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

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Annexes

SECTION A. General description of the project

A.1. Title of the project:

The implementation of energy efficiency measures at Chelyabinsk Electrometallurgical Works, OJSC.
Sectoral scope:
09 Metal production
Version No.: 04
Date: August 02, 2011

A.2. Description of the project:

The project mission is to reduce power consumption during ferrosilicon production at Chelyabinsk Electrometallurgical Works, OJSC and to reduce greenhouse gas emissions.

Chelyabinsk Electrometallurgical Works, OJSC, is located in the Chelyabinsk Region (the Southern Urals, Russia), and is the largest ferroalloy producer in the Russian Federation. Its market share in the ferrosilicon market in Russia is about 40%[1].

Ferrous alloys are the iron-based alloys of silicon, manganese, chromium and tungsten, and other elements, which are used in steelmaking for the improvement of its properties and alloying. Ores are the feed stock for ferrous alloying. Thus, in ferrosilicon production they use ores rich in reducible silicon oxide (quartzite). Ferrosilicon is smelted in reduction electric arc ferroalloy melting furnaces, which are in continuous operation and consume a lot of power.

Before the project started, ChEMW, OJSC had used quartzite from the Bakalskoe deposit in silicon alloy production. The Bakalskoe deposit is also located in the Chelyabinsk Region, 270 km from the plant. But, despite the 50-year experience of using quartzite from the Bakalskoe deposit and its satisfactory quality, in 2004 ChEMW began to use another type of quartzite, mined at the Antonovskoe deposit located in the Kemerovo Region (Siberia), 1710 km from the plant. Quartzite from the Antonovskoe deposit has a higher reduction ratio as compared to quartzite from the Bakalskoe deposit, as well as less slag-forming impurities, which lead to molten slag formation and a decrease in the reduction ratio. Besides, low alumina content in quartzite from the Antonovskoe deposit enabled ferrosilicon to be produced which was poor in aluminum without additional expenditures on ladle treatment.

Thus, the implementation of ferrosilicon smelting technology with the use of quartzite from the Antonovskoe deposit instead of quartzite from the Bakalskoe deposit made it possible to increase the furnace capacity, reduce silicon losses and reduce the specific electrical energy consumption.

Baseline scenario

Maintaining the situation which existed before the project started – using quartzite from the Bakalskoe deposit in ferrosilicon production, is considered as the baseline scenario.

[1] http://www.metalbulletin.ru/analytics/black/389/

The quartzite is delivered by rail.

The average specific electrical energy consumption during ferrosilicon production when using quartzite from the Bakalskoe deposit is 5455.4 kWh/b.t.

Project

The project scenario involves using quartzite from the Antonovskoe deposit in ferrosilicon production, which enables the specific electrical energy consumption to be reduced. The average specific electrical energy consumption during ferrosilicon production when using quartzite from the Antonovskoe deposit is 5169.4kWh/b.t.

Thus, when replacing quartzite from the Bakalskoe deposit with quartzite from the Antonovskoe deposit, the specific electrical energy consumption during ferrosilicon production decreases by 5.3%. The implementation of the project results in electrical energy saving during ferrosilicon production, which leads to the consequent reduction of greenhouse gas and pollutant emissions due to the reduced fuel consumption at the electric power plants of the united power grid of the Urals.

Nevertheless, the adoption of quartzite from the Antonovskoe deposit, which is located further away than the Bakalskoe deposit, required an increase in delivery costs, which led to a consequent increase in ferrosilicon cost.

History of the project development

In 2003, the management of ChEMW, OJSC decided to replace quartzite from the Bakalskoe deposit with quartzite from the Antonovskoe deposit in ferrosilicon production. Considering that the implementation of the project resulted in a reduction of greenhouse gas emissions, which they can sell to "carbon" traders and thus receive funds to compensate for the increase in the cost of ferrosilicon production, the company management decided to use the mechanism of the Kyoto Protocol Joint Implementation.

In February 2004, the first delivery of quartzite from the Antonovskoe deposit was made, and it began to be used in shops No. 2, 7 and 8.

The implementation of the project will enable greenhouse gas emissions to be reduced to the amount of **304,397 t CO_2** during 2008-2012, which is an average of 60,879 t CO_2 per year.

A.3. Project participants:

Party involved	Legal entity project participants (as applicable)	Please indicate if the Party involved wishes to be considered as project participant (Yes/No)
Party A - Russian Federation (Host party)	Open Joint Stock Company "Chelyabinsk Electrometallurgical Works"	No
Party B	-	No

A.4. Technical description of the project:

A.4.1. Location of the project:

The Russian Federation

A.4.1.1. Host Party(ies):

The Russian Federation

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

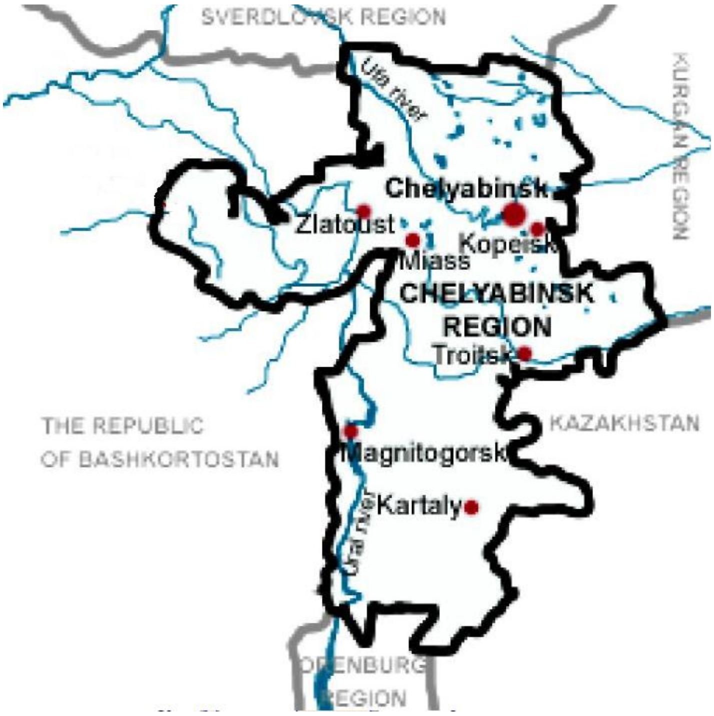
The Chelyabinsk Region. The Chelyabinsk Region is situated in the Southern Urals. The national borderline between Europe and Asia lies mainly along the dividing ridges of the Urals. The area of the Chelyabinsk Region is 88.5 thousand square kilometers, which is 0.5% of the territory of the Russian Federation. The region extends for 490 km from north to south and for 400 km from east to west. See the map below.

Figure A.4-1 The Chelyabinsk Region on a map of the Russian Federation

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

Chelyabinsk is the administrative center of the Chelyabinsk Region, and is situated in the north-east of the region, 1492 km to the east of the city of Moscow. Its population is about 1 million people.

Figure A.4-2. Chelyabinsk on a map of the Chelyabinsk Region



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

The address of Chelyabinsk Electrometallurgical Works, OJSC: 80-p/80 Geroev Tankograda St., 454081 Chelyabinsk.

Ferrosilicon is produced in the following shops of the plant:

Table A 4.1.4. Ferrosilicon grades smelted in the following shops

Shop number	Ferrosilicon grade
2	75
7	45,65 and 75
8	65 and 75

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

The ferrosilicon production process is based on silicon reduction from dioxide contained in quartzite by coke carbon or another reducing agent with further iron smelting. As silicon is a strong reducing agent and its dioxide (SiO_2) is quite a firm compound, silicon reduction with carbon requires high temperatures and sufficient excess carbon in the reaction zone.

During the smelting process, a whole complex of chemical reactions takes place in the bath of the furnace. The total overall reaction is:
$SiO_2 + 2C = Si + 2CO$.
Actually during silicon reduction middling products such as silicon monoxide (SiO) and silicon carbide (SiC) occur. The main task of the process control is to ensure the preferential progress of the reaction of silicon dioxide reduction to silicon, because an increase in silicon monoxide leads to gross silicon evaporation, and the formation of silicon carbide, which has high conductivity and a high melting point. It results in electrical disturbance and slag thickening hindering its exit from the furnace. This causes a reduction in the efficiency of silicon use.

Silicon reduction is greatly facilitated by iron, which destroys silicon carbides in the upper furnace zone with the formation of firm compounds – silicides FeSi, FeSi2, Fe2Si5; this discharges silicon from the reaction zone and enables increased silicon reduction at lower temperatures.

The main iron-bearing material in ferrosilicon smelting is steel chips.
As the iron content of the burden is specified by the alloy grade, high-grade silicon smelting is the most complex and energy-consuming.
As the silicon content decreases, the specific electrical energy consumption decreases and the furnace capacity increases.
The second thing needed for full silicon reduction is the removal from the reaction zone of a light-end product – carbon oxide (CO), which is almost entirely determined by the throat permeability. The throat permeability is conditioned by the burden permeability (which is determined by the size of the quartzite and other charging materials, the usage of chips) and its treatment.

The third thing needed to make the process effective is a high temperature in the lower zone of the bath, which enables silicon reduction reactions, the preheating of metal and slag for their smooth exit from the furnace, and the reduction in heat loss from gases exiting through the throat. This is provided by the deep, firm fit of the electrodes, the sufficient capacity ratio of the furnace's bath and by keeping the charging material gas-permeable at low temperatures.

Along with silica, quartzite impurities and the ash of the reducing agent are partly reduced in the furnace. Those impurities, which cannot be fully reduced due to the physicochemical parameters of the process (alumina, calcium, barium, magnesium, etc.), are slagged with silica. When there is not enough of the reducing agent, slag is dressed with silicon carbide as a result of skull failure. Slug has a high melting point and viscosity.

Ferrosilicon smelting is a non-stop process with continuous material charge and batch alloy tapping and flushing.

At present one of the basic consumer requirements of ferrosilicon chemical composition is low aluminum content. When an alloy poor in aluminum is required, which cannot be provided by the charging material used, liquid ferrosilicon is treated with siderite (ferrous carbonate FeCO3) in a ladle with the natural mixing of the melt by means of the resulting carbon dioxide. This enables the aluminum content in the melted alloy to be reduced by making oxide and removing it from the melt together with slag. Silicon is simultaneously oxidized and iron is reduced from siderite. The silicon losses during ferrosilicon ladle treatment result in an increase in all of the specific output indicators.
Quartzite fabrication characteristics are determined by its chemical composition and, to an even greater degree, by its structure and mineralogical makeup.

Until 2004, ChEMW used quartzite from the Bakalskoe deposit (the Southern Urals) in silicon alloy manufacture. In 2004 the plant started using the quartzite produced by the Antonovskoe mining administration, OJSC (Kemerovo Region). The analysis showed that quartzite from the Antonovskoe deposit has a higher reduction ratio than quartzite from the Bakalskoe deposit due to its numerous cracks and low strength, which lead to the intensive breakdown of its structure at temperatures lower than 1600 0C. As a result, the active surface area is enlarged and, consequently, the reducibility is increased. When the temperature is higher than 1700 0C and quartzite melts, its composition is the main factor influencing the reduction ratio.
Quartzite from the Antonovskoe deposit has less slag-forming impurities, which lead to the formation of molten slag, lowering the reduction ratio.

Besides, the low alumina content in quartzite from the Antonovskoe deposit made it possible to produce ferrosilicon poor in aluminum without additional expenditures on ladle treatment.

Thus, the implementation of ferrosilicon smelting technology with the use of quartzite from the Antonovskoe deposit instead of quartzite from the Bakalskoe deposit enabled the furnace capacity to be increased, whilst silicon losses and the specific electrical energy consumption were reduced.

The key figures of the shops' performance in 2000-2010 are given in Tables A 4.1 and A 4.2.

Table A. 4.1 Specific electrical energy consumption when using quartzite from the Bakalskoe deposit (before the project started) (kWh/t Si)

Shop No.\ Ferrosilicon grade	Ferrosilicon 45	Ferrosilicon 65	Ferrosilicon 75
Shop No.2			13,083.4
Shop No.7	11,907.2	11,892.8	13,083.4
Shop No.8		11,913.8	13,721.2

Table A. 4.2 Specific electrical energy consumption when using quartzite from the Antonovskoe deposit (after the project started) (kWh/t Si)

Shop No.\ Ferrosilicon grade	Ferrosilicon 45	Ferrosilicon 65	Ferrosilicon 75
Shop No.2			11,890.2
Shop No.7	11,125.2	11,231.9	11,773.0
Shop No.8		11,638.9	11,740.9

Table A 4.3. Schedule of the project realization

Date	Stage description
12.03.2003	Assessment of project technical realizeability
19.03.2003	Project decision making
01.04.2003	Conclusion of a contract about quartzite deliveries from OJSC "Antonovskoe mining administration" (contract № 87/16sb/03/1073)
17.04.2003	First quartzite pilot batch delivery from OJSC "Antonovskoe mining administration"

April – May 2003	Pilot campaign on using quartzite from the Antonovskoe deposit in ferrosilicon production.
June 2003	Technical meeting about results of pilot campaign.
04.08.2003	Second quartzite pilot batch delivery from OJSC “Antonovskoe mining administration”
7.02.2004	Quartzite delivery from OJSC “Antonovskoe mining administration” for the beginning of industrial processing, using of this quartzite for smelting of ferrosilicon of each grade at all furnaces of the shops # 2,7,8

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

The replacement of quartzite from the Bakalskoe deposit with quartzite from the Antonovskoe deposit results in a decrease in the electrical energy consumption during ferrosilicon production. This will lead to a reduction in the consumption of electric power generated by the thermal power plants of the united power grid of the Urals and, consequently, to a reduction in the amount of fossil fuels consumed. The average specific electrical energy consumption during ferrosilicon production when using quartzite from the Bakalskoe deposit is 5455.4 kWh/b.t. The average specific electrical energy consumption during ferrosilicon production when using quartzite from the Antonovskoe deposit is 5169.4kWh/b.t. Thus, using quartzite from the Bakalskoe deposit in ferrosilicon production increases the electrical energy consumption by 5.3% and, consequently, requires more fuel to be combusted at the power plants. The implementation of the project leads to a reduction in greenhouse gas emissions due to the reduction in the amount of fossil fuels consumed by the power plants of the united power grid.

An estimation of greenhouse gas emissions is given in section E. When estimating CO_2 emissions under the baseline scenario, the emission factor for the united power grid of the Urals is taken to be equal to 0.606 tCO2/MWh. This factor was developed in the project design documents “Construction of a new 400 MW CCGT unit at the Yaivinskaya hydroelectric power plant, Wholesale Generating Company-4, Perm Territory, Russia”[2], which was determined.

Without the project proposed (baseline scenario) ChEMW, OJSC would continue using quartzite from the Bakalskoe deposit. The following facts count in favour of this scenario:

- ChEMW, OJSC has been using quartzite from this deposit for the last 50 years.
- The Bakalskoe deposit is much nearer to the plant than the Antonovskoe deposit.
- The Ferrosilicon production cost when using quartzite from the Bakalskoe deposit is lower than when using quartzite from the Antonovskoe deposit.

For a more detailed analysis of these facts see section B.

[2] The project design documents mentioned are publicly available at the web-site of Sberbank of Russia, OJSC http://www.sbrf.ru/common/img/uploaded/files/tender/kioto2/26_OGK4_Yayvinskaya.pdf

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

	Years
Length of the crediting period: **2008-2012**	5
Year	Estimate of annual emission reductions in tonnes of CO_2 equivalent
2008	47008
2009	51442
2010	53032
2011	47461
2012	105729
Total estimated emission reductions over the crediting period (tones of CO_2 equivalent)	304673
Annual average of emission reductions over the crediting period (tones of CO_2 equivalent)	60935

A.5. Project approval by the Parties involved:

On October 28, 2009 the Government of the Russian Federation adopted a resolution “On Measures for the Implementation of Article 6 of the Kyoto Protocol to the UN Framework Convention on Climate Change”[3]. This document approves Regulations on the implementation of article 6 of the Kyoto Protocol.

According to paragraph 8 of the Resolution, the projects will be approved by the Ministry of Economic Development and Trade of the Russian Federation based on the results of the competitive selection of applications. The competitive selection of applications is held by the carbon unit operator (Sberbank of Russia) in compliance with paragraph 5 of the Resolution of the RF Government No.843.

The Order of the Ministry of Economic Development and Trade “On Approval of the Rules for the Competitive Selection of Applications Submitted for Approval of Projects Implemented in Accordance with Article 6 of the Kyoto Protocol to the UN Framework Convention on Climate Change”[4] specifies the requirements regarding the structure and content of an application. An application should contain a “positive expert opinion on the project documents prepared in compliance with international requirements by an independent agency chosen by the applicant”.

Thus, in accordance with the law of the Russian Federation applicable to the implementation of CO projects, the Project can be approved after a positive opinion is given by the determinator.

[3] Resolution of the RF Government No.843 dated 28.10.2009 - http://www.government.ru/gov/results/8030/
[4] Order of the Ministry of Economic Development and Trade No.485 dated 23.11.2009 - http://merit.consultant.ru/doc.asp?ID=10297

SECTION B. Baseline

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

The description and validation of the chosen baseline scenario will be carried out with use of JI specific approach on the basis of the "Guidelines for users of the JI PDD forms" (version 04) and "Guidance on criteria for baseline setting and monitoring" using the following stepwise approach:

Step. 1. Determination and description of the approach to be applied

Step. 2. Application of the chosen approach.

Below is a detailed description of these steps.

Step 1. Determination and description of the approach to be applied
The baseline scenario is selected after considering various alternative scenarios including the proposed project. The key factors will be specified as the criteria for the selection of the baseline scenario. All of the alternative scenarios will be considered with a view to their being influenced by these factors. The alternative scenario which is the least exposed to the negative influence of the key factors will be chosen as the baseline one.

Thus, these are the following steps to be taken in the selection of the baseline scenario:

- *Determination of the alternative scenarios available;*
- *Description of the key factors and analysis of their influence on these alternative scenarios;*
- *Selection of the most plausible alternative scenario.*

Step 2. Application of the chosen approach

Determination of the alternative scenarios available

The following alternative scenarios are being considered:

Alternative scenario 1. *Ferrosilicon production at ChEMW, OJSC using quartzite from the Bakalskoe deposit (i.e. maintaining the situation which existed before the project started).*

This scenario implies using quartzite from the Bakalskoe deposit in ferrosilicon production. Quartzite from the Bakalskoe deposit is characterized by its low silicon dioxide content (SiO_2) and high aluminum oxide content (Al_2O_3), which leads to an increase in quartzite consumption per basis ton of alloy and the necessity for additional processing to reduce the aluminum Al content in the alloy to that required by the standards. ChEMW, OJSC has been using quartzite from the Bakalskoe deposit in ferrosilicon production for more than 50 years. The Bakalskoe deposit is situated 270 km from the city of Chelyabinsk.

Table B 1.1. Chemical composition of quartzite from the Bakalskoe deposit

Chemical composition, %						
SiO_2	Al_2O_3	CaO	MgO	TiO_2	Fe_2O_3	P_2O_5
97.000	1.160	0.050	0.080	0.040	0.870	0.025

Table B 1.2. Specific electrical energy consumption during ferrosilicon production under the alternative scenario 1 (kWh/b.t)

Shop No.\ Ferrosilicon grade	Ferrosilicon 45	Ferrosilicon 65	Ferrosilicon 75
Shop No.2			9813
Shop No.7	5358	7730	9813
Shop No.8		7744	10291

<u>Alternative scenario 2</u>. *Ferrosilicon production at ChEMW, OJSC using quartzite from the Antonovskoe deposit (the project itself without considering its registration as a JI-activity).*

The scenario implies the replacement of quartzite from the Bakalskoe deposit with quartzite from the Antonovskoe deposit in ferrosilicon production at ChEMW, OJSC. Quartzite from the Antonovskoe deposit has a higher reduction ratio than quartzite from the Bakalskoe deposit due to its numerous cracks and low strength, which lead to the intensive breakdown of its structure at temperatures lower than 1600 ^{0}C. When the temperature is higher than 1700 ^{0}C and quartzite melts, its composition is the main factor influencing the reduction ratio. Quartzite from the Antonovskoe deposit has a lower aluminum content and less slag-forming impurities, which lead to the formation of molten slag and the consequent lowering of the reduction ratio.

Table B 1.3. Chemical composition of quartzite from the Antonovskoe deposit[5]

Chemical composition, %						
SiO_2	Al_2O_3	CaO	MgO	TiO_2	Fe_2O_3	P_2O_5
98.400	0.530	0.450	0.600	0.025	0.450	0.008

Table B 1.4. Specific electrical energy consumption during ferrosilicon production under the alternative scenario 2 (kWh/b.t)

Shop No.\ Ferrosilicon grade	Ferrosilicon 45	Ferrosilicon 65	Ferrosilicon 75
Shop No.2			8930
Shop No.7	5008	7304	8835
Shop No.8		7567	8812

[5]Ferrosilicon production. Reference book. Under the editorship of Snitko.U.P. Novokuznetsk. 2000

Alternative scenario 3. *Ferrosilicon production at ChEMW, OJSC using quartzite from other deposits.*

This scenario implies using quartzite from the Pervouralskoe, Cheremshanskoe or Ovruchskoe deposits in ferrosilicon production.

Table B 1.4. Chemical composition of quartzite from the Pervouralskoe, Cheremshanskoe and Ovruchskoe deposits.

Quartzite deposit	Chemical composition, %							Distance to Chelyabinsk, km
	SiO_2	Al_2O_3	CaO	MgO	TiO_2	Fe_2O_3	P_2O_5	
Pervouralskoe (the Southern Urals)	99.000	0.500	0.010	0.020	0.090	0.150	0.015	296
Cheremshanskoe (the Republic of Buryatia)	99.300	0.300	0.020	0.030	0.008	0.120	0.010	4890
Ovruchskoe (Ukraine)	97.400	1.240	0.600	0.300	0.060	0.550	0.020	2560

Quartzite from the Ovruchskoe deposit is characterized by its low SiO_2 content and high Al_2O_3 content, which leads to an increase in quartzite consumption per basis ton of alloy and the necessity for additional processing to reduce the Al content in the alloy to that required by the standards. Besides, quartzite from the Ovruchskoe deposit is rich in phosphorus and calcium, which makes it difficult to produce ferrosilicon correspondent to GOST 1415-93.

Quartzite from the Pervouralskoe deposit has a compact and tight structure, which means that this quartzite is difficult to reduce and that its reduction requires high temperatures.

Quartzite from the Cheremshanskoe deposit has a satisfactory chemical composition, but the deposit is located too far from ChEMW, OJSC.

Description of the key factors and analysis of their influence on these alternative scenarios

The baseline scenario will be developed with regard to the following key factors, which influence the choice of the source of the raw material (quartzite) supply for ferrosilicon smelting:

- Tradition of quartzite use at ChEMW;
- Remoteness of the quartzite deposit;
- Quality of the raw material.
- Ferrosilicon production cost
- Sectoral policy
- Economic situation and availability of capital
- Fuel prices and availability

The influence of the key factors on these alternative scenarios is analyzed by means of a factor analysis.

Table B1.5. Factor analysis

Factor	Scenario 1	Scenario 2	Scenario 3	Comments
Tradition of quartzite use	More than 50 years	Has never been used	Has never been used (except for quartzite from the Pervouralskoe deposit)	Scenario 1 is evidently the least sensitive to the influence of this factor.
Quality of raw material	Satisfactory	Satisfactory	Ovruchskoe deposit: unsatisfactory, Pervouralskoe deposit: unsatisfactory, Cheremshanskoe deposit: satisfactory.	The quality of raw material under scenarios 1 and 2 meets the requirements of ChEMW, so these scenarios are not influenced by this factor.
Remoteness of the quartzite deposit from ChEMW	Bakalskoe deposit: 270 km	Antonovskoe deposit: 1710 km	Ovruchskoe deposit: 2560 km, Pervouralskoe deposit: 296 km, Cheremshanskoe deposit: 4890 km	The Bakalskoe deposit is the nearest to ChEMW, so this factor has no impact on scenario 1.
Production cost[6] of various grades of ferrosilicon, rub/tSi	FS 45: 5770.8 FS 65: 11,790.76 FS 75: 8799.12	FS 45: 5887.53 FS 65: 12,129.35 FS 75: 8989.27	N/A	Scenario 1 is the least influenced by this factor. Considering the poor quality and remoteness of the quartzite under scenario 3, ferrosilicon production cost when using them is not expected to be lower than under scenario 2.
Conformity to sectoral policy	Conform	Conform	Do not conform	Scenario 1 and 2 conform to sectoral policy, videlicet “Growth policy of Russia metallurgical industry till

[6] For a more detailed cost calculation see the economic analyses in section B2.

				2020". Scenario 3 doesn't meet main purpose of Growth policy – to meet the growing metal production demand in required quality and to provide the growth of metal production competitive ability.
Economic situation and availability of capital	Satisfactory	Satisfactory	Unsatisfactory	Economic situation in Russia is not very favorable. There is hard to take a credit and bank rates are high. All this make producers to meet required quality of the goods without additional investment. Scenario 3 doesn't meet this point. Scenario 3 provides lower quality of goods.
Fuel prices and availability	Satisfactory	Satisfactory	Satisfactory	There are no any difficulties with fuel availability in Russia. There are enough fuel resources and available capacity. Fuel prices are reasonable.

Conclusion:

At the base of key factors analysis Alternative scenario 1 is the most plausible scenario and, consequently, this scenario - *ferrosilicon production at ChEMW, OJSC using quartzite from the Bakalskoe deposit* is **the baseline scenario**.

Baseline is determined in conservative way. Baseline assumes additional ladle treatment with use of siderite. Project leads to production ferrosilicon poor in aluminum without additional expenditures on ladle treatment. So, using of quartzite from the Antonovskoe deposit will lead to reduction of using raw materials for ladle treatment. Emissions from raw materials for ladle treatment under the baseline are excluded as conservative.

Baseline is determined according to following JI specific approach:

$$\mathbf{BE_y = \Sigma SEC_{\mathit{x}\,FS\,\mathit{y}\,BE} * P_{\mathit{x}\,FS\,\mathit{y}\,PE,bt} * EF_{grid,CM}}$$ **(formula B.1-1)**

$$SEC_{x\,FS\,y\,BE} = \frac{\sum_{2003}^{2001} EC_{x\,FS\,y}}{\sum_{2003}^{2001} P_{x\,FS\,y}}$$ **(formula B.1-2)**

where, $\mathbf{SEC_{\mathit{x}\,FS\,\mathit{y}\,BE}}$ – average specific electrical energy consumption during the production of grade y ferrosilicon in shop No. *x* in 2001-2003, kWh/b.t

$\sum_{2003}^{2001} P_{x\,FS\,y}$ ($\mathbf{P_{\mathit{x}\,FS\,\mathit{y}\,BE}}$) - cumulative production of grade *x* ferrosilicon in shop *y* in 2001-2003, b.t
$\sum_{2003}^{2001} EC_{x\,FS\,y}$ ($\mathbf{EC_{\mathit{x}\,FS\,\mathit{y}\,BE}}$) - cumulative electrical energy consumption during the production of grade *x* ferrosilicon in shop *y* in 2001-2003, kWh

$\mathbf{P_{\mathit{x}\,FS\,\mathit{y}\,PE,bt}}$ - output of grade *x* ferrosilicon in shop *y*, b.t.
$\mathbf{P_{\mathit{x}\,FS\,\mathit{y}\,PE,bt} = P_{\mathit{x}\,FS\,\mathit{y}\,PE,\,t}} * M_{\mathit{x}\,FS\,\mathit{y}\,PE}$ /x **(formula B.1-3)**

Where, $\mathbf{P_{\mathit{x}\,FS\,\mathit{y}\,PE,\,t}}$ - output of grade *x* ferrosilicon in shop *y*, metric tonn
$M_{\mathit{x}\,FS\,\mathit{y}\,PE}$ - silicon weight content in the alloy of grade *x* ferrosilicon in shop *y* , %.
x - silicon weight content according to the grade,%

The table with the key data and the variables used for the baseline definition is presented below:

Data/Parameter	$\mathbf{P_{\mathit{x}\,FS\,\mathit{y}\,BE}}$
Data unit	b.t [7]
Description	Cumulative production of grade *y* ferrosilicon in shop No. *x* in 2001-2003
Time of determination /monitoring	Calculated once
Source of data (to be) used	Scala software package, MGwin data sheet
Value of data applied (for ex ante calculations/determinations)	$P_{2\,FS\,75\,BE}$ = 57721.7 b.t./year $P_{7\,FS\,45\,BE}$ = 108893.0 b.t./year $P_{7\,FS\,65\,BE}$ = 197414.1 b.t./year $P_{8\,FS\,65\,BE}$ = 160938.9 b.t./year $P_{8\,FS\,75\,BE}$ = 17060.1 b.t./year

[7] B.t. – basis ton – is 1 ton of ferrous alloy with a strictly defined content of the leading element (or its compound). For example, GOST accepts that silicon content in ferrosilicon FS 45 can vary from 41 to 47%. A basis ton is taken equal to 1 ton of alloy containing 45% Si. (V.A. Kudrin. Steelmaking theory and technology. “Mir” Publishing House, Moscow, 2003, page 39)

Justification of the choice of data or description of measurement methods and procedures (to be) applied	The calculation is made by summing up the output of grade y ferrosilicon in shop No. x in 2001-2003. The calculation is made by experts at ChEMW, OJSC and given in an Excel file – Annex 4.
QA/QC procedures (to be) applied	All measurements are made with calibrated measuring instruments in compliance with accepted standards in the metal industry.
Any comment	

Data/Parameter	**$EC_{x\ FS\ y\ BE}$**
Data unit	MWh
Description	Cumulative electrical energy consumption during the production of grade *y* ferrosilicon in shop No. *x* in 2001-2003
Time of determination /monitoring	Calculated once
Source of data (to be) used	Scala software package, MGwin data sheet
Value of data applied (for ex ante calculations/determinations)	$EC_{2\ FS\ 75\ BE}$ =566398.3 MWh/year $EC_{7\ FS\ 45\ BE}$ = 583473.5 MWh/year $EC_{7\ FS\ 65\ BE}$ = 1526080.4 MWh/year $EC_{8\ FS\ 65\ BE}$ = 1246302.7 MWh/year $EC_{8\ FS\ 75\ BE}$ = 175564.7 MWh/year
Justification of the choice of data or description of measurement methods and procedures (to be) applied	The calculation is made by summing up the electrical energy consumption during the production of grade y ferrosilicon in shop No. x in 2001-2003. The calculation is made by experts at ChEMW, OJSC and is given in an Excel file – Annex 4.
QA/QC procedures (to be) applied	The measurements are made using TsE 6812 electric power meters; at furnace 54 the PM820 PowerMeter is used. The calibration period is 8 years and the accuracy rating is 0.5. All measurements are made with calibrated measuring instruments in compliance with the accepted standards in the metal industry.
Any comment	

Data/Parameter	**$SEC_{x\ FS\ y\ BE}$**
Data unit	kWh/b.t
Description	Average specific electrical energy consumption during the production of grade y ferrosilicon in shop No. x in 2001-2003
Time of determination /monitoring	Calculated once
Source of data (to be) used	Scala software package, MGwin data sheet

Value of data applied (for ex ante calculations/determinations)	$SEC_{2\ FS\ 75\ BE}$ =9813 kWh/b.t $SEC_{7\ FS\ 45\ BE}$ =5358 kWh/ b.t $SEC_{7\ FS\ 65\ BE}$ = 7730 kWh/ b.t $SEC_{7\ FS\ 75\ BE}$ = 9813 kWh/ b.t $SEC_{8\ FS\ 65\ BE}$ = 7744 kWh/ b.t $SEC_{8\ FS\ 75\ BE}$ =10291 kWh/ b.t
Justification of the choice of data or description of measurement methods and procedures (to be) applied	The calculation is made by dividing the cumulative electrical energy consumption during the production of grade y ferrosilicon in shop No. x in 2001-2003 by the cumulative production of grade y ferrosilicon in shop No. x in 2001-2003. The calculation is made by experts at ChEMW, OJSC and given in an Excel file – Annex 4.
QA/QC procedures (to be) applied	All measurements are made with calibrated measuring instruments in compliance with accepted standards in the metal industry.
Any comment	

Data/Parameter	$\mathbf{P}_{x\ \mathbf{FS}\ y\ \mathbf{PE}}$		
Data unit	m.t/year		
Description	Output of grade y ferrosilicon in shop No. *x*.		
Time of determination /monitoring	Calculated annually		
Source of data (to be) used	Scala software package, MGwin data sheet		
Value of data applied (for ex ante calculations/determinations)		2008	2009
		m.t./year	m.t./year
	$P_{2\ FS\ 75\ PE}$	29 104	25 733
	$P_{7\ FS\ 45\ PE}$	37 988	12 270
	$P_{7\ FS\ 65\ PE}$	52 703	36 670
	$P_{7\ FS\ 75\ PE}$	14 900	23 333
	$P_{8\ FS\ 65\ PE}$		3 316
	$P_{8\ FS\ 75\ PE}$		16 559
Justification of the choice of data or description of measurement methods and procedures (to be) applied	Measurements are made with the following scales: - VPP-2-1 floor electronic scales produced by VIK Tenzo M", CJSC. The load capacity limit is 10-2000 kg; - VP-30 electron-tensometric scales produced by Promkonstruktsiya, LLC. The load capacity limit is 200-30'000 kg; - VA-60-18-3 electronic truck scales produced by Promkonstruktsiya, LLC. The load capacity limit is 400-60'000 kg; - RD-M-150 wage scales produced by Promkonstruktsiya, LLC. The load capacity limit is 1.0 - 150 t. The ferroalloy output is measured by weighing and recorded in the Met_uch program. The necessary shipping reports are created with the help of the MGwin data sheet.		
QA/QC procedures (to be) applied	The scales calibration is tested monthly by the chief meteorologist division at ChEMW, OJSC, and annually by the state inspection agencies.		

	All measurements are made with calibrated measuring instruments in compliance with accepted standards in the metal industry.
Any comment	

Data/Parameter	**M** $_{x\ FS\ y\ PE}$
Data unit	%
Description	Silicon weight content in the alloy of grade *x* ferrosilicon in shop *y*
Time of determination /monitoring	Calculated annually
Source of data (to be) used	"Central Plant Laboratory form sheets" program
Value of data applied (for ex ante calculations/determinations)	see table below
Justification of the choice of data or description of measurement methods and procedures (to be) applied	Measurements are made by the analytical laboratory at ChEMW, OJSC
QA/QC procedures (to be) applied	All measurements are made by certified analytical laboratory at ChEMW, OJSC. All measurements are made with calibrated measuring instruments in compliance with accepted standards in the metal industry.
Any comment	

	2008	2009
	%	%
$P_{2\ FS\ 75\ PE}$	76.17	76.39
$P_{7\ FS\ 45\ PE}$	45.43	45.49
$P_{7\ FS\ 65\ PE}$	65.91	66.75
$P_{7\ FS\ 75\ PE}$	76350	76.47
$P_{8\ FS\ 65\ PE}$		66.08
$P_{8\ FS\ 75\ PE}$		75.88

Data/Parameter	**EF** $_{grid,\ CM}$
Data unit	tCO_2/MWh
Description	Joint emission factor from the united power grid of the Urals
Time of determination /monitoring	Calculated once
Source of data	The project design documents: "Construction of a new 400 MW CCGT unit at the Yaivinskaya hydroelectric power plant, Wholesale Generating Company-4, Perm Territory, Russia", http://ji.unfccc.int/UserManagement/FileStorage/SWGB8ROL1D0K7MFAXT24PYZJHUQV96 Reference number on UNFCCC site – 0215.

Value of data applied (for ex ante calculations/determinations)	0.606
Justification of the choice of data or description of measurement methods and procedures (to be) applied	The factor is estimated by Global Carbon BV in compliance with the approved CDM procedure "Guidelines for emission factor estimation for the power grid" (version 02)
QA/QC procedures (to be) applied	The project design documents: "Construction of a new 400 MW CCGT unit at the Yaivinskaya hydroelectric power plant, Wholesale Generating Company-4, Perm Territory, Russia" was determined by an independent expert company: Bureau Veritas Certification Holding SAS.
Any comment	

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

The analysis given in subsection B.1. clearly shows that the proposed Project is not the baseline scenario.

According to "Guidelines for users of the JI PDD form" version 04, the approved CDM methodology or JI specific approach to demonstrate additionality can be chosen.
To demonstrate additionality the JI specific approach is applied. It is developed in according with JISC "Guidance on criteria for baseline setting and monitoring" version 02 (Annex 1, paragraph 2a).
The project's additionality is analyzed below by means of the JI specific approach:

Stage 1. Identification of alternative scenarios
Stage 2. Barrier analysis;
Stage 3. Investment analysis
Stage 4. Common practice analysis.

Step 1. Description of the chosen approach

1. Identification of alternative scenarios

At this stage the alternative scenarios are determined and their compliance with legislation is checked.

2. Barrier analysis.

This stage implies the analysis of the possible barriers to the implementation of the alternative scenarios determined at the previous stage and the analysis of the effect that these barriers have on the implementation of the alternative scenarios.

3. Investment analysis

At this stage the most economically attractive scenario is selected. For this purpose a comparative analysis of the economic attractiveness of the scenarios is carried out. The ferrosilicon production unit cost is used as the indicator of the economic attractiveness.

4. Analysis of the common practice

At this stage the studies of the previous stages are backed up by an analysis of the prevalence of the project activity in the relevant industrial sector in which the project is being implemented.

The alternative scenario, which is the least economically attractive and prevalent activity, is considered to be an *additional* one.

Step 2. Application of the chosen approach

1. Identification of alternative scenarios

Alternative scenario 1. *Ferrosilicon production at ChEMW, OJSC using quartzite from the Bakalskoe deposit (i.e. maintaining the situation, which existed before the project started).*

This scenario implies using quartzite from the Bakalskoe deposit in ferrosilicon production. Quartzite from the Bakalskoe deposit is characterized by its low SiO_2 content and high Al_2O_3 content, which leads to an increase in quartzite consumption per basis ton of alloy and the necessity for additional processing to reduce the aluminum Al content in the alloy to that required by the standards. ChEMW, OJSC has been using quartzite from the Bakalskoe deposit in ferrosilicon production for more than 50 years. The Bakalskoe deposit is situated 270 km from the city of Chelyabinsk, which means that the delivery cost is a minimal part of the cost price for quartzite from this deposit.

Table B 2.1. Chemical composition of quartzite from the Bakalskoe deposit

Chemical composition, %						
SiO_2	Al_2O_3	CaO	MgO	TiO_2	Fe_2O_3	P_2O_5
97.000	1.160	0.050	0.080	0.040	0.870	0.025

Table B 2.2. Specific electrical energy consumption during ferrosilicon production under alternative scenario 1 (kWh/b.t)

Shop No.\ Ferrosilicon grade	Ferrosilicon 45	Ferrosilicon 65	Ferrosilicon 75
Shop No.2			9813
Shop No.7	5358	7730	9813
Shop No.8		7744	10291

Alternative scenario 2. *Ferrosilicon production at ChEMW, OJSC using quartzite from the Antonovskoe deposit (the project itself without considering its registration as a joint implementation project).*

The scenario implies using quartzite from the Antonovskoe deposit in ferrosilicon production at ChEMW, OJSC. Quartzite from the Antonovskoe deposit has a higher reduction ratio than quartzite from the Bakalskoe deposit due to its numerous cracks and low strength, which lead to the intensive breakdown of its structure at temperatures lower than 1600 0C. When the temperature is higher than 1700 0C and quartzite melts, its composition is the main factor influencing the reduction ratio.

Quartzite from the Antonovskoe deposit has less slag-forming impurities, which lead to the formation of molten slag and the consequent lowering of the reduction ratio.

Table B 2.3. Chemical composition of quartzite from the Antonovskoe deposit

Chemical composition, %						
SiO_2	Al_2O_3	CaO	MgO	TiO_2	Fe_2O_3	P_2O_5
98.400	0.530	0.450	0.600	0.025	0.450	0.008

Table B 2.4. Specific electrical energy consumption during ferrosilicon production under alternative scenario 2 (kWh/b.t)

Shop No.\ Ferrosilicon grade	Ferrosilicon 45	Ferrosilicon 65	Ferrosilicon 75
Shop No.2			8930
Shop No.7	5008	7304	8835
Shop No.8		7567	8812

Alternative scenario 3. *Ferrosilicon production at ChEMW, OJSC using quartzite from other deposits.*

This scenario implies using quartzite from the Pervouralskoe, Cheremshanskoe or Ovruchskoe deposits.

Table B 2.5. Chemical composition of quartzite from the Pervouralskoe, Cheremshanskoe and Ovruchskoe deposits.

Quartzite deposit	Chemical composition, %							Distance to Chelyabinsk (km)
	SiO_2	Al_2O_3	CaO	MgO	TiO_2	Fe_2O_3	P_2O_5	
Pervouralskoe	99.000	0.500	0.010	0.020	0.090	0.150	0.015	296 (the Southern Urals)
Cheremshanskoe	99.300	0.300	0.020	0.030	0.008	0.120	0.010	4890 (the Republic of Buryatia)
Ovruchskoe	97.400	1.240	0.600	0.300	0.060	0.550	0.020	2560 (Ukraine)

Quartzite from the Ovruchskoe deposit is characterized by its low SiO_2 content and high Al_2O_3 content, which leads to an increase in quartzite consumption per basis ton of alloy and the necessity for additional processing to reduce the Al content in the alloy to that required by the standards. Besides, quartzite from the Ovruchskoe deposit is rich in phosphorus and calcium, which makes it difficult to produce ferrosilicon correspondent to GOST 1415-91.

Quartzite from the Pervouralskoe deposit has a compact and tight structure, which means that this quartzite is difficult to reduce and that its reduction requires high temperatures.

Quartzite from the Cheremshanskoe deposit has a satisfactory chemical composition, but the deposit is located too far from ChEMW, OJSC.

Conclusion: All the scenarios described above comply with the legislation and can be further analyzed.

2. Barrier analysis

At this stage the influence of the **technological barrier** on the implementation of the scenarios is being considered.

Technological barrier

This barrier is considered from the point of view of the applicability of the quartzite chemical composition and its processing characteristics for ferrosilicon production in accordance with GOST 1415-91.

Alternative scenario 1. *Ferrosilicon production at ChEMW, OJSC using quartzite from the Bakalskoe deposit (i.e. maintaining the situation, which existed before the project started).*

ChEMW, OJSC has been using quartzite from the Bakalskoe deposit for 50 years. Thus, the usage of this quartzite can be considered as a prevailing traditional practice. All the processing characteristics of quartzite from the Bakalskoe deposit have been studied experimentally by the plant experts, and its further usage will not create any technological difficulties and uncertainty during ferrosilicon production.
Thus, the technological barrier does not influence the implementation of scenario 1.

Alternative scenario 2. *Ferrosilicon production at ChEMW, OJSC using quartzite from the Antonovskoe deposit (the project itself without considering its registration as a joint implementation project).*

ChEMW, OJSC received information on the processing characteristics of quartzite from the Antonovskoe deposit from Kuznetskiy Ferro-Alloy Plant, which is a major consumer of the quartzite mined by the Antonovskoe mining administration. The usage of quartzite from the Antonovskoe deposit, which has less impurities and a higher SiO_2 content, enables Kuznetskiy Ferro-Alloy Plant to obtain Ferrosilicon 75 with a 0,8-1,1% Al content. This prevents silicon losses when processing the alloy with siderite. The cracked structure of quartzite from the Antonovskoe deposit contributes to the intensification of the silicon reduction process and the formation of more active SiO_2 forms in thermal transformations. All this improves the ferrosilicon manufacturing conditions and reduces the electrical energy consumption of the production process. These processing characteristics became known only due to the experience of the Kuznetskiy Ferro-Alloy Plant. This means that the technological barrier does not influence the implementation of scenario 2.

Alternative scenario 3. *Ferrosilicon production at ChEMW, OJSC using quartzite from other deposits.*

ChEMW, OJSC has information on the chemical composition of quartzite from the Cheremshanskoe and Ovruchskoe deposits, as well as some experience in using quartzite from the Pervouralskoe deposit. Despite the fact that quartzite from the Pervouralskoe deposit is rich in SiO_2 and relatively poor in Al, it has a compact and tight structure, which means that this quartzite is difficult to reduce and that its processing requires high temperatures. In this case the chemical composition of the quartzite does not totally determine its processing characteristics, which are mainly determined by the structure and mineralogical makeup.

Thus, it is impossible to use quartzite from any of these deposits in ferrosilicon production without having true empirical information on its processing characteristics. The technological barrier influences the implementation of scenario 3.

Conclusion:

The analysis shows that the technological barrier influences the implementation of scenario 3. So, this scenario will not be further considered.

3. Investment analysis

In this case the investment analysis is made by comparing the final production cost when using quartzite from the Bakalskoe deposit to the final production cost when using quartzite from the Antonovskoe deposit.

Table B2.6. Ferrosilicon 45 production cost.

Description	Scenario 1 – quartzite from the Bakalskoe deposit	Scenario 2 – quartzite from the Antonovskoe deposit
Quartzite price cost (rub/b.t)	314.67	485.74
Electric power for smelting (rub/b.t)	2079.83	2024.75
Miscellaneous costs (rub/b.t)*	3383.3	3377.03
Total (rub/b.t)	5777.8	5887.53

*A detailed cost calculation is available on request. Data provided by ChEMW.

Table B2.7. Ferrosilicon 65 production cost.

Description	Scenario 1 – quartzite from the Bakalskoe deposit	Scenario 2 – quartzite from the Antonovskoe deposit
Quartzite price cost (rub/b.t)	465.74	743.84
Electric power for smelting (rub/b.t)	3047.37	2989.35
Miscellaneous costs (rub/t.Si)*	4150.89	4150.00
Total (rub/b.t)	7664.00	7883.19

* A detailed cost calculation is available on request. Data provided by ChEMW.

Table B2.8 Ferrosilicon 75 production cost.

Description	Scenario 1 – quartzite from the Bakalskoe deposit	Scenario 2 – quartzite from the Antonovskoe deposit
Quartzite from the Bakalskoe deposit (rub/b.t)	580.68	883.92
Electric power for smelting (rub/b.t)	3834.52	3721.43
Miscellaneous costs (rub/b.t)*	4383.93	4363.67
Total (rub/b.t)	8799.13	8969.02

* A detailed cost calculation is available on request. Data provided by ChEMW.

As is evident from Tables B1.1, B1.2 and B 1.3, the ferrosilicon production cost varies because of the different quartzite price costs and electricity costs. The miscellaneous costs are the same for both scenarios. The quartzite price cost depends very much on the delivery cost, which, in its turn, depends on the distance between the deposit and ChEMW, OJSC. The distance by rail from the Bakalskoe deposit to ChEMW, OJSC is 270 km, and from the Antonovskoe deposit it is 1710 km. Thus, the electrical energy saving when using quartzite from the Antonovskoe deposit instead of quartzite from the Bakalskoe deposit does not compensate for the increased delivery costs.

Sensitivity analysis
A sensitivity analysis is carried out using the key factors determined during the investment analysis: the quartzite price cost, electricity costs, and miscellaneous costs. The results of the project sensitivity analyses are shown in table B 2.9.

Table B2.9. Project sensitivity analyses

Factor/Change		**-10%**	**+10%**
Price cost of quartzite from the Bakalskoe deposit			
Production cost of the ferrosilicon produced from quartzite from the Bakalskoe deposit (rub/b.t.)	FS 45	5746	5809
	FS 65	7843	7986
	FS 75	8741	8857
Price cost of quartzite from the Antonovskoe deposit			
Production cost of the ferrosilicon produced from quartzite from the Antonovskoe deposit (rub/b.t.)	FS 45	5839	5936
	FS 65	8169	8398
	FS 75	8881	9057
Electric power			
Production cost of the ferrosilicon produced from quartzite from the Bakalskoe deposit (rub/b.t.)	FS 45	5570	5986
	FS 65	7359	7969
	FS 75	8416	9183
Production cost of the ferrosilicon produced from quartzite from the Antonovskoe deposit (rub/b.t.)	FS 45	5685	6090
	FS 65	7584	8182
	FS 75	88597	9341
Miscellaneous costs			
Production cost of the ferrosilicon produced from quartzite from the	FS 45	5439	6116

Bakalskoe deposit (rub/b.t.)	FS 65	7249	8079
	FS 75	8361	9238
Production cost of the ferrosilicon produced from quartzite from the Antonovskoe deposit (rub/b.t.)	FS 45	5550	6225
	FS 65	7468	8298
	FS 75	8553	9405

*Sensitivity analysis was made on the basis of the data provided by ChEMW.

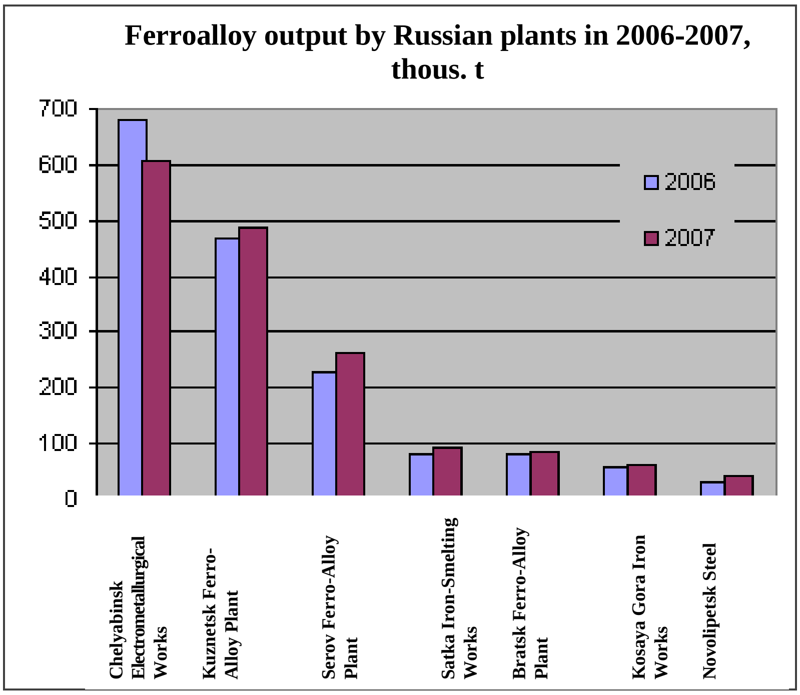
A change in miscellaneous costs have the greatest impact on ferrosilicon production cost because they constitute the biggest part of its structure. A change in quartzite price cost has the least impact on ferrosilicon production cost. If the price cost of quartzite from the Bakalskoe deposit is increased by 10% and the price cost of quartzite from the Antonovskoe deposit remains unchanged, the production cost of the ferrosilicon produced from quartzite from the Antonovskoe deposit is still higher than production cost of the ferrosilicon produced from quartzite from the Bakalskoe deposit. Also, if the price cost of quartzite from the Antonovskoe deposit is reduced by 10% and the price cost of quartzite from the Bakalskoe deposit remains unchanged, the production cost of the ferrosilicon produced from quartzite from the Antonovskoe deposit is still higher than that of the ferrosilicon produced from quartzite from the Bakalskoe deposit.

Conclusion: When using quartzite from the Bakalskoe deposit, the ferrosilicon production cost is lower than when using quartzite from the Antonovskoe deposit. Thus, scenario 1 is the most economically attractive.

4. Analysis of common practice

There several plants in Russia that produce ferroalloys including Chelyabinsk Electrometallurgical Works, Novolipetsk Steel (for internal consumption), Bratsk Ferro-Alloy Plant, Kuznetsk Ferro-Alloy Plant, Kosaya Gora Iron Works, Serov Ferro-Alloy Plant, and Satka Iron-Smelting Works. The ferroalloy output is shown in the following diagram.

Diagram B 2.9. Ferroalloy output in Russia



Chelyabinsk Electrometallurgical Works, OJSC is the major ferrosilicon producer in Russia with a 40% share of the domestic market[8]. About 214 thousand tons of quartzite is annually delivered to ChEMW to be used in the manufacture of this type of ferroalloy. All the other ferroalloy plants are minor ferrosilicon producers; the ferrosilicon output of these plants' installations is very small in comparison with that of ChEMW. Thus, this project is unique because the replacement of quartzite from one deposit with quartzite from another deposit is being done by a major ferrosilicon producer at such a large scale.

Also ChEMW changed grail practical size of the quartzite from Antonovskoe deposit from 25…120 mm, indicative for Kuznetsk Ferro-Alloy Plant, till 40…150mm. This change of quartzite preparation technology has reduced mechanical loadings on pieces of quartzite and has allowed to reduce a fines yield from 14 % to 6 % of quartzite mass.

Consequently, the project under implementation is not common practice.

Conclusion:

As it is clear from the above analysis the proposed project is not an economically attractive alternative. Besides, a change in the quartzite type used at such a large scale is not common practice in the Russian Federation. The project scenario is not part of the identified baseline scenario. Consequently, this project activity is **additional**.

8 http://www.metalbulletin.ru/analytics/black/389/

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

The project boundary is determined by the ferrosilicon production shops of Chelyabinsk Electrometallurgical Works, OJSC and by the electric power plants of the united power grid of the Urals, which supply electrical energy to the plant. The project boundary includes greenhouse gas (GHG) emissions from sources relevant to this project, which are significant (over 1% of the total HGH emissions) and which are being monitored by the project participants. Otherwise these sources of emissions are not included in the project boundary, and the emissions are considered as leakages.

The following table gives an analysis of the emission sources and GHG types with a view to their being included in the Project boundary.

Table B 3.1: Sources of emissions in the baseline scenario and the project activities

	Source	Gas	Included/Not included	Grounds/explanation
Baseline scenario	Power generation at the electric power plants of the united power grid of the Urals	CO_2	Included	Major emissions from the source
		CH_4	Not included	The emissions are insignificant. In accordance with IPCC Guidelines for National Greenhouse Gas Inventories, 2006, Volume 2, Chapter 2, Table 2.2, the CH_4 emission factor for fuel combustion plants in power production is insignificant (according to the calculation)
		N_2O	Not included	The emissions are insignificant. In accordance with IPCC Guidelines for National Greenhouse Gas Inventories, 2006, Volume 2, Chapter 2, Table 2.2, the N_2O emission factor for fuel combustion plants in power production is insignificant
	Electrical energy consumption when transporting quartzite by rail	CO_2	Included	The emissions from this source are not accounted for in the baseline scenario in compliance with the conservative approach.
		CH_4	Not included	The emissions are insignificant. The emissions from this source are not accounted for in the baseline scenario in compliance with the conservative approach.
		N_2O	Not included	The emissions are insignificant. The emissions from this source are not accounted for in the baseline scenario in compliance with the conservative approach.

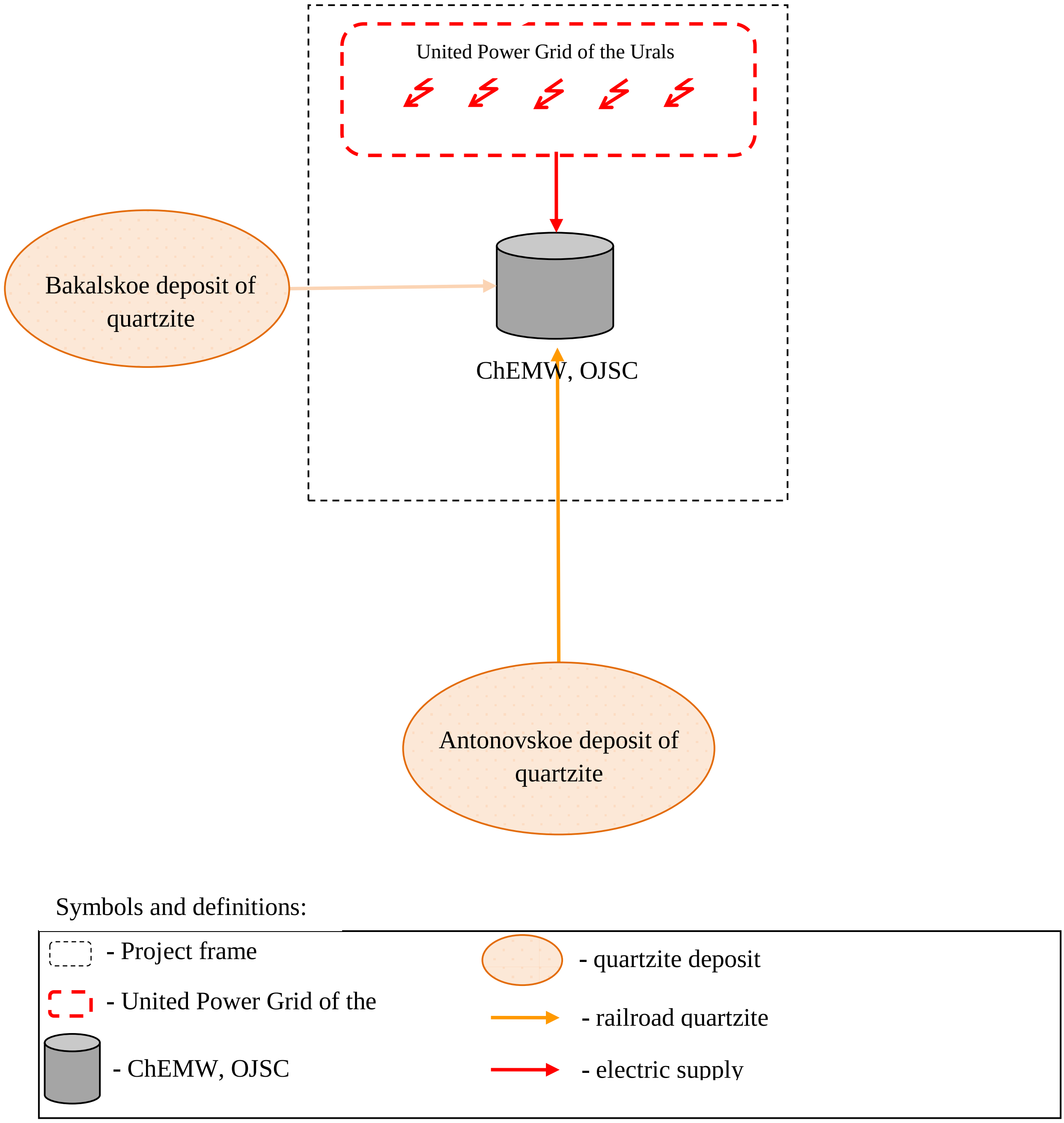
	Source	Gas	Included/Not included	Grounds/explanation
Baseline scenario	Row material	CO_2	Not included	Following sources are needed for ferrosilicon production: - quartzite - reductant (coke and coal) - electrodes - steel cuttings - wood chip - electricity - siderite (for ladle treatment) Project influences only on electricity consumption, quantity of quartzite being used and siderite. GHG emission sources in ferrosilicon production are: -reductant (coke and coal) -electricity -siderite (for ladle treatment) Quantity and quality of reductant, steel cuttings and wood chip will be the same in both baseline and project. Baseline assumes additional ladle treatment with use of siderite. Project leads to production ferrosilicon poor in aluminum without additional expenditures on ladle treatment. So, using of quartzite from the Antonovskoe deposit will lead to reduction of using raw materials for ladle treatment. Thus, excluded as conservative.
		CH_4	Not included	
		N_2O	Not included	

	Source	Gas	Included/Not included	Grounds/explanation
Project	Power generation at the coal-fired combined heat-and-power plants of the regional power grid, which is no longer utilized as a result of the project activities	CO_2	Included	Major emissions from the source
		CH_4	Not included	The emissions are insignificant In accordance with IPCC Guidelines for National Greenhouse Gas Inventories, 2006, Volume 2, Chapter 2, Table 2.2, the CH_4 emission factor for fuel combustion plants in power production is insignificant
		N_2O	Not included	The emissions are insignificant In accordance with IPCC Guidelines for National Greenhouse Gas Inventories, 2006, Volume 2, Chapter 2, Table 2.2, the N_2O emission factor for fuel combustion plants in power production is insignificant
	Fuel consumption when transporting quartzite by rail.	CO_2	Not included	These emissions are not controlled by ChEMW, OJSC and are consequently considered as leakages.
		CH_4	Not included	These emissions are not controlled by ChEMW, OJSC and are consequently considered as leakages.
		N_2O	Not included	These emissions are not controlled by ChEMW, OJSC and are consequently considered as leakages.

	Source	Gas	Included/Not included	Grounds/explanation
Project	Row material	CO_2	Not included	Following sources are needed for ferrosilicon production: - quartzite - reductant (coke and coal) - electrodes - steel cuttings - wood chip - electricity - siderite (for ladle treatment) Project influences only on electricity consumption, quantity of quartzite being used and siderite. GHG emission sources in ferrosilicon production are: -reductant (coke and coal) -electricity -siderite (for ladle treatment) Quantity and quality of reductant, steel cuttings and wood chip will be the same in both baseline and project. Baseline assumes additional ladle treatment with use of siderite. Project leads to production ferrosilicon poor in aluminum without additional expenditures on ladle treatment. So, using of quartzite from the Antonovskoe deposit will lead to reduction of using raw materials for ladle treatment. Thus, excluded as conservative.
		CH_4	Not included	
		N_2O	Not included	

Based upon this analysis the project boundary can be graphically represented as follows:

Diagram B 3.1. Project frame



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

Date of baseline set-up: 29/11/2010.

The baseline has been designed by CJSC "National carbon sequestration foundation" (Moscow)
Contact person : Baydakova Evgenia, Senior expert Project Development Department
Tel. +7 (499) 788-78-35,ext 104
Fax +7 (499) 788-78-35,ext 107
e-mail: BaydakovaEV@ncsf.ru

CJSC "National carbon sequestration foundation" is not a project participant.

SECTION C. Duration of the project / crediting period

C.1. Starting date of the project:

February 7, 2004 – the first delivery of quartzite from the Antonovskoe deposit to ChEMW, OJSC.

C.2. Expected operational lifetime of the project:

Ore-smelting furnace has similar constructional features with arc-type steel furnace. According to Resolution RF # 1 from 01.01 2002 (revised 10.12.2010) «About classification of the permanent assets included in amortisation groups» which defines operational life time of object, arc-type steel furnace belongs to the group of assets with useful operation lifetime of 10-15 years. So, operational life time is defined as 15 years.

15 years or 180 months: 01.01.2008 – 31.12.2023

C.3. Length of the crediting period:

5 years or 60 months: From 01.01.2008 till 31.12.2012

SECTION D. Monitoring plan

D.1. Description of monitoring plan chosen:

The description and validation of the monitoring plan is made by using a specific approach developed for this Joint Implementation Project. This approach is based on the regulations given in section D (Monitoring plan) of the JI Guidance on criteria for baseline setting and monitoring of version 02 and includes the following steps:

Step. 1. Indication and description of the chosen approach to monitoring setting.
Step. 2. Application of the chosen approach.

Below is more detailed description of the chosen approach.

1. Indication and description of the chosen approach to monitoring setting

In compliance with the "Guidelines for Users of the JI PDD Form" version 04, in section D it is necessary to examine in detail and clearly mark the data and ratios, which are:

a) Data and parameters that are not monitored throughout the crediting period, but are determined only once (and thus remain fixed throughout the crediting period), and that are available already at the stage of determination regarding the PDD;
b) Data and parameters that are not monitored throughout the crediting period, but are determined only once (and thus remain fixed throughout the crediting period), but that are not already available at the stage of determination regarding the PDD; and
c) Data and parameters that are monitored throughout the crediting period.

2. Application of the chosen approach

The Project implies the production of ferrosilicon at ChEMW, OJSC using quartzite from the Antonovskoe deposit. The baseline scenario implies the production of ferrosilicon at ChEMW, OJSC using quartzite from the Bakalskoe deposit. When replacing quartzite from the Bakalskoe deposit with quartzite from the

Antonovskoe deposit, the specific electrical energy consumption during ferrosilicon production decreases by 8%. The implementation of the Project will enable fuel to be saved in the power grid of the Urals, which, consequently, will lead to a reduction in greenhouse gas emissions and pollutants due to the reduction in the amount of fuel combusted in the condensing operation mode of the combined heat-and-power plant.
Thus, the reduction in greenhouse gas emissions is estimated by comparing the electrical energy consumption during the production of equal amounts of ferrosilicon under the baseline scenario and after the implementation of the Project.

The following data is to be measured and estimated for monitoring purposes:

1. Data and parameters that are not monitored throughout the crediting period, but are determined only once (and thus remain fixed throughout the crediting period), and that are available already at the stage of determination regarding the PDD:
   - Average specific electrical energy consumption rates of ferrosilicon production at ChEMW, OJSC in 2001-2003
   - Rate of greenhouse gas emissions from the electric power plants of the United Power Grid of the Urals.
2. Data and parameters that are not monitored throughout the crediting period, but are determined only once (and thus remain fixed throughout the crediting period), but that are not already available at the stage of determination regarding the PDD:
   -N/A

3. Data and parameters that are monitored throughout the crediting period:
   - Ferrosilicon production at ChEMW, OJSC
   - Silicon weight content in ferrosilicon
   - Electrical energy consumption rate for the production of ferrosilicon at ChEMW, OJSC

Silicon weight content in ferrosilicon is reflected in the name of grade. The measurement of silicon weight content in ferrosilicon at ChEMW is carried out only for attributing it to appropriate grade. Calculations of all specific rates under the baseline and under the project are carried out with use of prescribed silicon weight content in ferrosilicon -45%, 65% or 75%. This method prescribed by GOST 1415-93 "Technical requirements specification and condition of supply". OJSC ChEMW does not provides calculations with exact silicon weight content in ferrosilicon.

Specific factors

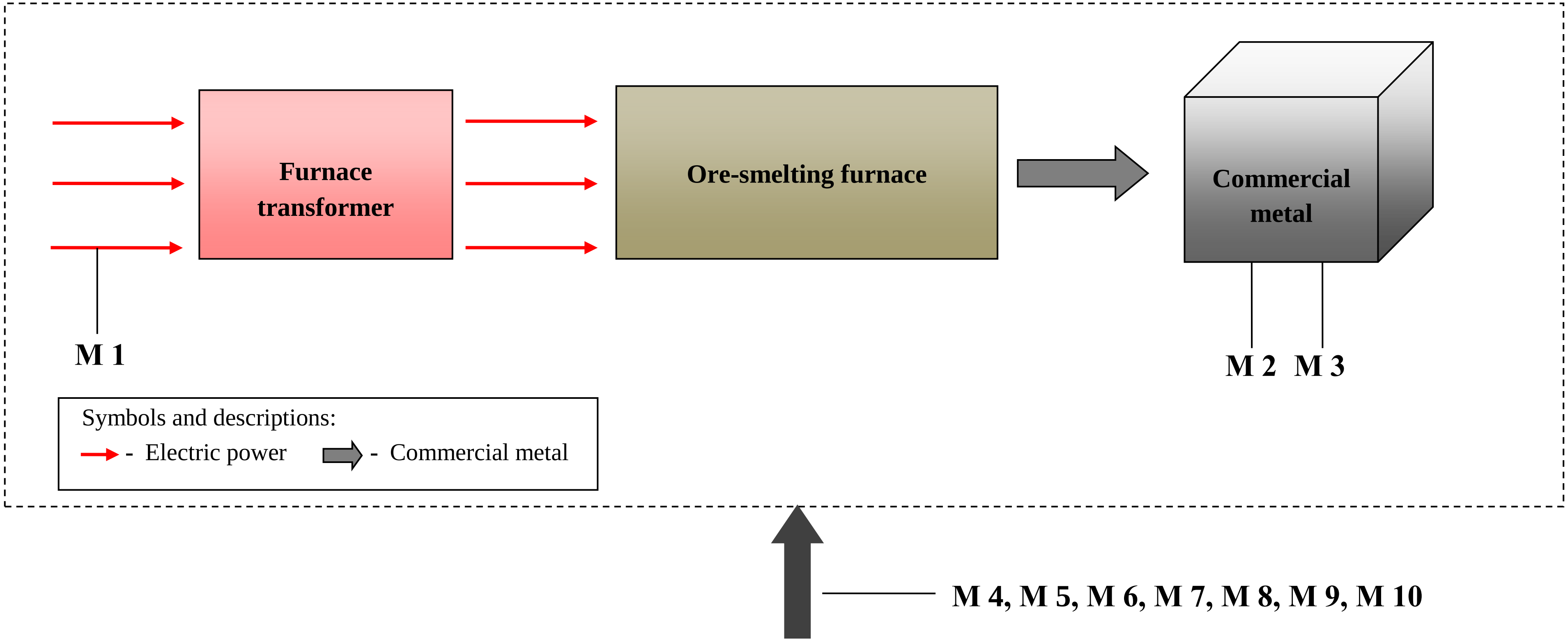
The baseline specific indicator is estimated by means of a calculation.
The specific electrical energy consumption during the production of different grades of ferrosilicon at ChEMW, OJSC under the baseline scenario SEC $_{\mathbf{x\ FS\ y\ BE}}$ is calculated as the average specific power consumption during the production of different grades of ferrosilicon in the shops at ChEMW, OJSC in 2001-2003:

$$SEC_{\mathbf{x}\ \boldsymbol{FS}\ \mathbf{y}\ \boldsymbol{BE}} = \frac{\sum_{2003}^{2001} EC_{x\ FS\ y}}{\sum_{2003}^{2001} P_{x\ FS\ y}}$$ **(formula D.1-1)**

Where $\sum_{2003}^{2001} P_{x\,FS\,y}$- cumulative production of grade x ferrosilicon in shop y in 2001-2003, b.t
$\sum_{2003}^{2001} EC_{x\,FS\,y}$- cumulative electrical energy consumption during the production of grade x ferrosilicon in shop y in 2001-2003, kWh

The parameters given in the tables below are for monitoring. All the data collected for monitoring will be stored for at least 2 years after the last transfer of ERUs for the project. All the measurements will be made with calibrated measuring instruments in compliance with accepted standards in the metal industry.
The work of ChEMW, OJSC in the sphere of measurement and monitoring meets the requirements of the Federal Law No. 4871-1 dated April 27, 1993 “On Ensuring the Uniformity of Measurements” and a number of other national standards and regulations of the regional metrological service. ChEMW, OJSC has all the relevant plans, documents, and calibration schedules using the measurement instruments.
The key project parameters are measured in compliance with the metrological system accepted in the Russian Federation.

Below is a scheme with the monitoring points indicated:


Furnace transformer
Ore-smelting furnace
Commercial metal
M 1
M 2
M 3
Symbols and descriptions:
- Electric power
- Commercial metal
M 4, M 5, M 6, M 7, M 8, M 9, M 10

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
M1	$EC_{x\ FS\ y}$ Electrical energy consumption during production of grade *x* ferrosilicon in shop No. *y*	Scala software package, MGwin data sheet	kWh	(m)	Permanently	100%	Electronic	Measured with TsE 6812 electric power meters

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

$$PE_y = \sum(EC_{x\ FS\ y}/1000) * EF_{grid,\ CM\ Ural} \quad \text{(formula D.1-2)}$$

where $EC_{x\ FS\ y}$ – electrical energy consumption during the production of grade *x* ferrosilicon in shop No. *y*, kWh
$EF_{grid,CM}$ – rate of greenhouse gas emissions from the electric power plants of the United Power Grid of the Urals, tCO_2/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	Data variable	Source of data	Data unit	Measured (m),	Recording	Proportion of	How will the	Comment

(Please use numbers to ease cross-referencing to D.2.)				calculated (c), estimated (e)	frequency	data to be monitored	data be archived? (electronic/ paper)	
M2	$\mathbf{P}_{x\ \mathbf{FS}\ y\ \mathbf{PE,\ t}}$ output of grade *x* ferrosilicon in shop *y*	Scala software package, MGwin data sheet	Metric ton	(m)	Permanently	100%	Electronic	Measured with: - DGG-2-1 floor electronic scales - VP-30 electron-tensometric scales
M3	$M_{x\ \mathbf{FS}\ y\ \mathbf{PE}}$ Silicon weight content in the alloy of grade *x* ferrosilicon in shop *y*	"Central Plant Laboratory form sheets" program	%	(m)	Permanently	100%	Electronic	Measured by the analytical laboratory at ChEMW, OJSC

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

$$\mathbf{BE_y = \Sigma SEC}_{x\ \mathbf{FS}\ y\ \mathbf{BE}} * \mathbf{P}_{x\ \mathbf{FS}\ y\ \mathbf{PE,bt}} * \mathbf{EF_{grid,CM}} \qquad \textbf{(formula D.1-3)}$$

where, $\mathbf{SEC}_{x\ \mathbf{FS}\ y\ \mathbf{BE}}$ – average specific electrical energy consumption during the production of grade y ferrosilicon in shop No. *x* in 2001-2003, kWh/b.t (formula D.1-1)

$\mathbf{P}_{x\ \mathbf{FS}\ y\ \mathbf{PE,bt}}$ - output of grade *x* ferrosilicon in shop *y*, b.t.

$$\mathbf{P}_{x\ \mathbf{FS}\ y\ \mathbf{PE,bt}} = \mathbf{P}_{x\ \mathbf{FS}\ y\ \mathbf{PE,\ t}} * M_{x\ \mathbf{FS}\ y\ \mathbf{PE}}\ /x \qquad \textbf{(formula D.1-4)}$$

Where, $\mathbf{P}_{x\,FS\,y\,PE,\,t}$ - output of grade *x* ferrosilicon in shop *y*, metric tonn
$M_{x\,FS\,y\,PE}$ - silicon weight content in the alloy of grade *x* ferrosilicon in shop *y* , %.
x - silicon weight content according to the grade,%

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

Option 2 is not used

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

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 used

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
M4	$\mathbf{P_{q\,y}}$ Volume of quartzite deliveries to ChEMW, OJSC in year *y*	Invoice	t	(e)	Once	100%	Electronic/ Paper	Calculated as average volume of quartzite deliveries to ChEMW for 2008-2010, by totaling up the invoice for each wagon or shipment.
M5	**l** distance from the Kuznetskoe mining administration to ChEMW, OJSC	Data of transport department ChEMW	km	(e)	Once	100%	Electronic/ Paper	Data of transport department ChEMW
M6	$\mathbf{m_q}$ average weight of cargo in a wagon	Data for the model 12-1000	t	(e)	Once	100%	Electronic/ Paper	http://www.fenexweb.ru/information/20-half_trains/32-half.html

M7	**q_r** number of wagons in a train pulled by one locomotive	Data of transport department ChEMW	pcs	(e)	Once	100%	Electronic/ Paper	Data of transport department ChEMW
M8	**m_r** wagon weight	Data for the model 12-1000	t	(e)	Once	100%	Electronic/ Paper	http://www.fenexweb.ru/information/20-half_trains/32-half.html
M9	**m_l** mass of locomotive	Data for the model VL 85	t	(e)	Once	100%	Electronic/ Paper	http://www.poezdvl.com/books/rakov/rakov1_6.html
M10	**$SEC_{del\ y}$** Specific electrical energy consumption for hauling operations at RZD, JSC	Data from RZD, JSC	kWh/ 10 thous. gross t.km	(e)	Once	100%	Electronic	Calculated by experts at RZD, JSC

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

In this project, leakages are the CO_2 emissions resulting from quartzite transportation from the Kemerovo Region to ChEMW, OJSC.
CO_2 emissions resulting from the quartzite transportation from the Kemerovo Region (Siberia) to ChEMW, OJSC are calculated based on the specific power consumption rates for hauling operations by rail rendered by RZD, JSC (100% owner of rail roads in Russia) and on the greenhouse gas emissions from the

electric power plants of the United Power Grid of Siberia, as for the most part the train passes through Siberia. Specific electrical energy consumption for transportation is forecasted for the period 2011-2012 by JSC “RZD”. The forecast was made in conservative way. This data is determined once for credit period.
$LE = EC_{del\ y} * EF_{grid,\ CM\ Siberia}$
According to information from ChEMW, OJSC, quartzite is transported from the Kemerovo Region by an electric train.

Year	Specific electrical energy consumption, kWh/ 10 thous. gross t.km
2008	115.4
2009	115.7
2010	115.1
2011	114.3
2012	113.7

$EC_{del y}$ – electrical energy consumption during quartzite transportation in year *y*, kWh
$EF_{grid,\ CM\ Siberia}$ – rate of greenhouse gas emissions from the electric power plants of the United Power Grid of Siberia, tCO_2/MWh (see table D 1.2)

$EC_{del\ y} = SEC_{del\ y} * (l * (P_{qy} + M_{train}) + (l * M_{train}))$ **(formula D.1-4)**

$SEC_{del\ y}$ – Specific electrical energy consumption for hauling operations at RZD, JSC, kWh/ 10 thous. gross t.km
$(l * (P_{qy} + M_{train})$ – cargo delivery to ChEMW, OJSC
$(l * M_{train})$ – empty run back
l – distance from the Kuznetskoe mining administration to ChEMW, OJSC, km
P_{qy} – volume of quartzite deliveries in year *y*, t
M_{train} – weight of the train

$M_{train} = r*m_r + N_l*m_l$ **(formula D.1-5)**

r- number of quartzite transporting wagons in year *y*, pcs

N_l – number of electric locomotives pulling quartzite transporting wagons in year *y*, pcs
m_r- wagon weight, t
m_r = 22 t[9]
m_l – locomotive (electric locomotive) weight, t
m_l=290 t[10]
$r = N_l*q_r$ **(formula D.1-6)**

$N_l = P_{qy}/m_q*q_r$ **(formula D.1-7)**

q_r- number of wagons in a train pulled by one locomotive, pcs
m_q – average weight of cargo in a wagon, t
q_r = 45[11]
m_q=69 t[10]

Table D.2. Rate of greenhouse gas emissions from the electric power plants of the United Power Grid of Siberia

Year	$EF_{grid, CM Siberia}$ (tCO_2/MWh)[12]
2008	1.003
2009	1.003
2010	1.006
2011	0.993
2012	0.949

[9] http://www.fenexweb.ru/information/20-half_trains/32-half.html
[10] http://www.poezdvl.com/books/rakov/rakov1_6.html
[11] According to information from ChEMW, OJSC
[12] According to calculations made by Lahmeyer International. These rates were determined by an independent auditor – TUV SUD - http://www.ebrd.com/downloads/sector/eecc/Baseline_Study_Russia.pdf (page 5.3, table 5.2); http://www.ebrd.com/downloads/sector/eecc/Validation_report_Russia.pdf

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):

$ER_y = BE_y – PE_y - LE$ (formula D.1-8)

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:

According to the Resolution of the Federal State Statistics Service No.157 dated 30.04.2004 "On the Approval of Statistical Instruments for Organizing the Statistical Monitoring of Production and Consumption Wastes by the Federal Service for Ecological, Technological and Nuclear Supervision" and the Order of the Federal State Statistics Service No.166 dated 10.08.2009 "On the Approval of Statistical Instruments for Organizing the Federal Statistical Monitoring of Farming and the Environment" ChEMW, OJSC annually presents the Office of the Federal Supervisory Natural Resources Management Service for the Chelyabinsk Region the following reports:
2 tp (air) – Information on atmospheric air protection
2 tp (wastes) – Information on the generation, processing, transportation and disposal of production and consumption wastes, in kind
2 tp (waterworks) - Information on water use, in kind
4-OS – Information on the current expenditures on environment protection and environmental payments, in monetary terms

Once every 5 years the environmental monitoring laboratory at ChEMW, OJSC, which is accredited in the analytical laboratories accreditation system (hereinafter - the Laboratory) carries out an "Inventory of the stationary pollution sources" at ChEMW, OJSC. The inventory results are approved by the Federal Supervisory Natural Resources Management Service and the “Project on the Quantitative Estimates of pollutant emissions into the atmosphere and of the harmful physical impacts on it" is developed. A specialized organization (usually Ekont, LLC) is engaged in the Project development. The Project is presented to the Federal Supervisory Natural Resources Management Service. On the basis of the decision approved by the Federal Supervisory Natural Resources Management Service, a “Permit for pollutant discharge in the atmosphere” is issued for a 5-year term.

Once every three months the Laboratory surveys the atmospheric air in the sanitary protection zone and sends the result sheets to the Federal Supervisory Natural Resources Management Service. The “Schedule of monitoring gas treatment, dust-collecting, as well as input-outlet atmospheric air systems and industrial wastewater by the laboratory for environmental monitoring at ChEMW, OJSC” is organized annually as part of the “Project on the Quantitative Estimates of pollutant emissions into the atmosphere and of the harmful physical impacts on it"; the schedule is approved by the Federal Supervisory Natural Resources Management Service.

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.
M-1 (Table D1.1.1)	Low	Measured using TsE 6812 and RM820 electric power meters. The accuracy rating is 0.5. The calibration period is 8 years. The meters are part of the Automated System of Technical and Energy Resources Control and Accounting (ASTERCA) at ChEMW, OJSC, which comprises the computerized accounting of the power and industrial (furnace) electrical energy of the plant. ASTERCA is a distributed multilevel information system; the local computer network of ChEMW, OJSC is used as a transmission medium. ASTERCA consists of the host and standby servers, on which the application software interrogates data acquisition and transmission devices and stores consumption information in the ASTERCA database.
M-2 (Tables D1.1.3)	Low	Measured with: - DGG-2-1 floor electronic scales - VP-30 electron-tensometric scales Each of the scales has a passport, in which the monthly internal calibration tests made by the chief meteorologist division at ChEMW, OJSC and the annual state calibration tests made by the state inspection agencies are registered.
M-3 (Table D1.1.3)	Low	The analysis of metal samples is carried out by the analytical laboratory at ChEMW, OJSC, which is regularly accredited by the Federal Agency on Technical Regulating and Metrology. The analytical laboratory of ChEMW, OJSC is certified to analyze the silicon content in ferrosilicon in the range of 8.0-99.9 mac.%.
M-4, (Table D1.3.1)	Low	Calculated by transport department of ChEMW.
M-5 (Table D1.3.1)	Low	Calculated using the data from quartzite delivery notes received with each wagon or shipment.
M-6,M-8 (Table D1.3.1)	Low	Data presented by transport department of ChEMW.
M-7,M-9,M-10 (Table D1.3.1)	Low	Information data from web-sites: http://www.fenexweb.ru/information/20-half_trains/32-half.html http://www.poezdvl.com/books/rakov/rakov1_6.html
M-11 (Table D1.3.1)	Low	Calculated annually by the specialists of RZD, OJSC

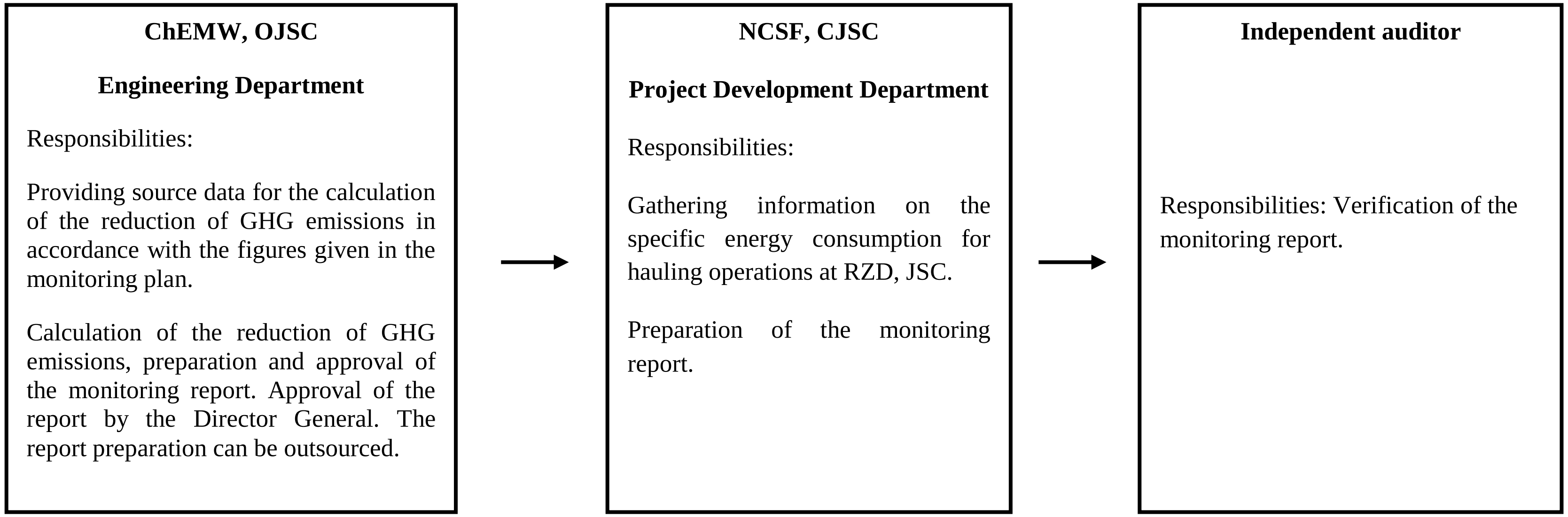
Quality Control and Quality Assurance procedures on the above specified parameters are guaranteed by compliance with the following legal documents requirements:

- Federal Law No.102-FZ dated 26.06.2008 “On Ensuring the Uniformity of Measurements”;

- "Calibration Performance Standards" approved by Resolution No.17 dated 21.09.1994 of the Federal Agency on Technical Regulating and Metrology;
- SI Federal Register;
- PR 50.2.006-94.

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

Diagram D.3. Operation structure of the Project monitoring



For the purposes of monitoring a first rank engineer from the Engineering Department of ChEMW, OJSC annually collects the data necessary for the further calculation of the relevant rates and for the preparation of the monitoring report. A first rank engineer from the Engineering Department of ChEMW collects the data from the following sources:

Data	Source
Electrical energy consumption during the production of grade *x* ferrosilicon in shop No. *y*	Watt-hour meter values are automatically sent to ASTERCA and represented via the program interface in the form of reports, diagrams, and process graphics.
Output of grade *x* ferrosilicon in shop No. *y*	All melted metal is processed to get commercial grades, each grade is weighed and then the metal is grouped into batches meeting the requirements of the standards, technical specifications, and delivery contracts. The ferroalloy outgoing inventory includes ferroalloys accepted by the Quality Control Department and stored in the finished goods warehouse. The ferroalloy outgoing inventory is weighed at the when they are moved to the finished goods warehouse and this is recorded in the Met_uch program. The necessary shipping reports are prepared using a MGwin data sheet.
Silicon weight content in the alloy	The monitoring of the silicon content in ferrosilicon is based upon the “Central Plant Laboratory form sheets” program available to all the monitoring specialists of the plant through its local computer network. A metal sample is taken from each metal output or from several outputs using the developed techniques under the monitoring of specialists from the Quality Control Department. The sample is forwarded to the analytical laboratory for analysis. The analytical laboratory operator enters the analysis results into the “Central Plant Laboratory form sheets” program, which enables the results to be monitored and the reports to be prepared. After the metal has been processed to get commercial grades, the batches are formed, and in compliance with GOST requirements, grade samples are taken and forwarded to the analytical laboratory for analysis. The results of the analysis are entered into the “Central Plant Laboratory form sheets” program by the analytical laboratory operator and recorded, together with the weight of the metal, in the Met_uch program by the quality inspectors.
Volume of quartzite deliveries	Information on the volume of quartzite deliveries is taken from the CMR notes kept by the manager of the raw material storehouse at ChEMW, OJSC.
Specific electrical energy consumption for hauling operations at RZD, JSC	The figures calculated by RZD, JSC are annually available to NCSF, CJSC on request.

No additional training is required to implement the project and to carry out the Project operating activities. All the necessary skills are available and controlled by the existing training system.

The information stated above will be submitted in the time prescribed by ChEMW, OJSC to the Engineering Department of ChEMW, OJSC for the calculation of the actual reduction of greenhouse gas emissions in accordance with the formulae in Section D and the preparation of annual monitoring reports. Being the Project operator, ChEMW, OJSC is liable for all of the measurement, testing and analysis procedures, which are necessary to obtain the data required by the monitoring plan.
Data collection, transfer and backup, as well as the calculation of the reduction of greenhouse gas emissions are included in the current reporting system of ChEMW, OJSC.

The approved monitoring report is submitted to an independent auditor for verification of the reduction gained.

The person responsible for the implementation and control of the monitoring plan:

Head of Engineering Department of ChEMW, OJSC
Tel. +7 (351) 779-22-32
E-mail: shinkin@chemk.ru

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

The monitoring plan has been designed by CJSC “National carbon sequestration foundation” (Moscow)
Contact person: Baydakova Evgenia, Senior expert Project Development Department
Tel. +7 (499) 788-78-35,ext 104
Fax +7 (499) 788-78-35,ext 107
e-mail: BaydakovaEV@ncsf.ru

CJSC “National carbon sequestration foundation” is not a project participant.

SECTION E. Estimation of greenhouse gas emission reductions

E.1. Estimated project emissions:

Table E.1.1

Line No.	Index/year	2008	2009	2010	2011	2012
1	$EC_{75\ FS\ 2}$ (MWh)	259,949	229,808	214,436	301,235	387,780
2	$EC_{45\ FS\ 7}$ (MWh)	190,758	60,209	25,472	35,061	0
3	$EC_{65\ FS\ 7}$ (MWh)	382,813	271,072	242,405	297,532	218,082
4	$EC_{75\ FS\ 7}$ (MWh)	133,573	209,227	76,081	8967	441,903
5	$EC_{65\ FS\ 8}$ (MWh)	0	26,519	128,496	20,989	143,640
6	$EC_{75\ FS\ 2}$ (MWh)	0	151,728	214,165	174,157	291, 060
7	$EF_{grid,\ CM}$ (t CO_2/ MWh)	0.606				
8	PE_{FSy} (tCO_2)	586058	574829	546039	507792	898374

PE_y = ([1]+[2]+[3]+[4]+[5]+[6]) * [7]
A detailed calculation is given in the Excel documents.

E.2. Estimated leakage:

Table E.2.1

	2008	2009	2010	2011	2012
tCO_2	7944	8049	7267	7579	7205

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

Table E.3.1

	2008 (Dec)	2009	2010	2011	2012
tCO_2	594002	582878	553307	515372	905579

E.4. Estimated baseline emissions:

Emissions under the baseline scenario are calculated using the formulas in Section D 1.1.4.

Table E.4.1

Line No.	**Index**	**Value**

1	SEC $_{75\ FS\ 2}$ (kWh/b.t)	9813				
2	SEC $_{45\ FS\ 7}$ (kWh/ b.t)	5358				
3	SEC $_{65\ FS\ 7}$ (kWh/ b.t)	7730				
4	SEC $_{75\ FS\ 7}$ (kWh/ b.t)	9813				
5	SEC $_{65\ FS\ 8}$ (kWh/ b.t)	7744				
6	SEC $_{75\ FS\ 8}$ (kWh/ b.t)	10291				
	Index/year	**2008**	**2009**	**2010**	**2011**	**2012**
7	P $_{75\ FS\ 2}$ (t Si)	29556	26211	24720	34206	44960
8	P $_{45\ FS\ 7}$ (t Si)	38350	12404	5304	7045	0
9	P $_{65\ FS\ 7}$ (t Si)	53443	37660	34066	41389	29431
10	P $_{75\ FS\ 7}$ (t Si)	15198	23790	8716	1081	51235
11	P $_{65\ FS\ 8}$ (t Si)	0	3371	16820	2750	19385
12	P $_{75\ FS\ 8}$ (t Si)	0	16753	24337	19776	33746
13	$EF_{grid,\ CM}$ (t CO_2/MWh)	0.606				
14	BE (t CO_2)	641009,95	634320,2	606339	562833,2	1011308
16	Total BE (2008-2012) (tCO_2)	3455811				

$$BE_y = (\sum ([7]*[1]) + ([8]*[2]) + ([9]*[3]) + ([10]*[4]) + ([11]*[5]) + ([12]*[6])) * [13]$$

A detailed calculation is given in the Excel documents.

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

The reduction in emissions is defined as the difference between the values in line [14] of Table E.4-1 and the values in line [8] of Table E.3-1.

Table E.5.1

	2008	2009	2010	2011	2012
tCO_2	47008	51442	53032	47461	105729
Total (2008-2012)	304673				

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

Table E.6.1

Year	Estimated project emissions (tones of CO_2 equivalent)	Estimated leakage (tones of CO_2 equivalent)	Estimated baseline emissions (tones of CO_2 equivalent)	Estimated emission reductions (tones of CO_2 equivalent)
2008	586058	7944	641010	47008
2009	574829	8049	634320	51442
2010	546039	7267	606339	53032
2011	507792	7579	562833	47461
2012	898374	7205	1011308	105729
Total (tones of CO_2 equivalent)	3113093	38045	3455811	304673

The Excel documents are given in a separate file, Annex 4.

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:

According to legislation the project does not require any supplemental support documentation related to the environmental impact analysis, and the State Environmental Expert Review.
As a result of the project, ChEMW, OJSC is conducting its routine activity and is not undertaking any new construction, sanitary zone expansion or new equipment installation. The implementation of the project results in a decrease in electrical energy consumption, which leads to the consequent reduction in greenhouse gas and pollutant emissions, as well as ash and slag waste, due to the reduced amount of fuel consumed at the combined heat-and-power plants of the united power grid of the Urals.

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:

According to legislation the implementation of this project does not require a State Environmental Expert Review.

SECTION G. Stakeholders' comments

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

Public hearings were not held.

Annex 1

CONTACT INFORMATION ON PROJECT PARTICIPANTS

Organisation:	OJSC “ChEMW”
Street/P.O.Box:	Geroev Tankograda
Building:	80P
City:	Chelyabinsk
State/Region:	
Postal code:	454081
Country:	Russian Federation
Phone:	8-351-779-22-32
Fax:	8-351-772-96-19
E-mail:	shinkin@chemk.ru
URL:	www. chemk.ru
Represented by:	
Title:	The Head of Technical Department
Salutation:	
Last name:	Shinkin
Middle name:	Vladimirovich
First name:	Alexey
Department:	Technical Department
Phone (direct):	8-351-779-22-32
Fax (direct):	8-351-772-96-19
Mobile:	
Personal e-mail:	shinkin@chemk.ru

Annex 2

BASELINE INFORMATION

Data/Parameter	$\mathbf{P}_{x\ FS\ y\ BE}$
Data unit	b.t [13]
Description	Cumulative production of grade *y* ferrosilicon in shop No. *x* in 2001-2003
Time of determination /monitoring	Calculated once
Source of data (to be) used	Scala software package, MGwin data sheet
Value of data applied (for ex ante calculations/determinations)	$P_{2\ FS\ 75\ BE}$ = 57721.7 b.t./year $P_{7\ FS\ 45\ BE}$ = 108893.0 b.t./year $P_{7\ FS\ 65\ BE}$ = 197414.1 b.t./year $P_{8\ FS\ 65\ BE}$ = 160938.9 b.t./year $P_{8\ FS\ 75\ BE}$ = 17060.1 b.t./year
Justification of the choice of data or description of measurement methods and procedures (to be) applied	The calculation is made by summing up the output of grade y ferrosilicon in shop No. x in 2001-2003. The calculation is made by experts at ChEMW, OJSC and given in an Excel file – Annex 4.
QA/QC procedures (to be) applied	All measurements are made with calibrated measuring instruments in compliance with accepted standards in the metal industry.
Any comment	

Data/Parameter	$\mathbf{EC}_{x\ FS\ y\ BE}$
Data unit	MWh
Description	Cumulative electrical energy consumption during the production of grade *y* ferrosilicon in shop No. *x* in 2001-2003
Time of determination /monitoring	Calculated once
Source of data (to be) used	Scala software package, MGwin data sheet
Value of data applied (for ex ante calculations/determinations)	$EC_{2\ FS\ 75\ BE}$ =566398.3 MWh/year $EC_{7\ FS\ 45\ BE}$ = 583473.5 MWh/year $EC_{7\ FS\ 65\ BE}$ = 1526080.4 MWh/year $EC_{8\ FS\ 65\ BE}$ = 1246302.7 MWh/year $EC_{8\ FS\ 75\ BE}$ = 175564.7 MWh/year
Justification of the choice of data or description of measurement methods and procedures (to be) applied	The calculation is made by summing up the electrical energy consumption during the production of grade y ferrosilicon in shop No. x in 2001-2003. The calculation is made by experts at ChEMW, OJSC and is given in an Excel file – Annex 4.

[13] B.t. – basis ton – is 1 ton of ferrous alloy with a strictly defined content of the leading element (or its compound). For example, GOST accepts that silicon content in ferrosilicon FS 45 can vary from 41 to 47%. A basis ton is taken equal to 1 ton of alloy containing 45% Si. (V.A. Kudrin. Steelmaking theory and technology. "Mir" Publishing House, Moscow, 2003, page 39)

QA/QC procedures (to be) applied	The measurements are made using TsE 6812 electric power meters; at furnace 54 the PM820 PowerMeter is used. The calibration period is 8 years and the accuracy rating is 0.5. All measurements are made with calibrated measuring instruments in compliance with the accepted standards in the metal industry.
Any comment	

Data/Parameter	**$SEC_{x\ FS\ y\ BE}$**
Data unit	kWh/b.t
Description	Average specific electrical energy consumption during the production of grade y ferrosilicon in shop No. x in 2001-2003
Time of determination /monitoring	Calculated once
Source of data (to be) used	Scala software package, MGwin data sheet
Value of data applied (for ex ante calculations/determinations)	$SEC_{2\ FS\ 75\ BE}$ =9813 kWh/b.t $SEC_{7\ FS\ 45\ BE}$ =5358 kWh/ b.t $SEC_{7\ FS\ 65\ BE}$ = 7730 kWh/ b.t $SEC_{7\ FS\ 75\ BE}$ = 9813 kWh/ b.t $SEC_{8\ FS\ 65\ BE}$ = 7744 kWh/ b.t $SEC_{8\ FS\ 75\ BE}$ =10291 kWh/ b.t
Justification of the choice of data or description of measurement methods and procedures (to be) applied	The calculation is made by dividing the cumulative electrical energy consumption during the production of grade y ferrosilicon in shop No. x in 2001-2003 by the cumulative production of grade y ferrosilicon in shop No. x in 2001-2003. The calculation is made by experts at ChEMW, OJSC and given in an Excel file – Annex 4.
QA/QC procedures (to be) applied	All measurements are made with calibrated measuring instruments in compliance with accepted standards in the metal industry.
Any comment	

Data/Parameter	**$P_{x\ FS\ y\ PE}$**		
Data unit	m.t/year		
Description	Output of grade y ferrosilicon in shop No. *x*.		
Time of determination /monitoring	Calculated annually		
Source of data (to be) used	Scala software package, MGwin data sheet		
Value of data applied (for ex ante calculations/determinations)		2008	2009
		m.t./year	m.t./year
	$P_{2\ FS\ 75\ PE}$	29 104	25 733
	$P_{7\ FS\ 45\ PE}$	37 988	12 270
	$P_{7\ FS\ 65\ PE}$	52 703	36 670
	$P_{7\ FS\ 75\ PE}$	14 900	23 333
	$P_{8\ FS\ 65\ PE}$		3 316

	$P_{8\ FS\ 75\ PE}$		16 559
Justification of the choice of data or description of measurement methods and procedures (to be) applied	Measurements are made with the following scales: - VPP-2-1 floor electronic scales produced by VIK Tenzo M", CJSC. The load capacity limit is 10-2000 kg; - VP-30 electron-tensometric scales produced by Promkonstruktsiya, LLC. The load capacity limit is 200-30'000 kg; - VA-60-18-3 electronic truck scales produced by Promkonstruktsiya, LLC. The load capacity limit is 400-60'000 kg; - RD-M-150 wage scales produced by Promkonstruktsiya, LLC. The load capacity limit is 1.0 - 150 t. The ferroalloy output is measured by weighing and recorded in the Met_uch program. The necessary shipping reports are created with the help of the MGwin data sheet.		
QA/QC procedures (to be) applied	The scales calibration is tested monthly by the chief meteorologist division at ChEMW, OJSC, and annually by the state inspection agencies. All measurements are made with calibrated measuring instruments in compliance with accepted standards in the metal industry.		
Any comment			

Data/Parameter	**$M_{x\ FS\ y\ PE}$**		
Data unit	%		
Description	Silicon weight content in the alloy of grade *x* ferrosilicon in shop *y*		
Time of determination /monitoring	Calculated annually		
Source of data (to be) used	"Central Plant Laboratory form sheets" program		
Value of data applied (for ex ante calculations/determinations)		2008	2009
		%	%
	$P_{2\ FS\ 75\ PE}$	76.17	76.39
	$P_{7\ FS\ 45\ PE}$	45.43	45.49
	$P_{7\ FS\ 65\ PE}$	65.91	66.75
	$P_{7\ FS\ 75\ PE}$	76350	76.47
	$P_{8\ FS\ 65\ PE}$		66.08
	$P_{8\ FS\ 75\ PE}$		75.88
Justification of the choice of data or description of measurement methods and procedures (to be) applied	Measurements are made by the analytical laboratory at ChEMW, OJSC		
QA/QC procedures (to be) applied	All measurements are made by certified analytical laboratory at ChEMW, OJSC. All measurements are made with calibrated measuring instruments in compliance with accepted standards in the metal industry.		

Any comment	

Data/Parameter	**$EF_{grid, CM}$**
Data unit	tCO_2/MWh
Description	Joint emission factor from the united power grid of the Urals
Time of determination /monitoring	Calculated once
Source of data	The project design documents: "Construction of a new 400 MW CCGT unit at the Yaivinskaya hydroelectric power plant, Wholesale Generating Company-4, Perm Territory, Russia", http://ji.unfccc.int/UserManagement/FileStorage/SWGB8ROL1D0K7MFAXT24PYZJHUQV96 Reference number on UNFCCC site – 0215.
Value of data applied (for ex ante calculations/determinations)	0.606
Justification of the choice of data or description of measurement methods and procedures (to be) applied	The factor is estimated by Global Carbon BV in compliance with the approved CDM procedure "Guidelines for emission factor estimation for the power grid" (version 02)
QA/QC procedures (to be) applied	The project design documents: "Construction of a new 400 MW CCGT unit at the Yaivinskaya hydroelectric power plant, Wholesale Generating Company-4, Perm Territory, Russia" was determined by an independent expert company: Bureau Veritas Certification Holding SAS.
Any comment	

Annex 3

MONITORING PLAN

The information is provided at section D of the PDD.