Supervision across the Lipetsk area of Federal Service on Environmental, Technical and Atomic Supervision on 22 June 2006.

The main conclusion of Expert Committee is "…Expert Committee considers that the project can be implemented and project environmental impact is permissible".

These conclusions are obligatory according to Federal Law "On the Environmental Expertise".

Subproject 2
The EIA of the subproject "Commissioning the hydrogen plant based on steam reforming of natural gas technology" was prepared in 2003. Positive conclusion No 149 of the Expert Committee of SEE was approved by Natural Resources Committee across the Lipetsk area of Ministry of Natural Resources of the Russian Federation on 01 October 2004.

The main conclusion of Expert Committee is "…Expert Committee considers that the project can be implemented and project environmental impact is permissible".

These conclusions are obligatory according to Federal Law "On the Environmental Expertise".

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:

Not applicable

SECTION G. Stakeholders' comments

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

Proposed projects were submitted and approved by Administration of Lipetsk and other local stakeholders. For example, these projects have got positive conclusions from Lipetsk Center of Hygiene and Epidemiology of Federal Supervision Service on Consumer Rights Protection and Human Wellbeing.

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/. Also NLMK prepared annual reports "Corporative Stability and Social Responsibility" in 2006, 2007 and 2008 (http://www.nlmk.ru/social/srep/).

No comments were received on the proposed projects.

Annex 1

CONTACT INFORMATION ON PROJECT PARTICIPANTS

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Annex 2

BASELINE INFORMATION

Subproject 1. Reconstruction of heating furnaces No 4 and 5 at the Hot Sheet-Rolling Shop

The subproject started in 2002 but furnace No 5 was stopped in August 2000. Therefore the data for 1997-1999 was used for calculation average baseline parameters. The main parameters of the Hot Sheet-Rolling Shop before the subproject 1 implementation for 1997-1999 and its average values are presented in Table Anx.2.1.

Table Anx.2.1: The main parameters of the Hot Sheet-Rolling Shop and its average values

Parameter	Unit	1997	1998	1999	Average
Energy efficiency					
Steel (slabs) output	t steel	4,849,244	4,237,778	4,131,773	4,406,265
Total fuel consumption	t.c.e	483,490	398,233	393,784	425,169
	GJ	14,180,762	11,680,179	11,549,685	12,470,208
Specific fuel consumption	GJ/t steel	2.92	2.76	2.80	**2.83**
Heat output					
Heat output	Gcal	n/a	147,950	125,657	140,519
	GJ	n/a	619,465	526,125	588,352
Specific heat generation per 1 GJ of fuel consumption	GJ/GJ	n/a	0.066	0.056	**0.061**
Waste of steel					
Waste of steel	tonne/tonne of steel	119,211	85,444	85,708	96,788
		0.025	0.020	0.021	**0.022**

The average values of the specific fuel consumption ($SFC_{sp1,BL}$), the specific heat generation ($SHG_{sp1,BL}$) and the specific waste of steel of the furnaces ($SWM_{sp1,BL}$) are used for calculation of the baseline and the project emissions in the formulas in Section D. They are ex-ante for period 2008-2012.

Subproject 2. Commissioning the hydrogen plant based on steam reforming of natural gas technology

The main parameters of the two electrolysis installations before implementation of subproject 2 for 2001-2003 and its average values are presented in Table Anx.2.2.

Table Anx.2.2: The main parameters of the two electrolysis installation and its average values

Indictor	Unit	2001	2002	2003	Average
Electrolysis installation No 1					
Electricity consumption	MWh	72,988	75,838	80,316	76,381
Steam consumption	GJ	80,683	80,420	76,354	79,152
H_2 output	1000 m^3	13,515	14,305	15,230	14,350
Electrolysis installation No 2					
Electricity consumption	MWh	76,126	79,120	84,905	80,050

Steam consumption	GJ	31,796	32,428	34,660	32,961
H_2 output	1000 m^3	13,359	13,919	15,255	14,177
Specific electricity consumption	MWh/1000 m^3	5.55	5.49	5.42	**5.48**
Specific steam consumption	GJ/1000 m^3	4.19	4.00	3.64	**3.93**

The average values of the specific electricity consumption ($SEC_{sp2,BL}$) and the specific steam consumption ($SSC_{sp2,BL}$) are used for calculation of the baseline of subproject 2 emissions in the formulas 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[25]
	tCO_2/GJ
Natural gas	0.0561
Coke oven gas	0.0444
Blast furnace gas	0.2596

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." [26]. 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.

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.

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

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

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:

$EF_{CO2,ELEC}$ = 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 formulas 6 and 13 (please Section D). The initial data and results of calculation are presented in Table Anx.2.5.

Table Anx.2.5: The initial data and results of emission factors calculation

Indicator	Unit	2007	2008	2009	Total/ Average
Emission factor for electricity					
Electricity grid					
Electricity consumption from grid	**MWh**	**3,111,349**	**2,966,975**	**2,344,462**	**8,422,786**
Grid electricity emission factor	tCO_2/MWh	0.526	0.526	0.526	0.526
Emission associated with electricity consumption from grid	**tCO_2**	**1,636,570**	**1,560,629**	**1,233,187**	**4,430,386**
NLMK CHPP					
Total fuel consumption	**t.c.e**	**1,778,230**	**1,712,998**	**1,619,027**	**5,110,255**
Natural gas	t.c.e	317,287	349,254	467,908	1,134,450
	%	17.8	20.4	28.9	22.2
Heavy fuel oil	t.c.e	89	4,251	9,652	13,993
	%	0.01	0.2	0.6	0.3
Coke oven gas	t.c.e	588,077	545,330	284,739	1,418,146
	%	33.1	31.8	17.6	27.8
Blast furnace gas	t.c.e	872,776	814,163	856,727	2,543,667
	%	49.1	47.5	52.9	49.8
Electricity output	**MWh**	**2,027,097**	**2,001,374**	**1,870,000**	**5,898,472**
Specific fuel consumption per 1 MWh	kg.c.e./MWh	454.32	452.65	440.28	449.30
	GJ/MWh	13.3	13.3	12.9	13.2
Total fuel consumption for electricity generation	GJ	26,992,148	26,551,666	24,130,796	77,674,609
Natural gas consumption for electricity generation	GJ	4,816,176	5,413,474	6,973,944	17,203,594
Natural gas emission factor	tCO_2/GJ	0.0561	0.0561	0.0561	0.0561
Emission from natural gas burning	**tCO_2**	**270,187**	**303,696**	**391,238**	**965,122**
Heavy fuel oil consumption for electricity generation	GJ	1,352	65,893	143,864	211,108
Heavy fuel oil emission factor	tCO_2/GJ	0.0774	0.0774	0.0774	0.0774
Emission from heavy fuel oil burning	**tCO_2**	**105**	**5,100**	**11,135**	**16,340**
Coke oven gas consumption for electricity	GJ	8,926,557	8,452,675	4,243,893	21,623,125

Indicator	Unit	2007	2008	2009	Total/ Average
generation					
Coke oven gas emission factor	tCO_2/GJ	0.0444	0.0444	0.0444	0.0444
Emission from coke oven gas burning	**tCO_2**	**396,339**	**375,299**	**188,429**	**960,067**
Blast furnace gas consumption for electricity generation	GJ	13,248,063	12,619,624	12,769,095	38,636,782
Blast furnace gas emission factor	tCO_2/GJ	0.2600	0.2600	0.2600	0.2600
Emission from blast furnace gas burning	**tCO_2**	**3,444,496**	**3,281,102**	**3,319,965**	**10,045,563**
Emission factor for electricity					
Total electricity consumption at NLMK	MWh	5,138,446	4,968,349	4,214,463	14,321,258
Total emission associated with electricity	tCO_2	5,747,697	5,525,826	5,143,954	16,417,477
Average emission factor for electricity	**tCO_2/MWh**	**1.119**	**1.112**	**1.221**	**1.146**
Emission factor for heat					
NLMK CHPP heat output	**Gcal**	**3,531,324**	**3,407,723**	**3,301,895**	**10,240,941**
	GJ	**14,785,652**	**14,268,135**	**13,825,032**	**42,878,819**
Specific fuel consumption per 1 Gcal	kg.c.e/Gcal	170.50	170.04	171.22	170.58
	GJ/Gcal	5.0	5.0	5.0	5.0
Total fuel consumption for electricity generation	GJ	17,646,676	16,983,075	16,569,854	51,199,605
Natural gas consumption for electricity generation	GJ	3,148,675	3,462,586	4,788,787	11,400,048
Natural gas emission factor	tCO_2/GJ	0.0561	0.0561	0.0561	0.0561
Emission from natural gas burning	**tCO_2**	**176,641**	**194,251**	**268,651**	**639,543**
Heavy fuel oil consumption for electricity generation	GJ	884	42,147	98,787	141,817
Heavy fuel oil emission factor	tCO_2/GJ	0.0774	0.0774	0.0774	0.0774
Emission from heavy fuel oil burning	**tCO_2**	**68**	**3,262**	**7,646**	**10,977**
Coke oven gas consumption for electricity generation	GJ	5,835,921	5,406,531	2,914,147	14,156,600
Coke oven gas emission factor	tCO_2/GJ	0.0444	0.0444	0.0444	0.0444
Emission from coke oven gas burning	**tCO_2**	**259,115**	**240,050**	**129,388**	**628,553**
Blast furnace gas consumption for electricity generation	GJ	8,661,196	8,071,811	8,768,133	25,501,140
Blast furnace gas emission factor	tCO_2/GJ	0.2600	0.2600	0.2600	0.2600
Emission from blast furnace gas burning	**tCO_2**	**2,251,911**	**2,098,671**	**2,279,715**	**6,630,296**
Emission factor for heat					
Total emission associated with heat generation	tCO_2	2,687,735	2,536,234	2,685,400	7,909,369
Emission factor for heat generation	**tCO_2/GJ**	**0.182**	**0.178**	**0.194**	**0.184**

Annex 3

MONITORING PLAN

General

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

Energy Saving Centre of NLMK will prepare the monitoring plan. The department accesses to all data necessary for emission reduction calculations.

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

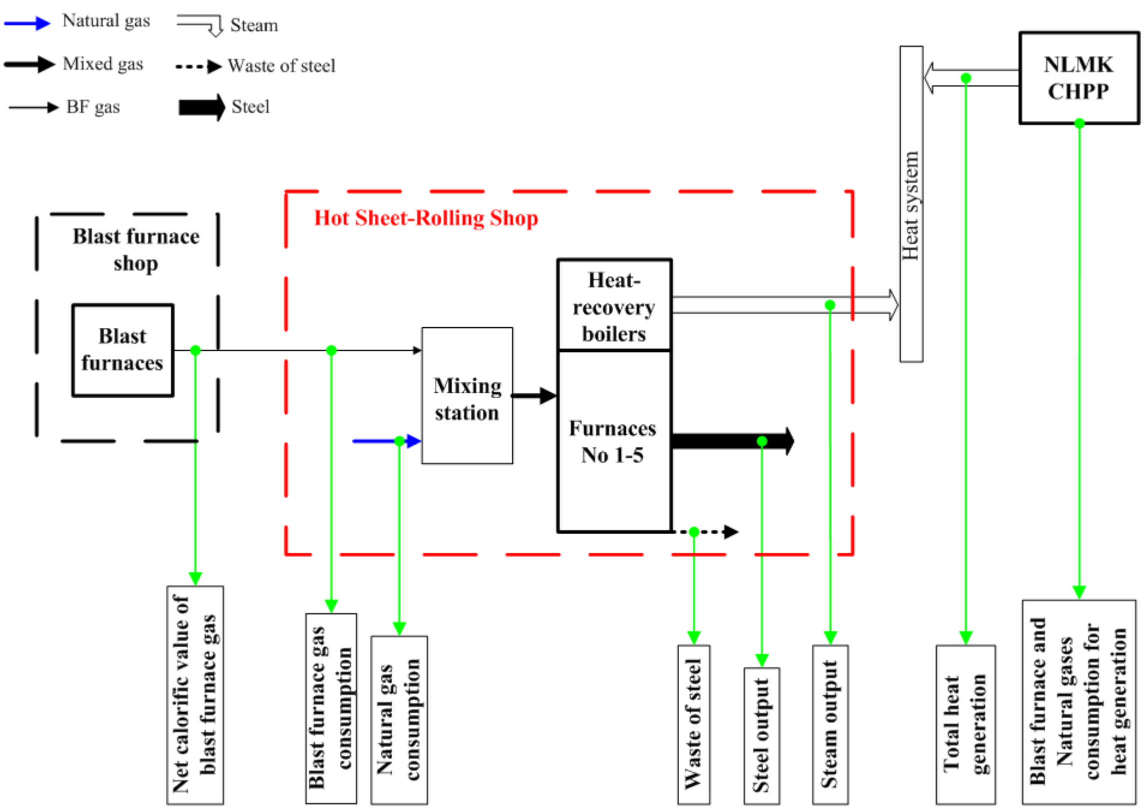
Subproject 1. Reconstruction of heating furnaces No 4 and 5 at the Hot Sheet-Rolling Shop

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

- Steel output from heating furnaces No 1-5;
- Waste of metal;
- Natural and blast furnace gases consumption at heating furnaces No 1-5;
- Net calorific value of blast furnace gas;
- Heat generation at NLMK CHPP and at the heat recovery boilers of furnaces No 1-5;
- Fuel consumption for heat generation at NLMK CHPP.

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

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



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

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

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

- The default IPCC CO_2 emission factors of natural, blast furnace gases and heavy fuel oil;
- Specific fuel consumption of furnaces No 1-5 before the reconstruction of the furnaces No 4 and 5;
- The default IPCC CO_2 emission factor for Basic Oxygen Furnace;
- Specific waste of steel of the furnaces No 1-5 before the reconstruction of the furnaces No 4 and 5.

Description, sources of data and values of these fixed parameters are presented in Section B.1 in tabular form.

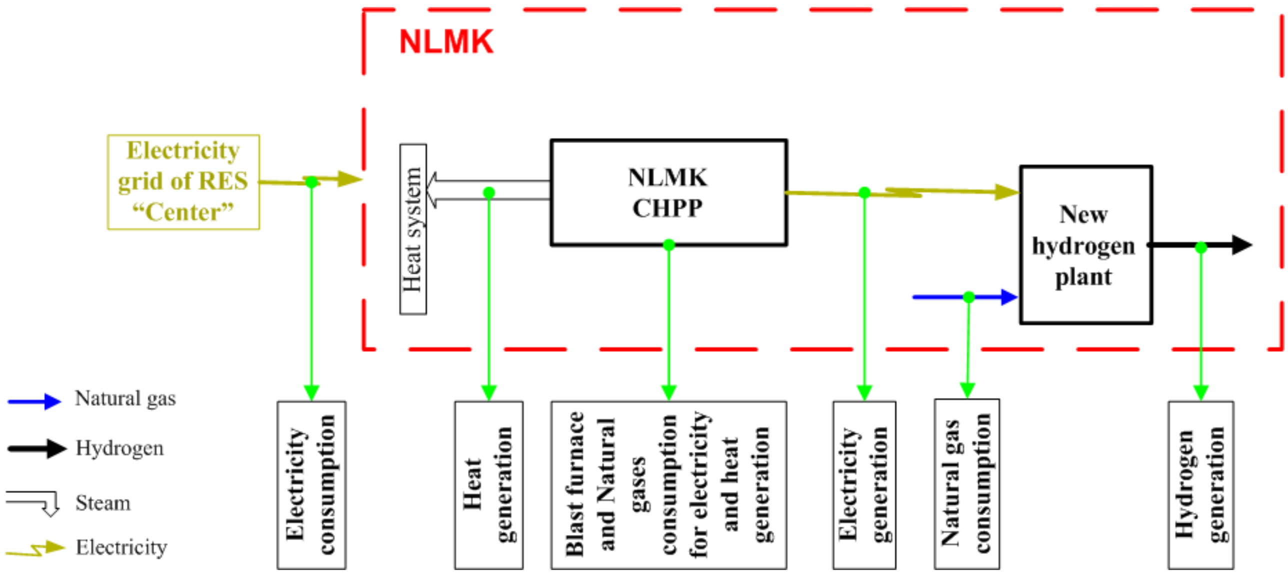
The project, baseline emissions and emission reduction of the subproject 1 are calculated according to the formulae are presented in Sections D.1.1.2, D.1.1.3 and D.1.4, respectively.

Subproject 2. Commissioning the hydrogen plant based on steam reforming of natural gas technology
During monitoring process of the subproject 2 the following parameters will be measured at NLMK shops:

- Generated volume of hydrogen at new hydrogen plant;
- Natural gas consumption at new hydrogen plant;
- Electricity consumption at new hydrogen plant;
- Total electricity consumption at NLMK from grid;
- Electricity generation at NLMK CHPP;
- Fuel consumption for electricity generation at NLMK CHPP;
- Heat generation at NLMK CHPP;
- Fuel consumption for heat generation at NLMK CHPP.

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

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



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

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

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

- The default IPCC CO_2 emission factors of natural, blast furnace gases and heavy fuel oil;
- The CO_2 emission factor for electricity consumption from grid;
- Specific electricity consumption per 1000 m^3 of hydrogen for electrolysis installations;
- Specific steam consumption per 1000 m^3 of hydrogen for electrolysis installations;
- The CO_2 emission factor for electricity consumption from grid.

Description, sources of data and values of these fixed parameters are presented in Section B.1 in tabular form and in Annex 2 (CO_2 emission factor for electricity consumption from grid).

The project, baseline emissions and emission reduction of the subproject 2 are calculated according to the formulae are presented in Sections D.1.1.2, D.1.1.3 and D.1.4, respectively.