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

## CONTENTS



**Annexes**

## SECTION A. General description of the project

### A.1. Title of the project:

Switch from wet to dry process at OJSC "Shchurovsky Cement", Russia

Sectoral scope 4: Manufacturing industries[1]

Project Design Document (PDD) version 3.2

25 September 2009

### A.2. Description of the project:

The cement plant of OJSC "Shchurovsky Cement" (hereinafter referred to as "Shchurovsky Cement") is the first cement plant in Russia. It is located in the Central part of Russia in Kolomna town. The production started in 1870. The first white cement production line was launched in 1952. A new rotary kiln with an annual production capacity of about 650,000 tonnes of grey cement was built in 1975 and one year later another kiln was built with an annual capacity of about 650,000 tonnes of grey cement. Presently, the Shchurovsky Cement plant has a grey cement production line with a maximum technical production capacity of about 1.3 million tonnes per year and a white cement production line.

Cement production is a highly energy intensive process generating significant emissions of greenhouse gases (GHGs), in particular $CO_2$. There are three main sources of $CO_2$ emissions in the cement production process. The first source is the chemical decomposition of limestone into calcium oxide and carbon dioxide. The second source is the fossil fuel combustion. The third source, being smaller in comparison with the first two, is the electricity consumption of the plant's motor drives (e.g. for kiln rotation, pumping, ventilation) and other electrical equipment.

**Project purpose**
The goal of this proposed Joint Implementation (JI) project is to use a more energy efficient dry production process and thus significantly reduce the emissions associated with the grey cement production line as well as increase the grey cement production capacity at the Shchurovsky Cement plant.

**Current status**
Shchurovsky Cement plant has two wet kilns. The average specific energy consumption from fossil fuel combustion is 5,931 MJ per tonne of clinker (situation prior to the project start). The present production volume of grey cement is about 1.1 million tonnes per year. Limestone, clay and additives are crushed and mixed in the raw mill during the raw material preparation stage. In the case of wet cement technology water is added to the raw mill along with the raw materials in order to produce slurry. The slurry is further homogenized and fed to the rotary kiln. At the point of the kiln inlet, at the drying zone, water is evaporated from the slurry, and the raw materials are moved further into the kiln to be calcinated and burnt into clinker. Evaporation of water from wet slurry consumes significant amounts of energy.

These two existing wet kilns were constructed in 1975-1976 and can be operated at least until 2020[2].

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[1] http://ji.unfccc.int/Ref/Documents/List_Sectoral_Scopes_version_02.pdf

[2] In Russia there are some kilns which are being operated for more than 45 years without renovation and nearly 60 years with renovation

Currently natural gas is being used as fuel at Shchurovsky Cement plant. It is typical fuel at the Russian cement plants excluding cement plants in Siberia because it is cheaper and cleaner than heavy oil fuel and coal. In future natural gas can be more expensive and many Russian facilities (including cement plants) plan to shift to coal. Shchurovsky Cement also intends to switch to coal as of 1st October 2010[3].

The wet cement production technology is the conventional technology of cement production in Russia, while the dry production technology has a very limited number of applications in the country. In 2007 there are only 30[4] (17%) dry kilns out of 177 total kilns in Russia as a whole and only nine (13%) dry kilns[5] out of 67 kilns are located in the Central part of Russia. All kilns were constructed before 1992 and some of them were renovated during 1970-2000. Only three new kilns were constructed in Russia since 1992:

- in the Central part of Russia: one kiln at Mordovcement (2008, dry);
- in the Ural region: two kilns at JSC “Soda” (2007, dry) and at Magnitogorsky cement plant (2007, wet).

In the Central part of Russia average distance of cement transportation is less than 500 km. This means that changes in cement production at one plant will not impact the production at another cement plant located at 1000 km. 19 plants are located within this circle. Wet process is the predominant technology in Russia as of today and there are no new installations within the last 15 years in the Central part of Russia without the status of a JI project.

**Project scenario**
Shchurovsky Cement plans to modernize the grey cement production line. The expected commissioning date is 01 October 2010 (third quarter 2010). According to the modernization program the wet cement production process will be fully replaced by a dry cement production process. More detailed information about the dry cement production process and the JI modernization project is presented in Section A.4.2 below. The main benefit of the dry cement production process is a decreased fuel consumption in comparison with the wet cement production process and therefore a reduction of $CO_2$ emissions. For the dry cement production process the average specific energy consumption amounts to 3,600 MJ per tonne of clinker produced. The expected production volume of grey cement will be approximately 2.1 million tonnes per year. Coal will be used as main fuel and natural gas will be used for additives drying and heat production only[6].

**Baseline scenario**
The project will result in an additional production of approximately 0.8 million tonnes of grey cement per year (Expected production of 2.1 million tonnes per year minus maximum possible production at existing lines of 1.3 million tonnes per year. If the project was not implemented, the market demand would be covered by other cement manufacturers, which can increase cement production at the existing capacity by increasing the number of run-days and decreasing the duration of stops, would be covered by installing new capacities. Thus $CO_2$ emissions in the baseline scenario would consist of the existing capacity emissions and incremental capacity emissions. The emissions of incremental capacity are calculated based on the assumption that the incremental cement volume would be produced by other cement producers. The incremental capacity emissions are determined taking into account the principles of the

[3] Approved Financial Plan of OJSC “Shchurovsky Cement” - “FinPlan 2009-2013”

[4] This and further information of cement plants is taken from OJSC “NIICEMENT” annual statistical report “Russian Cement Industry in 2006”. This information from future reports will be used also for monitoring purposes in future

[5] Including six small shaft furnaces at Podgorensky cement plant

[6] This assumption is true also for baseline scenario

Combined Margin approached which was firstly introduced in the approved CDM[7] tool "Tool to calculate the emission factor for an electricity system" (version 01.1). The baseline scenario is presented in detail in Section B.1 below.

**Project background**
Holcim (hereinafter referred to as "Holcim"), the corporate of Shchurovsky Cement, has decided to conduct a feasibility study on the new dry cement production line at Shchurovsky Cement in 2006. This study was prepared at the beginning of 2007. In April 2007 Holcim decided to switch from wet to dry grey cement production. Holcim also started looking for a JI project developer for this project in mid-2007. It contacted Global Carbon BV for this purpose in July 2007 and Shchurovsky Cement concluded a contract in August 2008.

**Contribution to sustainable development**
The project's contribution to the sustainable development of the Moscow area of Russia is fourfold:

*Social and economic:* A demand for skilled jobs is created relating to the construction of the new cement line as well as the operation and maintenance of the installed equipment. The project generates both direct and indirect local employment. For example, about 700 additional workers are involved in the new cement line construction activity during 24 months.

More cement will be produced that will be used as construction material for infrastructure development. New roads and highways will indirectly increase the employment rate. The project also helps to create a business opportunity for the local stakeholders such as bankers/consultants, suppliers/manufacturers, contractors etc.

Through the lower fossil fuel consumption of the process, the project will contribute to the conservation of non-renewable natural resources, like natural gas.

*Environmental:* The project focuses on the production of cement by modern dry method equipment, instead of using the old wet method equipment. Thus, dust and $CO_2$ emissions will be significantly reduced. Additionally, diversion of water from the Oka river will be reduced considerably (i.e. saving of water resources).

*Technological:* The proposed dry cement production technology is relatively new for Russia and the property rights of the technology lie solely with the foreign technology licensor. A vital part of the project will be to provide appropriate training to the managerial and operational staff of the Shchurovsky Cement plant. An intensive in-house knowledge base will be developed to build up scientific and technical expertise for running the process. Adoption of this technology also contributes to capacity building of the enterprise staff by stronger exposure to modern technological developments in the cement industry. Moreover, this technology can be replicated by other cement producers in Russia.

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[7] Clean development mechanism

**A.3. Project participants:**

| Party involved | Legal entity project participant (as applicable) | Please indicate if the Party involved wishes to be considered as project participant (Yes/No) |
|---|---|---|
| Party A: Russia (Host party) | OJSC "Shchurovsky Cement" | No |
| Party B: The Netherlands | Holcim Group Support Ltd | No |

Role of the project participants:

- OJSC "Shchurovsky Cement" is the second largest cement company in the Moscow region. The Shchurovsky Cement plant has a grey cement line and a white cement line. It has three production sites. Shchurovsky Cement will implement the proposed JI project and own the ERUs[8] associated with the project. OJSC "Shchurovsky Cement" is a project participant;
- Holcim is one of the world's leading producers of cement and aggregates. Holcim is the majority shareholder of OJSC "Shchurovsky Cement". Holcim provides funding for the proposed JI project and the specific technologies. Holcim Group Support Ltd is a project participant;

[8] Emission reduction units

**A.4. Technical description of the project:**

**A.4.1. Location of the project:**

The project is located in the town of Kolomna, 114 kilometers southeast of Moscow (see Figure A.4.1.1).

***Figure A.4.1.1: Map of Moscow area with the project location***


*Source: http://map.rin.ru/cgi-bin/main_e.pl?Region=moscowobl*

**A.4.1.1. Host Party(ies):**

The Russian Federation

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

The Moscow area (oblast) is the second largest area by number of population (6,672,000) in Russia. Most of the population in the area lives in towns (80%). The Moscow area is also second in Russia (after Moscow city) by volume of industrial production. It has developed machine-building and metal industries, as well as chemical, construction and light industries.

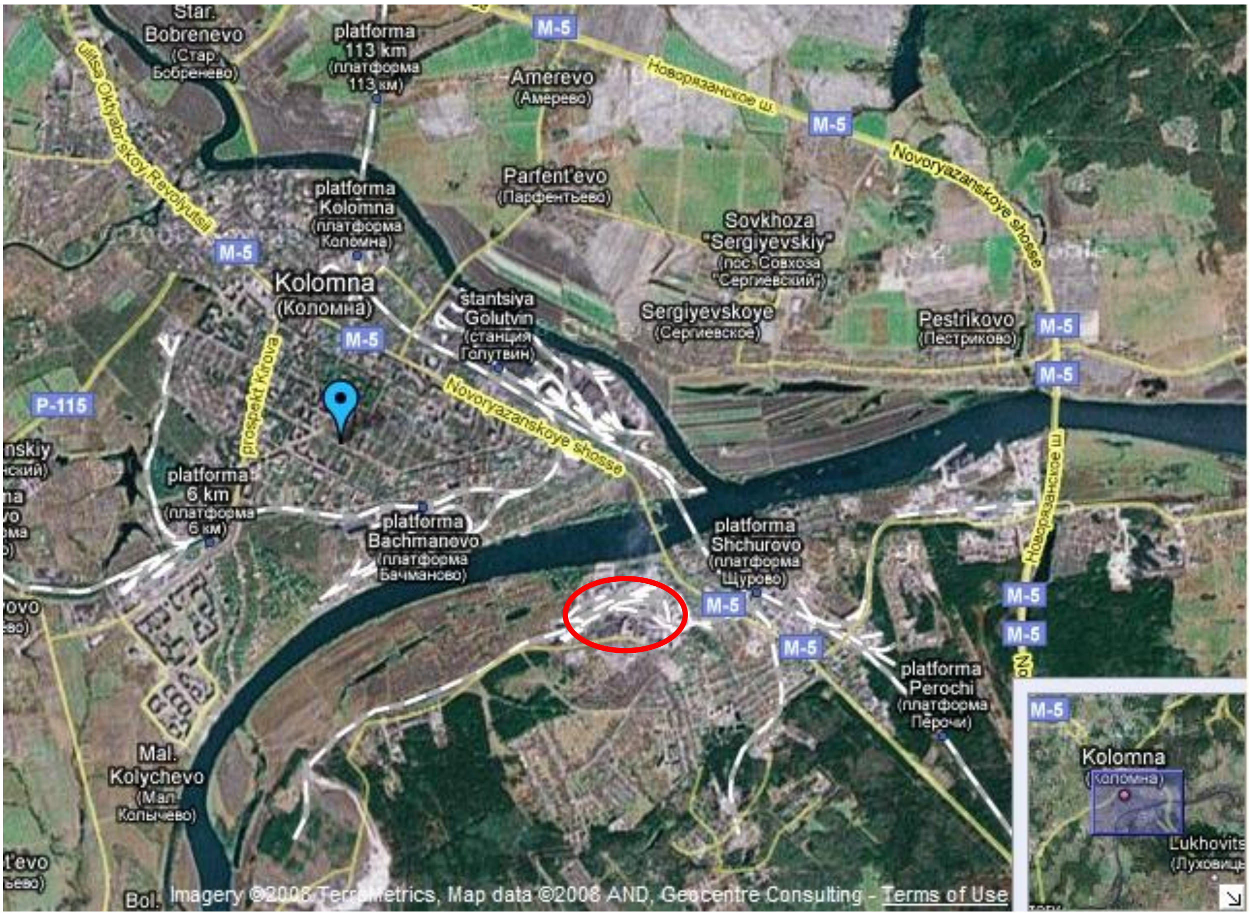
**A.4.1.3. City/Town/Community etc.:**

Kolomna is the seventh largest town in the Moscow area with a population of 148,000 people and a territory of 65 square kilometres. It was founded around 1177 and hosts machine-building and construction, as well as car, railway and river transport industries. Kolomna was recognized as the most comfortable town of the Moscow area in 2006.

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

The Shchurovsky Cement production site is located at the southeast outskirts of Kolomna town (see Figure A.4.1.4.1). The site coordinates are: 55°4´46´´ N, 38°46´42´´ E.

*Figure A.4.1.4.1: Satellite image of Kolomna town with Shchurovsky Cement plant*[9]




*Source: TerraMetrics (2008)*

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

Presently, Shchurovsky Cement uses the wet process of cement production, but the proposed JI project aims at changing the existing wet production process into a dry production process. The dry process of the cement production is more energy efficient. The plant plans to modernize production of grey cement.

**General description of cement production**

The cement production cycle can be divided into four stages:

[9] Marked in red

*1. Raw materials extraction*
The main chemical compounds necessary for the cement production are contained in limestone or chalk ($CaCO_3$) and clay or loam ($SiO_2$, $Fe_2O_3$ and $Al_2O_3$). Limestone (or chalk) and clay (or loam) are extracted from natural deposits, crushed and transported to the cement production site.

*2. Processing of raw materials*
The crushed limestone and clay are mixed in a proportion of approximately 4:1. In the case of wet production technology water is added to form slurry, which is later evaporated in the drying section of the rotary kiln. In the dry process raw materials are mixed, milled and homogenized without adding water. The waste heat from the dry kiln can be used to dry the raw materials at the preparation stage.

*3. Clinker burning*
The raw material is passed to the rotary kiln. Under the influence of high temperatures, limestone (calcium carbonate) is calcinated into lime (calcium oxide) and carbon dioxide:

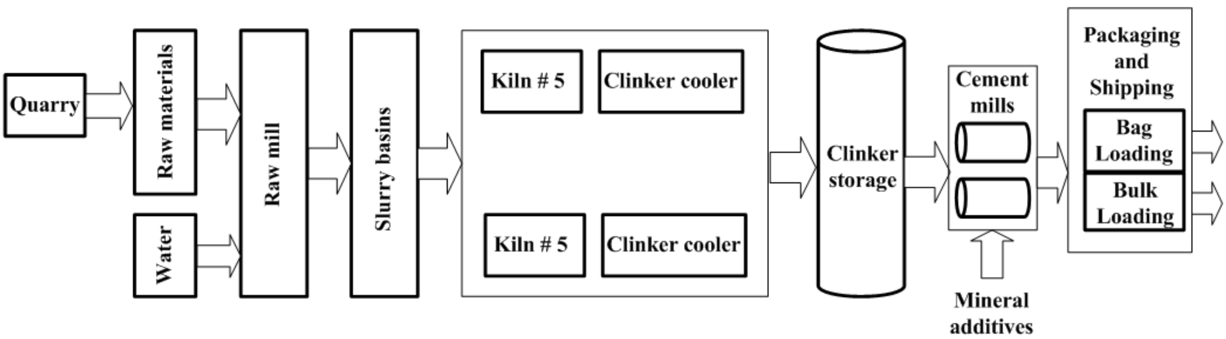
$$CaCO_3 \rightarrow CaO + CO_2 \qquad (1)$$

This chemical reaction is one of the three main sources of carbon dioxide during the cement production. Another main source of $CO_2$ is the fuel burning in order to heat the kiln. After the calcination, the calcium oxide reacts with the other chemical compounds present at temperatures between 1400 – 1450$^o$ C. This reaction is called sintering. The final product of these reactions is called clinker. Clinker that emerges out of the kiln is cooled and heat is returned to the process by the clinker coolers.

*4. Making cement from clinker*
The last stage of the cement production is fine crushing of clinker in cement mills to the state of powder. Mineral components (e.g. slag, fly ash or gypsum) are added to the clinker and milled together in order to produce different types of cement.

**Current process layout**
The current grey cement production at Shchurovsky Cement is presented in Figure A.4.2.2 below.

***Figure A.4.2.2: Existing wet cement production process at Shchurovsky Cement plant***




*Source: Shchurovsky Cement*

Limestone and clay are extracted from the quarry, crushed and transported (approximately five kilometres) to the cement plant. The raw materials are crushed separately. Then they are mixed and milled to slurry with the addition of water in the raw mill. After homogenisation in slurry basins, the kiln feed slurry is fed into rotary wet kilns. The first process in the kiln is the evaporation of water.

Thereafter, with the mineralogical/chemical reactions of calcination and sintering, clinker is formed. Clinker is passed to the cooler, and further to cement grinding. Then cement is being packed and shipped.

Currently, two wet rotary kilns are in operation, kiln № 5 has a capacity of 1,680 tonnes of clinker per day and kiln № 6 has a capacity of 1,668 tonnes of clinker per day (total capacity: 3,348 tonnes of clinker per day). The average clinker factor (for 2005-2007) is 0.832. Shchurovsky cement forecasts the change of clinker factor from 0.832 to 0.794 by 2010. And the average kiln runtime factor of existing kilns (for 2005-2007) is 0.732 but can be 0.850. At existing maximum technical capacity, the plant can produce approx. 1.3 million tonnes of cement annually, with a clinker factor of 0.794 and kiln runtime factor of 0.850.

Both kilns use natural gas as fuel but as shown in the Section A.2 the coal will be used as of 1st October 2010
The main technical data of the existing wet cement production line (the average data for 2005-2007 and the baseline data for the period 2010-2012) are presented in Table A.4.2.1 below.

***Table A.4.2.1: Main technical data of the existing plant and the baseline***

| **Indicator** | **Unit** | **Existing wet production line** | |
|---|---|---|---|
| | | **Average 2005-2007** | **Baseline** |
| Kiln capacity | tonnes clinker per day | 3,348 | 3,348 |
| Clinker production capacity | tonnes per year | 893,785 | 1,038,717[10] |
| Cement production capacity | tonnes per year | 1,074,317 | 1,308,208[11] |
| Kiln runtime factor | - | 0.732 | 0.850 |
| Clinker / cement factor | - | 0.832 | 0.794 |
| Fuel | - | Natural gas | Coal |
| Specific heat energy consumption | MJ/t clinker | 5,931 | 5,931 |
| Specific consumption of electrical energy | kWh/t cement | 135 | 135 |
| Emission factor | $tCO_2$/tonne of cement | 0.792 | 0.971 |

*Source: Shchurovsky Cement*

**Situation after project implementation**
The two old kilns (for the wet process) will be dismantled, a new dry kiln and additional equipment (for the dry production process) will be installed instead. Two clinker storages and two cement storages will be built. The existing packaging line will be mothballed, two new packaging lines, a pallet loader, pallet rails and a palletized bag storage will be built instead. Some of the current auxiliary equipment will be used in the new dry line (cement mills № 5 and № 6, raw mills № 7 and № 8, cement silos etc.). Some additional auxiliary equipment will be installed e.g. in the quarry. Crushed limestone and overburden will be transported to the cement plant by a new overland belt conveyor. Four new storages will be used to store components of raw meal. A new vertical roller mill and homogenizing silo will be used for raw meal preparation. The plant intends to use coal as fuel as of 1st October 2010.

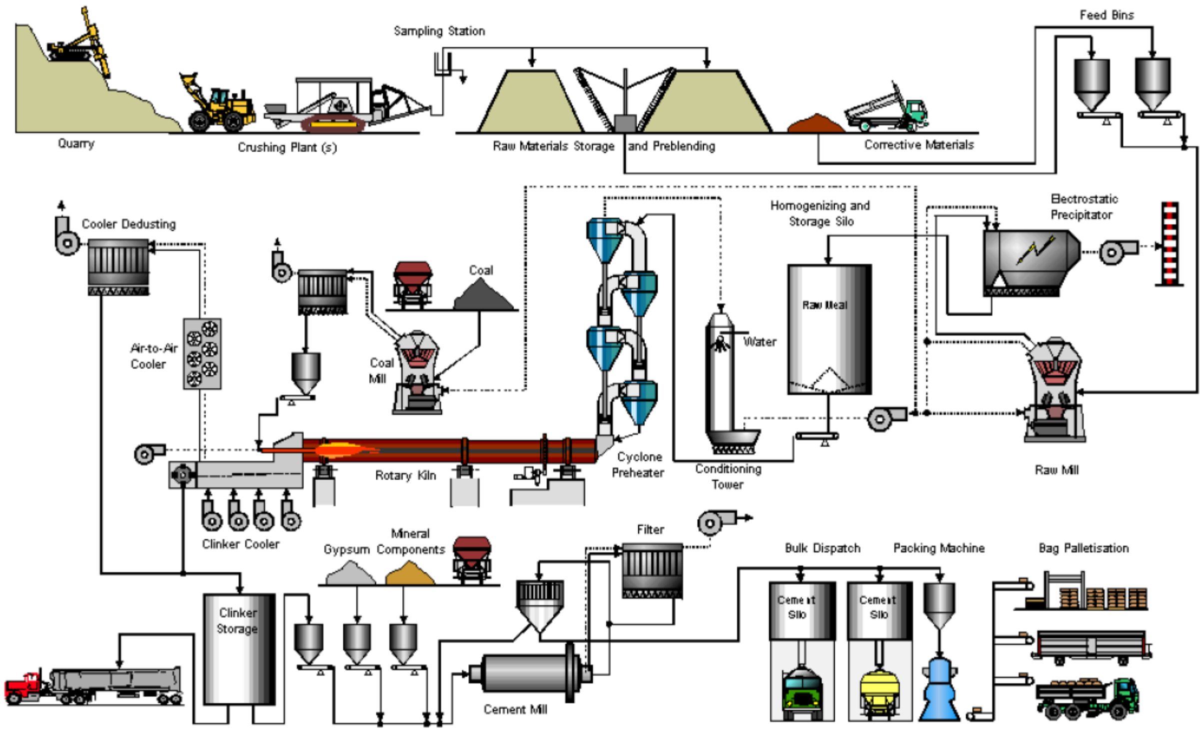
[10] Clinker technical production capacity

[11] Maximum technical capacity

The dry process of grey cement production is presented in Figure A.4.2.3 below. Blasted limestone and overburden are loaded onto trucks, hauled to the crushing plant adjacent to the quarry and deposited into two crusher feed hoppers, one for limestone and another for overburden. The limestone feed hoppers have access ramps for feeding from two sides. The limestone and overburden are extracted from the hoppers by means of two belt feeders in the crusher. A single stage impact crusher is used for raw material crushing. The crushed limestone and overburden mixture is fed onto an overland belt conveyor for transportation to an integrated longitudinal pre-blending pit. Then raw meal is prepared by drying and grinding of raw material components in mills. Hot kiln exhaust gases are utilized for drying.

In the preheater kilns, the raw meal is fed to the top of a series of cyclones passing down in stepwise counter-current flow with hot exhaust gases from the rotary kiln, thus providing intimate contact and efficient heat exchange between solid particles and hot gas. The cyclones thereby serve as separators between solids and gas.

***Figure A.4.2.3: Dry cement production process***




*Source: Cembureau, Best available techniques for the cement industry (1999)*

Prior to entering the rotary kiln, the raw meal is heated up to a temperature of approximately 810 – 830°C, whereby the calcination (i.e. also the release of $CO_2$ from the carbonates) is already about 30% complete. The exhaust gases leave the preheater at a temperature of 300 – 360° C and are further utilised for raw material drying in the raw mill. In the rotary kiln, calcium carbonate is (fully) calcinated into calcium oxide and carbon dioxide:

$$CaCO_3 + heat \Rightarrow CaO + CO_2 \qquad (2)$$

This chemical reaction is one of the three main sources of carbon dioxide emissions during cement production. The second main source of $CO_2$ emissions is the fuel burning in order to heat the kiln.

After the calcination, the calcium oxide reacts with the other chemical compounds present at temperatures between 1400 – 1450°C.

$$3CaO + SiO_2 \Rightarrow 3CaO \cdot SiO_2 \quad (3)$$

$$2CaO + SiO_2 \Rightarrow 2CaO \cdot SiO_2 \quad (4)$$

$$3CaO + Al_2O_3 \Rightarrow 3CaO \cdot Al_2O_3 \quad (5)$$

$$4CaO + Al_2O_3 + Fe_2O_3 \Rightarrow 4CaO \cdot Al_2O_3 \cdot Fe_2O_3 \quad (6)$$

These reactions are called sintering. The final product of these reactions is called clinker. Part of the calcium oxide does not react with anything. This calcium oxide is called free.

Clinker that comes out of the kiln is cooled and heat is returned to the process by clinker coolers. The last stage of the cement production is fine crushing of clinker in cement mills to the state of powder. Mineral components (e.g. slag, fly ash or gypsum) are added to the clinker and milled together in order to produce different types of cement.

The production capacity of the new kiln will be 5,500 tonnes of clinker per day. The annual production of the new dry installation will be approximately 1,667,400 tonnes of clinker or approximately 2.1 million tonnes of cement per year.

The main technical data of planned JI project is presented in Table A.4.2.2 below.

***Table A.4.2.2: Main technical data for JI project***

| Indicator | Unit | Dry production line |
|---|---|---|
| Kiln capacity | tonnes clinker per day | 5,500 |
| Clinker production capacity[12] | tonnes per year | 1,667,400 |
| Cement production capacity[13] | tonnes per year | 2,100,000r |
| Kiln runtime factor | - | 0.831 |
| Clinker / cement factor | - | 0.794 |
| Fuel | - | Coal |
| Specific heat energy consumption | MJ/t clinker | 3,600 |
| Specific consumption of electricity | kWh/t cement | 100 |
| Emission factor | $tCO_2$/tonne of cement | 0.762 |

*Source: Shchurovsky Cement*

According to the schedule, the new grey cement line will be commissioned in October 2010. The project implementation schedule is presented in Table A.4.2.3 below.

***Table A.4.2.3: Implementation schedule***

[12] Maximum technical capacity

[13] Maximum technical capacity

| N | Title | 2007 | | | | 2008 | | | | 2009 | | | | 2010 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | I q | II q | III q | IV q | I q | II q | III q | IV q | I q | II q | III q | IV q | I q | II q | III q | IV q |
| 1 | Decision making | | | | | | | | | | | | | | | | |
| 2 | Preliminary engineering | | | | | | | | | | | | | | | | |
| | Final engineering | | | | | | | | | | | | | | | | |
| | Civil works | | | | | | | | | | | | | | | | |
| | Commissioning | | | | | | | | | | | | | | | | |

*Source: Shchurovsky Cement*

**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:**

As a result of the project, emissions of $CO_2$ will be significantly reduced, in particular also due to a reduction of the kiln fuel consumption because of the introduction of a dry kiln with enhanced efficiency.

Switching from wet to dry process has some benefits, but the project is not financially/economically feasible without the sale of the associated ERUs, which will be shown in Section B.2 below, by applying an investment analysis in accordance with the approved CDM "Tool for the demonstration and assessment of additionality" (version 05.2).

The cement industry is a capital intensive industry and the proposed project requires a significant amount of funding. The IRR benchmark used in the investment analysis is 10.5%, while in the proposed project (not being implemented as a JI project) the IRR will be only 6.30%. For more detailed information on baseline setting and additionality, please refer to Section B.

Therefore if the project is not implemented, more greenhouse gases will be emitted to produce the same amount of cement.

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

***Table A.4.3.1.1: Estimated emission reductions over the crediting period***

| | Years |
|---|---|
| Length of the crediting period | 2.25 |
| Year | Estimate of annual emission reductions in tonnes of $CO_2$ equivalent |
| 2010 | 81,655 |
| 2011 | 326,620 |
| 2012 | 326,620 |
| Total estimated emission reductions over the crediting period (tonnes of $CO_2$ equivalent) | 734,894 |
| Annual average of estimated emission reductions over the crediting period (tonnes of $CO_2$ equivalent) | 326,620 |

***Table A.4.3.1.2: Estimated emission reductions after the crediting period***

| | Years |
|---|---|
| Period after 2012, for which emission reductions are estimated | 8 |
| Year | Estimate of annual emission reductions in tonnes of $CO_2$ equivalent |
| 2013 | 326,620 |
| 2014 | 326,620 |
| 2015 | 326,620 |
| 2016 | 326,620 |
| 2017 | 326,620 |
| 2018 | 326,620 |
| 2019 | 326,620 |
| 2020 | 326,620 |
| Total estimated emission reductions over the period indicated (tonnes of $CO_2$ equivalent) | 2,612,958 |

### A.5. Project approval by the Parties involved:

After the PDD has passed the determination process, the PDD and the determination report will be presented to the Russian designated focal point for approval of the proposed JI project. Additionally, project approvals from Switzerland and the Netherlands will be applied for.

## SECTION B. Baseline

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

A baseline for a JI project has to be set in accordance with appendix B of the annex to decision 9/CMP.1 (hereinafter referred to as “JI guidelines”), and, in particular, the “Guidance on criteria for baseline setting and monitoring”[14] developed by the Joint Implementation Supervisory Committee (JISC) (hereinafter referred to as “Guidance”).

A baseline shall be established on a project-specific basis and/or using a multi-project emission factor.

If a baseline is established on a project-specific basis, the project participants may apply approved CDM baseline and monitoring methodologies (paragraph 20 (a) of the Guidance) or establish a baseline that is in accordance with appendix B of the JI guidelines, also using selected elements or combinations of approved CDM baseline and monitoring methodologies or approved CDM methodological tools, as appropriate (paragraph 20 (b) of the Guidance).

**Step 1: Theoretical approach to identify the baseline**

For the cement industry four approved CDM baseline and monitoring methodologies exist: ACM0003, ACM0005, ACM0015 (consolidating AM0033 and AM0040) and AM0024. None of these methodologies can be applied directly to the project which foresees a process switch combined with an increase in production, but these methodologies have been carefully studied to identify the main principles underlying the approach to baseline setting, additionality and monitoring.

Furthermore, the approach regarding baseline setting applied for the JI project “Switch from wet-to-dry process at Podilsky Cement, Ukraine” (JI Track 2[15] reference number: 0001), for which the determination has been deemed final, has been taken into account with respect to production at the maximum technical capacity. This approach is applied for the replacement of wet method by dry method cement production with the same capacity.

On this basis, a JI specific approach regarding baseline setting and monitoring has been developed in accordance with appendix B of the JI Guidelines and the JISC’s Guidance.

The baseline for a JI project is the scenario that reasonably represents the anthropogenic emissions by sources (or anthropogenic removals by sinks) of GHGs that would occur in the absence of the proposed project.

As no approved CDM baseline and monitoring methodology can be applied directly, in accordance with paragraph 21 (b) of the Guidance, plausible future scenarios are identified and listed on the basis of conservative assumptions (step 1). The proposed project, not being developed as a JI project, has been included as one of the alternatives. These alternatives are assessed whether or not to be credible and reasonable and the most plausible is identified as the baseline (step 2).

Consistency between the baseline scenario and the additionality assessment has been checked.

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[14] See http://ji.unfccc.int/Ref/Guida.html.

[15] The verification procedure under the JISC, as defined in paragraphs 30-45 of the JI guidelines, is also referred to as “JI Track 2 procedure”.

**Step 2: Application of the approach to the project**

***Step 2a: Identification and listing of plausible alternative baseline scenarios***

Shchurovsky Cement is producing cement by applying the wet process since the very beginning. The wet process was the predominant technology in the Soviet Union. The main reason to use wet processes was the simplicity of raw material handling and the control of the cement quality. Energy efficiency was not considered to be a high priority at that time.

The maximum technical cement production capacity of the existing grey cement production line (two wet kilns) is approximately 1.3 million tonnes per year. After project implementation, cement production will amount to approximately 2.1 million tonnes per year. Hence, the incremental production will be approximately 0.8 million tonnes of cement per year.

At Shchurovsky Cement several options for the production of grey cement are technically feasible. These are discussed below.

*Production capacity*

a. Keeping the existing cement production lines. Third party producers will satisfy cement demand instead (approximately 0.8 million tonnes of cement per year);
b. Keeping the existing cement production lines and constructing a new cement production line (technical production capacity approximately 0.8 million tonnes of cement per year);
c. Dismantling the existing cement production lines and constructing a new cement production line with a larger capacity (technical production capacity approximately 2.1 million tonnes of cement per year).

*Technology of new cement production line*

d. Applying a wet process;
e. Applying a semi-dry process;
f. Applying a dry process.

Combining the six options mentioned above results in seven possible alternative baseline scenarios:
Alternative 1: Keeping the existing lines. Third party producers will satisfy cement demand instead;
Alternative 2: Keeping the existing lines and constructing a new line applying a wet process;
Alternative 3: Keeping the existing lines and constructing a new line applying a semi-dry process;
Alternative 4: Keeping the existing lines and constructing a new line applying a dry process;
Alternative 5: Constructing a new line applying a wet process and dismantling the existing lines;
Alternative 6: Constructing a new line applying a semi-dry process and dismantling the existing lines;
Alternative 7: Constructing a new line applying a dry process and dismantling the existing lines.

The seven alternatives are described below in more detail.

*1) Keeping the existing lines. Third party producers will satisfy cement demand instead*

The technical clinker production capacity at the existing kilns is approx. 1,000,000 tonnes per year. Thus, the annual cement production will be approximately 1.3 million tonnes. Incremental production (approximately 0.8 million tonnes of cement per year) would have to be covered by other (new and/or existing) cement plants.

*2) Keeping the existing lines and constructing a new line applying a wet process*

A new wet kiln and new auxiliary equipment for the new line will be built to be operated together with the existing lines. The total technical cement production capacity will be approximately 2.1 million tonnes per year (existing kilns: 1.3 million tonnes, new kiln: 0.8 million tonnes).

*3) Keeping the existing lines and constructing a new line applying a semi-dry process*

This alternative is similar to alternative 2 above, but the new cement production line will use the semi-dry method.

*4) Keeping the existing lines and constructing a new line applying a dry process*

This alternative is similar to alternatives 2 and 3 above, but the new cement production line will use the dry method.

*5) Constructing a new line applying a wet process and dismantling the existing lines*

Shchurovsky Cement will construct a new cement production line which applies the wet method. The existing lines will be dismantled. The total technical cement production capacity will be approximately 2.1 million tonnes per year.

*6) Constructing a new line applying a semi-dry process and dismantling the existing lines*

This alternative is similar to alternative 5 above, but the new cement production line will apply the semi-dry method.

*7) Constructing a new line applying a dry process and dismantling the existing lines*

Similar to alternatives 5 and 6 above, but the new cement production line will apply the dry method.

***Step 2b: Identification of the most plausible alternative scenario***

***Assessment of alternative 1: Keeping the existing lines. Third party producers will satisfy cement demand instead***

The wet process is the predominant cement production technology in Russia and Shchurovsky Cement can continue to apply the wet process. There are no legal or other requirements which would force Shchurovsky Cement to discontinue using the wet production process. The existing lines can continue operation till at least 2020. No additional investment is required. Thus, alternative 1 is a reasonable and feasible one.

***Assessment of alternative 2: Keeping the existing lines and constructing a new line applying a wet process***

Under alternative 2, a new wet line would be built and operated together with the existing wet lines. The wet process has already been used on-site, it is well known, and its construction and operation will not face technical and staff training difficulties. However, wet kilns are an out-dated technology with high specific energy consumption per tonne of clinker produced. Given the fact that energy prices are constantly rising, the reinforced application of this technology will lead to high (and increasing) cement production costs. Thus, this alternative cannot be considered as a reasonable and feasible one. Moreover, this alternative is not conservative in terms of GHG emissions.

***Assessment of alternative 3: Keeping the existing lines and constructing a new line applying a semi-dry process***

For the semi-dry method, cost of equipment is almost the same as for the dry method (investment costs are comparable), but fuel consumption is higher (hence, cost of operation is higher). Moreover, the semi-dry method is usually used if the moisture content of the raw material is more than 25%. The raw materials used by Shchurovsky Cement have a moisture content of 8 – 20%. Therefore this method is less reasonable than the dry method.

***Assessment of alternative 4: Keeping the existing lines and constructing a new line applying a dry process***

The technical cement production capacity of the new line would be approximately 0.8 million tonnes per year. Investment cost would amount to approximately 70% of the investment cost of alternative 7. However, fuel savings would be around 60% less. From the financial point of view the performance of this alternative is weak, so this option cannot be regarded as reasonable.

***Assessment of alternative 5: Constructing a new line applying a wet process and dismantling the existing lines***

This option is the similar to alternative 2, but for its implementation more investment is required. Therefore alternative 5 is less reasonable than alternative 2.

***Assessment of alternative 6: Constructing a new line applying a semi-dry process and dismantling the existing lines***

For the semi-dry method, equipment cost is almost the same as for the dry method, but fuel consumption is higher. Moreover, the semi-dry method is usually used if the moisture content of the raw material is higher than 25%. The raw materials used by Shchurovsky Cement have a moisture content of 8 – 20%. Therefore, this method is less reasonable than the dry method.

***Assessment of alternative 7: Constructing a new line applying a dry process and dismantling the existing lines***

Changing from a wet to a dry process requires a significant investment plus the application of a new technology at Shchurovsky Cement. However, the application of the dry process provides a significant increase in fuel efficiency. In principle, this alternative is a reasonable and feasible one.

***Conclusion***
Only alternatives 1 and 7 are, in principle, realistic and credible. However, alternative 7 is economically/financially not feasible (without the revenue from the sale of associated ERUs). This is proven in Section B.2 below, by applying an investment analysis in accordance with the approved CDM “Tool for the demonstration and assessment of additionality” (version 05.2).

Alternative 1 is the only remaining realistic and credible alternative and is therefore identified as the most plausible baseline scenario.

The baseline emissions of alternative 1 are elaborated in Sections D and E, as well as Annex 2 whereas:

- For the baseline emissions related to the replacement of the existing capacity the JI specific approach of JI0001 at Podilsky Cement has been used;
- For the baseline emissions related to the incremental capacity a multi-sectoral baseline approach is introduced in Annex 2.

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

| **Data/Parameter** | $CLNK_{BL\_cap}$ |
|---|---|
| Data unit | Tonnes |
| Description | Clinker technical production capacity of the existing kilns |
| Time of determination/monitoring | Ex-ante |
| Source of data (to be) use | Plant records |
| Value of data applied (for ex ante calculations/determinations) | 1,038,717 |
| Justification f the choice of data or description of measurement methods and procedures (to be) applied | This parameter is defined according to the approach for baseline setting applied in the JI project "Switch from wet-to-dry process at Podilsky Cement, Ukraine" (JI Track 2[16] reference number: 0001).<br>The clinker technical production capacity of the existing kilns was calculated as total daily production capacity multiplied by a runtime factor.<br>The existing kilns have a total daily production capacity of 3,348 tonnes of clinker. The runtime factor was calculated based on 320 rundays per annum with a 3% time for emergence stops (3,348*320*0.97). |
| OA/QC procedures (to be) applied | - |
| Any comment | This parameter defines maximum possible clinker production at the existing kilns in baseline and is used in formulae 11 and 12 in Section D. |

| **Data/Parameter** | $PCF_{PR,y}$ |
|---|---|
| Data unit | - |
| Description | Project clinker factor (clinker to cement ratio) in year *y* |
| Time of determination/monitoring | During the crediting period |
| Source of data (to be) use | Plant records |
| Value of data applied (for ex ante calculations/determinations) | 0.794 |
| Justification f the choice of data or description of measurement methods and procedures (to be) applied | This parameter depends on types of cement produced is forecasted by Shchurovsky cement. The weighting method is used to identify the amount of cement and additives. Clinker production is calculated as a difference between the cement produced and the additives used in process. The weighting equipment is being calibrated and checked by the plant staff. |

[16] The verification procedure under the JISC, as defined in paragraphs 30-45 of the JI guidelines, is also referred to as "JI Track 2 procedure".

| | |
|---|---|
| OA/QC procedures (to be) applied | The company has special Department for Control and Measuring devices. This department is in charge of supervision of measuring devices operation and performance. It checks and substitutes devices (adjusted and calibrated) from the reserve if necessary. The company has approval regulations of measurements, registration and archiving data and the annual calibration and replacement devices schedule. |
| Any comment | - |

| **Data/Parameter** | $CEM_{BL,y}$ |
|---|---|
| Data unit | Tonnes |
| Description | Cement production in the baseline scenario on the existing kilns in year y |
| Time of determination/monitoring | During the crediting period |
| Source of data (to be) use | Plant records |
| Value of data applied (for ex ante calculations/determinations) | 1,308,208 |
| Justification f the choice of data or description of measurement methods and procedures (to be) applied | This parameter is calculated as multiplication of $CLNK_{BL,y}$ (please see formula 11 in Section D.1.1.4) and project clinker factor (please see the explanation in Section A.4.2).<br>The weighting method is used to identify the amount of cement. The weighting equipment is being calibrated and checked by the plant staff. |
| OA/QC procedures (to be) applied | The company has a special Department for Control and Measuring devices. This department is in charge of supervision of measuring devices operation and performance and checks and substitutes devices (adjusted and calibrated) from the reserve if necessary. The company has approval regulations of measurements, registration and archiving data and the annual calibration and replacement devices schedule. |
| Any comment | This parameter is being used in calculations of emissions for replacement capacity only. |

| **Data/Parameter** | $CEM_{BL\_incr,y}$ |
|---|---|
| Data unit | Tonnes |
| Description | Incremental cement production in year *y* |
| Time of determination/monitoring | During the crediting period |
| Source of data (to be) use | Plant records |
| Value of data applied (for ex ante calculations/determinations) | 791,792 |
| Justification f the choice of data or description of measurement methods and procedures (to be) applied | This parameter is the difference between the project cement production and $CEM_{BL,y}$.<br>The project cement production: 2,100,000 tonnes per year. The weighting method is used to identify the amount of cement. The weighting equipment is being calibrated and checked by the plant staff. |
| OA/QC procedures (to be) applied | The company has a special Department for Control and Measuring devices. This department is in charge of supervision of measuring devices operation and performance and checks and substitutes devices |

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| | (adjusted and calibrated) from the reserve if necessary. The company has approval regulations of measurements, registration and archiving data and the annual calibration and replacement devices schedule. |
| Any comment | This parameter is being used emission calculations for incremental production. It may be zero if $CEM_{BL,y}$ is less than the project cement production. |

| **Data/Parameter** | $EF_{dec,y}$ |
|---|---|
| Data unit | $tCO_2$/t clinker |
| Description | Default calcination factor in year *y* |
| Time of determination/monitoring | During the crediting period |
| Source of data (to be) use | Cement Sustainability Initiative (CSI) of the World Busness Council for Sustainable Development (WBCSD) 2005, $CO_2$ Accounting and Reporting Standard for the Cement Industry, www.wbcsd.org |
| Value of data applied (for ex ante calculations/determinations) | 0.525 |
| Justification f the choice of data or description of measurement methods and procedures (to be) applied | This default emission factor is close to the IPCC default factor and is adjusted for Mg carbonates |
| OA/QC procedures (to be) applied | - |
| Any comment | - |

| **Data/Parameter** | $BKE_{BL}$ |
|---|---|
| Data unit | GJ/t clinker |
| Description | Average kiln efficiency of existing on-site wet kilns |
| Time of determination/monitoring | Ex-ante |
| Source of data (to be) use | Plant records |
| Value of data applied (for ex ante calculations/determinations) | 5.931 |
| Justification f the choice of data or description of measurement methods and procedures (to be) applied | This parameter is being calculated as 2005-2007 average of the relevant actual operation data. This parameter is defined in accordance with the approach applied in the JI project “Switch from wet-to-dry process at Podilsky Cement, Ukraine” (JI Track 2 reference number: 0001) as the annual fuel consumption for clinker production*average fuel net calorific value/the annual clinker production.<br>The natural gas (fuel) consumption is measured continuously. The gas flow meters are used. The independent company calibrates the meters. Measurement is carried out automatically. Results of measurement are recorded and archived in electronic system of the plant.<br>The natural gas net calorific value is taken from the Certificate of natural gas supplier. The natural gas supplier issues it on monthly basis.<br>Clinker production is calculated as a difference between the cement produced and the additives used in process. The weighting equipment |

| | |
|---|---|
| | is being calibrated and checked by the plant staff. |
| OA/QC procedures (to be) applied | The company has special Department for Control and Measuring devices. This department is in charge of supervision of measuring devices operation and performance. It checks and substitutes devices (adjusted and calibrated) from the reserve if necessary. The company has approval regulations of measurements, registration and archiving data and the annual calibration and replacement devices schedule. |
| Any comment | This parameter is being used emission calculations for replacement production. It may used for any fuel types. |

| **Data/Parameter** | $RATIO_{fuel\_i,y}$ |
|---|---|
| Data unit | - |
| Description | Share of type *i* fuel consumption in total fuel consumption in year *y* |
| Time of determination/monitoring | During the crediting period |
| Source of data (to be) use | Plant records |
| Value of data applied (for ex ante calculations/determinations) | For natural gas consumption: 0.05;<br>For coal consumption: 0.95. |
| Justification f the choice of data or description of measurement methods and procedures (to be) applied | It is the forecasted by Shchurovsky cement. |
| OA/QC procedures (to be) applied | - |
| Any comment | - |

| **Data/Parameter** | $BELF_{el}$ |
|---|---|
| Data unit | MWh/t cement |
| Description | Average specific electricity consumption by cement production |
| Time of determination/monitoring | Ex-ante |
| Source of data (to be) use | Plant records |
| Value of data applied (for ex ante calculations/determinations) | 0.135 |
| Justification f the choice of data or description of measurement methods and procedures (to be) applied | This parameter is being calculated as 2005-2007 average of the relevant actual operation data. This parameter is defined in accordance with the approach applied in the JI project “Switch from wet-to-dry process at Podilsky Cement, Ukraine” (JI Track 2 reference number: 0001) as the total annual electricity consumption for cement production / the annual cement production.<br>The electricity consumption is measured continuously. The electrical meters are used. The independent company calibrates the meters. Measurement is carried out automatically. Results of measurement are recorded and archived in electronic system of the plant.<br>The weighting method is used to identify the amount of cement. The weighting equipment is being calibrated and checked by the plant staff. |
| OA/QC procedures (to be) applied | The company has special Department for Control and Measuring devices. This department is in charge of supervision of measuring |

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| | devices operation and performance. It checks and substitutes devices (adjusted and calibrated) from the reserve if necessary. The company has approval regulations of measurements, registration and archiving data and the annual calibration and replacement devices schedule. |
| Any comment | This parameter is being used in calculations of emissions for replacement only. |

| **Data/Parameter** | $NCV_{fuel\_i,y}$ ("fuel_i" is natural gas) |
|---|---|
| Data unit | GJ/1000 $m^3$ |
| Description | Net calorific value of natural gas in year *y* |
| Time of determination/monitoring | During the crediting period |
| Source of data (to be) use | Plant records |
| Value of data applied (for ex ante calculations/determinations) | 33.6 |
| Justification f the choice of data or description of measurement methods and procedures (to be) applied | The natural gas net calorific value is taken from the Certificate of natural gas supplier. The natural gas supplier issues it on monthly basis. |
| OA/QC procedures (to be) applied | - |
| Any comment | - |

| **Data/Parameter** | $NCV_{fuel\_i,y}$ ("fuel_i" is coal) |
|---|---|
| Data unit | GJ/tonne |
| Description | Net calorific value of coal in year *y* |
| Time of determination/monitoring | During the crediting period |
| Source of data (to be) use | 2006 IPCC Guidelines on National GHG Inventories |
| Value of data applied (for ex ante calculations/determinations) | 11.9 |
| Justification f the choice of data or description of measurement methods and procedures (to be) applied | The IPCC default net calorific value of lignite is used for coal[17]. |
| OA/QC procedures (to be) applied | - |
| Any comment | - |

| **Data/Parameter** | $EF_{fuel\_i}$ ("fuel_i" is natural gas) |
|---|---|
| Data unit | $tCO_2$/GJ |
| Description | Emission factor of natural gas |
| Time of | During the crediting period |

[17] Currently the type of coal is not defined. Therefore the IPCC default net calorific value of lignite is used for emission calculation in Section E. After project implementation the data of net calorific value from the Certificate of coal supplier will be used for project and baseline emission calculation.

| | |
|---|---|
| determination/monitoring | |
| Source of data (to be) use | 2006 IPCC Guidelines on National GHG Inventories |
| Value of data applied (for ex ante calculations/determinations) | 0.056 |
| Justification f the choice of data or description of measurement methods and procedures (to be) applied | IPCC default emission factor is used because the local data is not available |
| OA/QC procedures (to be) applied | - |
| Any comment | - |

| **Data/Parameter** | $EF_{fuel\_i}$ ("fuel_i" is coal) |
|---|---|
| Data unit | $tCO_2/GJ$ |
| Description | Coal Emission factor |
| Time of determination/monitoring | During the crediting period |
| Source of data (to be) use | 2006 IPCC Guidelines on National GHG Inventories |
| Value of data applied (for ex ante calculations/determinations) | 0.101 |
| Justification f the choice of data or description of measurement methods and procedures (to be) applied | IPCC default emission factor is used because the local data is not available. The IPCC default net calorific value of lignite is used for coal. |
| OA/QC procedures (to be) applied | - |
| Any comment | - |

| **Data/Parameter** | $PF_{fuel\_i,y}^{boilers}$ |
|---|---|
| Data unit | $m^3$ |
| Description | Consumption of fuel of type *i* in the boiler houses in year *y* |
| Time of determination/monitoring | During the crediting period |
| Source of data (to be) use | Plant records |
| Value of data applied (for ex ante calculations/determinations) | 4,307,081 |
| Justification f the choice of data or description of measurement methods and procedures (to be) applied | This parameter is being calculated as 2005-2007 average of the relevant actual operation data.<br>The natural gas (fuel) consumption is measured continuously. The gas flow meters are used. The independent company calibrates the meters. Measurement is carried out automatically. Results of measurement are recorded and archived in electronic system of the plant.<br>The natural gas net calorific value is taken from the Certificate of natural gas supplier. The natural gas supplier issues it on monthly basis. |
| OA/QC procedures (to be) applied | The company has a special Department for Control and Measuring devices. This department is in charge of supervision of measuring |

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| | devices operation and performance and checks and substitutes devices (adjusted and calibrated) from the reserve if necessary. The company has approval regulations of measurements, registration and archiving data and the annual calibration and replacement devices schedule. |
| Any comment | - |

| **Data/Parameter** | $PF_{fuel\_i,y}^{HGG}$ |
|---|---|
| Data unit | $m^3$ |
| Description | Consumption of fuel of type *i* in the hot gas generator in year *y* |
| Time of determination/monitoring | During the crediting period |
| Source of data (to be) use | Plant records |
| Value of data applied (for ex ante calculations/determinations) | 4,918 |
| Justification f the choice of data or description of measurement methods and procedures (to be) applied | The type of hot gas generator is not defined yet. Therefore this parameter is calculated on the basis the specific fuel consumption hot gas generator in the Podilsky Cement project[18].<br>The natural gas (fuel) consumption is measured continuously. The gas flow meters are used. The independent company calibrates the meters. Measurement is carried out automatically. Results of measurement are recorded and archived in electronic system of the plant.<br>The natural gas net calorific value is taken from the Certificate of natural gas supplier. The natural gas supplier issues it on monthly basis. |
| OA/QC procedures (to be) applied | The company has a special Department for Control and Measuring devices. This department is in charge of supervision of measuring devices operation and performance and checks and substitutes devices (adjusted and calibrated) from the reserve if necessary. The company has approval regulations of measurements, registration and archiving data and the annual calibration and replacement devices schedule. |
| Any comment | - |

| **Data/Parameter** | $BEL_y^{CEM}$ |
|---|---|
| Data unit | MWh |
| Description | Electricity consumption of cement production, including raw materials transportation and preparation, kiln operation and clinker grinding, in the baseline scenario in year *y* |
| Time of determination/monitoring | During the crediting period |
| Source of data (to be) use | Plant records |
| Value of data applied (for ex ante calculations/determinations) | 177,087 |
| Justification f the choice of data or description of measurement methods and procedures (to be) applied | The value of data is defined as baseline cement production multiplied by average specific electricity consumption - $BELF_{el}$ .<br>The electricity consumption is measured continuously. The electrical |

[18] JI project "Switch from wet-to-dry process at Podilsky Cement, Ukraine" (JI Track 2 reference number: 0001)

| | |
|---|---|
| | meters are used. The independent company calibrates the meters. Measurement is carried out automatically. Results of measurement are recorded and archived in electronic system of the plant. |
| OA/QC procedures (to be) applied | The company has a special Department for Control and Measuring devices. This department is in charge of supervision of measuring devices operation and performance and checks and substitutes devices (adjusted and calibrated) from the reserve if necessary. The company has approval regulations of measurements, registration and archiving data and the annual calibration and replacement devices schedule. |
| Any comment | |

| **Data/Parameter** | $BEL_y^{boiler}$ |
|---|---|
| Data unit | MWh |
| Description | Electricity consumption by the boiler houses in the baseline scenario in year *y* |
| Time of determination/monitoring | During the crediting period |
| Source of data (to be) use | Plant records |
| Value of data applied (for ex ante calculations/determinations) | 821 |
| Justification f the choice of data or description of measurement methods and procedures (to be) applied | This parameter is being calculated as 2005-2007 average of the relevant actual operation data.<br>The electricity consumption is measured continuously. The electrical meters are used. The independent company calibrates the meters. Measurement is carried out automatically. Results of measurement are recorded and archived in electronic system of the plant. |
| OA/QC procedures (to be) applied | The company has a special Department for Control and Measuring devices. This department is in charge of supervision of measuring devices operation and performance and checks and substitutes devices (adjusted and calibrated) from the reserve if necessary. The company has approval regulations of measurements, registration and archiving data and the annual calibration and replacement devices schedule. |
| Any comment | |

| **Data/Parameter** | $BEL_y^{coal\_mill}$ |
|---|---|
| Data unit | MWh |
| Description | Electricity consumption by the coal mill in the baseline scenario in year *y* |
| Time of determination/monitoring | During the crediting period |
| Source of data (to be) use | Specifications of FLSmidth ATOX Coal Mill |
| Value of data applied (for ex ante calculations/determinations) | 492 |
| Justification f the choice of data or description of measurement methods and procedures (to be) applied | This parameter is calculated as baseline cement production multiplied by the specific electricity consumption of coal mill. The specific electricity consumption of coal mill is taken in accordance with the Specifications of FLSmidth ATOX Coal Mill.<br>The electricity consumption is measured continuously. The electrical |

| | |
|---|---|
| | meters are used. The independent company calibrates the meters. Measurement is carried out automatically. Results of measurement are recorded and archived in electronic system of the plant. |
| OA/QC procedures (to be) applied | The company has a special Department for Control and Measuring devices. This department is in charge of supervision of measuring devices operation and performance and checks and substitutes devices (adjusted and calibrated) from the reserve if necessary. The company has approval regulations of measurements, registration and archiving data and the annual calibration and replacement devices schedule. |
| Any comment | |

| **Data/Parameter** | $EF_{el\_j,y}$ |
|---|---|
| Data unit | $tCO_2$/MWh |
| Description | Standardized $CO_2$ emission factor of the regional energy system (RES) *j* (multi-project baseline) |
| Time of determination/monitoring | Ex-ante |
| Source of data (to be) use | The study “Development of grid GHG emission factors for power systems of Russia” commissioned by “Carbon Trade and Finance” in 2008 (further in the text – Study) |
| Value of data applied (for ex ante calculations/determinations) | 0.526 – for RES “Centre”;<br>0.591 – for RES “Mid Volga”;<br>0.534 – for RES “North-West”;<br>0.602 – for RES “South”. |
| Justification of the choice of data or description of measurement methods and procedures (to be) applied | The Study was verified by Bureau Veritas Certification in 2008 |
| OA/QC procedures (to be) applied | - |
| Any comment | For the calculation of emissions related to electricity consumption in the project and baseline scenarios for replacement part of cement production, the combined margin emission factor for RES “Centre” was applied.<br>For the calculation of emissions related to electricity consumption in the baseline scenarios for incremental part of cement production, the corresponding grid emission factors (for RES “Centre”, RES “Mid Volga”, RES “North-West” and RES “South”) were applied. Please see Annex 2. |

| **Data/Parameter** | $BEF_{incr,y}$ |
|---|---|
| Data unit | $tCO_2$/t cement |
| Description | Baseline emission factor for incremental cement production |
| Time of determination/monitoring | During the crediting period |
| Source of data (to be) use | OJSC “NIICEMENT” annual statistical report “Russian Cement Industry in 2006”. This report contains the data of annual cement and clinker production and annual fuel and electricity consumption at Russian cement plants. |
| Value of data applied | 0.831 |

| | |
|---|---|
| (for ex ante calculations/determinations) | |
| Justification f the choice of data or description of measurement methods and procedures (to be) applied | The underlying principle of the Combined Margin (as first introduced in the "Tool to calculate the emission factor for an electricity system") is used. IPCC default values are used for $CO_2$ emission factor of fossil fuels. The default grid emission factors for the regional power systems of Russia are used. Please see Annex 2 for more detail description including the assumptions, formulae, parameters, data sources and key factors |
| OA/QC procedures (to be) applied | - |
| Any comment | - |

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

According to paragraph 2 of Annex 1 of the JISC's Guidance, unless an approved CDM baseline and monitoring methodology is used, inter alia, the following options may be applied:

- Application of the most recent version of the "Tool for the demonstration and assessment of additionality" approved by the CDM Executive Board;
- Application of any other method for proving additionality approved by the CDM Executive Board;
- Provision of traceable and transparent information showing that the baseline was identified on the basis of conservative assumptions, that the project scenario is not part of the identified baseline scenario and that the project will lead to reductions of anthropogenic emissions by sources or enhancements of net anthropogenic removals by sinks of GHGs;
- Provision of traceable and transparent information that an accredited independent entity has already positively determined that a comparable project (to be) implemented under comparable circumstances (same GHG mitigation measure, same country, similar technology, similar scale) would result in a reduction of anthropogenic emissions by sources or an enhancement of net anthropogenic removals by sinks that is additional to any that would otherwise occur and a justification why this determination is relevant for the project at hand.

In this PDD, the most recent version of the "Tool for the demonstration and assessment of additionality" (version 05.2) (hereinafter referred to as "Additionality Tool") is applied to prove that the emission reductions by the proposed JI project are additional to any that would otherwise occur.

***Step 1: Identification of alternatives to the project consistent with current laws and regulations***

***Sub-step 1a: Define alternatives to the project***

Plausible alternatives to the project were identified in Section B.1 above:
Alternative 1: Keeping the existing lines. Third party producers will satisfy cement demand instead;
Alternative 2: Keeping the existing lines and constructing a new line applying a wet process;
Alternative 3: Keeping the existing lines and constructing a new line applying a semi-dry process;
Alternative 4: Keeping the existing lines and constructing a new line applying a dry process;
Alternative 5: Constructing a new line applying a wet process and dismantling the existing lines;
Alternative 6: Constructing a new line applying a semi-dry process and dismantling the existing lines;
Alternative 7: Constructing a new line applying a dry process and dismantling the existing lines.

Only alternatives 1 and 7 were identified as, in principle, realistic and credible.

***Sub-step 1b: Consistency with mandatory laws and regulations***

All the alternatives defined in sub-step 1a are in compliance with mandatory legislation and regulations.

***Step 2: Investment analysis***

The main goal of the investment analysis is to determine whether the proposed project is not:
(a) The most economically or financially attractive; or
(b) Economically or financially feasible, without the revenue from the sale of ERUs associated with the JI project.

To conduct the investment analysis, the following sub-steps have to be applied.

***Sub-step 2a: Determine appropriate analysis method***

In principle, there are three methods applicable for an investment analysis: simple cost analysis, investment comparison analysis and benchmark analysis.

A simple cost analysis (Option I) shall be applied if the proposed JI project and the alternatives identified in step 1 generate no financial or economic benefits other than JI related income. The proposed JI project results in fuel and electricity savings and additional sales revenues due to the incremental production capacity installed. Thus, this analysis method is not applicable.

An investment comparison analysis (Option II) compares suitable financial indicators for realistic and credible investment alternatives. As only alternative 7 represents an investment, a benchmark analysis (Option III) is applied.

***Sub-step 2b: Option III. Apply benchmark analysis***

The proposed project, upgrading an existing process, shall be implemented by the project participant Shchurovsky Cement. As soon it has no internal IRR benchmark for investment decisions making the approach recommended in p. 6 (a) of Additionality Tool is applied – using “government bonds rates increased by a suitable risk premium”. As Russia does not have long term governmental bonds a conservative approach of using Central Bank RF discount rate of 10.5% is proposed in the analysis. The risk rate is not applied to be conservative. Thus overall IRR benchmark amounts to 10.5%. If the proposed project (not being implemented as JI project) has a less favourable indicator, i.e. a lower IRR, than the benchmark, then the project cannot be considered as financially attractive.

***Sub-step 2c: Calculation and comparison of financial indicators***

The financial analysis refers to the time of investment decision-making.

The following assumptions have been used based on the information provided by the enterprise:
1. Investment decision: April 2007, commissioning date: 1 October 2010;
2. The project requires investments of approximately EUR 500 million during four years;
3. The old wet kilns will be dismantled after commissioning of the new dry kiln;
4. All relevant indicators are calculated per tonne of cement (using the appropriate clinker factor);
5. The project lifetime is 20 years (lifetime of dry kiln);

6. The calculations are made at constant prices as of April 2007[19];
7. The exchange rate (EUR/RUR) is rounded up to 1/34.69 in accordance with the enterprise's conversion practice;
8. Production is assumed at the maximum technical capacity;
9. The cement production is extended to 2.1 million tonnes per year in accordance with the enterprise plans;
10. Fuel and electricity consumption reduction is taken into account in line with the technical specifications of the project design.
11. The coal is the main fuel. Natural gas will be only five percent in the fuel balance for some processes.

All essential techno-economical parameters and assumptions (such as capital costs, fuel prices, lifetime and other) are received from Shchurovsky Cement.

The Tool recommends to provide the all the relevant assumptions, preferably in the CDM-PDD, or in separate annexes to the CDM-PDD, so that a reader can reproduce the analysis and obtain the same results. The background financial data is available in Excel file on Financial analysis. Formulae are designed in a such a way that all background information used can be traced. This file was made available to an Accredited Independent Entity and after the final determination will be publicised at the UNFCCC website as Supporting document. Therefore this is the only one deviation from the Tool.

The project cash flow focuses, in addition to investment-related outflows, on revenue flows generated:

- Savings on fuel and electricity;
- Additional sales of cement due to the incremental production capacity.

The project's financial indicators are presented in Table B.2.1 below.

***Table B.2.1. Financial indicators of the project***

| **Scenario** | **IRR (%)** | **Simple payback period (years)[20]** |
|---|---|---|
| Base case | 6,30 | 11 |

The cash flow analysis shows an IRR of 6.3%, which is well below IRR benchmark of 10.5%. A negative NPV[21] results. Hence, the project cannot be considered as financially attractive.

***Sub-step 2d: Sensitivity analysis***

A sensitivity analysis shall be conducted to show whether the conclusion regarding the financial/economic attractiveness is robust to reasonable variations in the critical assumptions.

The following three key factors were considered in the sensitivity analysis: investment cost electricity, gas and cement prices. The cost of slag does not play an important role in the cost structure and its development is therefore not considered in the sensitivity analysis. As it is unlikely that tariffs or fuel/raw

[19] The calculation at constant prices as of the time of decision-making provides an objective view of the long-term future. It allows to perform a "pure" sensitivity analysis not impacted by expert estimations of inflation levels, prices etc., and to identify the most important factors really impacting the project's financial performance.

[20] The discounted payback period would be outside of the project lifetime.

[21] Net present value

material prices will decrease in Russia, downward trends of the production cost components are not considered. In line with the Additionality Tool the sensitivity analysis should be undertaken within the corridor of ±10% for the key indicators.

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

*Scenario 2* is based on the assumption of a 10% investment cost decrease that improves cash flow and performance indicators making IRR the closest among all scenarios to the conservative benchmark but usually in practice investment cost increases especially taking into account that project is implemented during four years. So this is unlikely that the cost will decrease making project IRR higher than conservative benchmark.

*Scenario 3* assumes 10% gas price increase and *Scenario 4* is opposite to Scenario 3. Both scenarios demonstrate that gas price does not much disturb the cash flow performance.

Scenario 5 implies 10% electricity tariff growth and Scenario 6 – 10% electricity tariff drop. The cash flow proves robustness for these indicator deviations.

*Scenario 7* and *Scenario 8* are based on upward and downward 10% cement price trend. Of course cement price is the most sensitive indicator. But IRR still remains within conservative benchmark proving the robustness of cash flows.

In all scenarios NPV is negative. Simple payback period is more than 9 years and discounted payback period exceeds project life time.

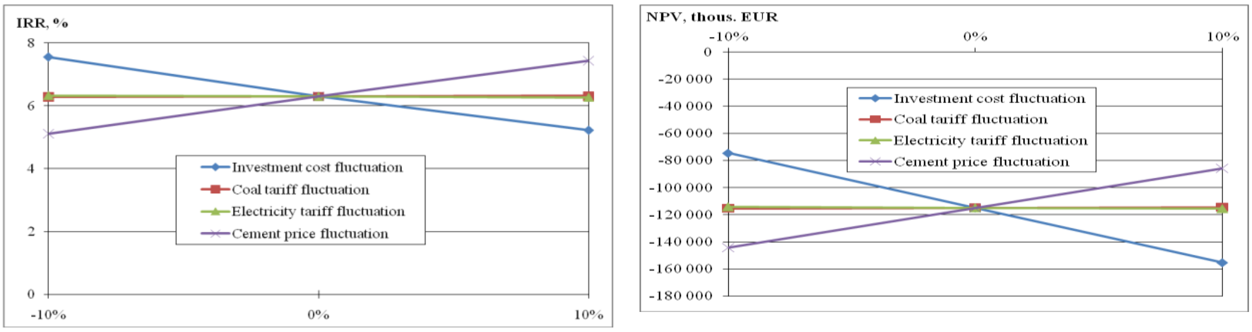
A summary of the results is presented in Table B.2.2 and in Figures B.2.1 below.

***Table B.2.2: Sensitivity analysis (summary)***

| Scenario | IRR (%) | Discounted payback period | Simple payback period (years)[22] |
|---|---|---|---|
| Scenario 1 | 6.30% | Out of project lifetime | 11 |
| Scenario 2 | 5.23% | Out of project lifetime | 12 |
| Scenario 3 | 7.55% | Out of project lifetime | 10 |
| Scenario 4 | 6.32% | Out of project lifetime | 11 |
| Scenario 5 | 6.29% | Out of project lifetime | 11 |
| Scenario 6 | 6.27% | Out of project lifetime | 11 |
| Scenario 7 | 6.33% | Out of project lifetime | 11 |
| Scenario 8 | 7.44% | Out of project lifetime | 10 |

[22] The discounted payback periods would be outside of the project lifetime.

*Figure B.2.1: IRR Sensitivity analysis*




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

***Step 3: Barrier analysis***

In line with the Additionality Tool, a barrier analysis is not conducted.

***Step 4: Common practice analysis***

In Russia the majority of kilns at cement plants were constructed before 1988. About 86% of cement is produced using the wet method. The wet process was the predominant technology in the Soviet Union. No new cement capacity additions can be observed during the last 10 years within a radius of 1,000 km from the project site (see also Annex 2).

Hence, the proposed JI project does not reflect common practice.

***Conclusion***

The application of the CDM Additionality Tool demonstrates that the emission reductions by the proposed JI project are additional to any that would otherwise occur.

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

There are three different sources of GHG emissions while producing cement:
- Geogenic emissions from the calcination (decarbonisation) process;
- Fuel combustion;
- GHG emissions in the power grid as a result of electricity consumption.

The project boundary shall encompass all anthropogenic emissions by sources of GHGs which are:
- Under the control of the project participants;
- Reasonably attributable to the project; and
- Significant.

An overview of all emission sources within the project boundary is given in Table B.3.1 below.

*Table B.3.1: Sources of emissions*

| № | Source | Gas[23] | Included/ excluded | Justification/Explanation |
|---|---|---|---|---|
| 1 | Fuel consumption at the quarry | $CO_2$ | Excluded | • Minor source of emissions (less than 1%);<br>• It can be reasonably assumed that emissions in the project and baseline scenarios are comparable. |
| 2 | Grid electricity consumption at the quarry | $CO_2$ | Excluded | • Same as above. |
| 3 | Fuel consumption during the process of the raw material transportation | $CO_2$ | Excluded | • Minor source of emissions (less than 1%);<br>• It can be reasonably assumed that emissions due to raw material transportation in the project and baseline scenarios are comparable. However, the project foresees an electricity powered belt conveyor for raw material transportation instead of fuel powered vehicle transport in the baseline scenario. Hence, emissions from fuel consumption during transportation are reduced and excluding this source is conservative;<br>• Electricity consumption is included for reasons of conservativeness (see below). |
| 4 | Grid electricity consumption during the process of the raw material transportation | $CO_2$ | Included | • It can be reasonably assumed that emissions due to raw material transportation in the project and baseline scenarios are comparable. However, increased on-site electricity consumption will be taken into account for reasons of conservativeness (see above);<br>• Emissions are calculated using a standardized Russian regional electricity emission factor[24]. |
| 5 | Fuel combustion to dry the raw material | $CO_2$ | Included | • In the project and baseline scenarios the fuel combustion will differ. |
| 6 | Change in grid electricity consumption of the coal mill | $CO_2$ | Included | • In the project and the baseline scenarios the volume of coal will be different;<br>• Emissions are calculated using a standardized Russian regional electricity emission factor. |
| 7 | Fuel combustion to dry the coal | $CO_2$ | Included | • In the project and the baseline scenarios the fuel combustion will differ. |

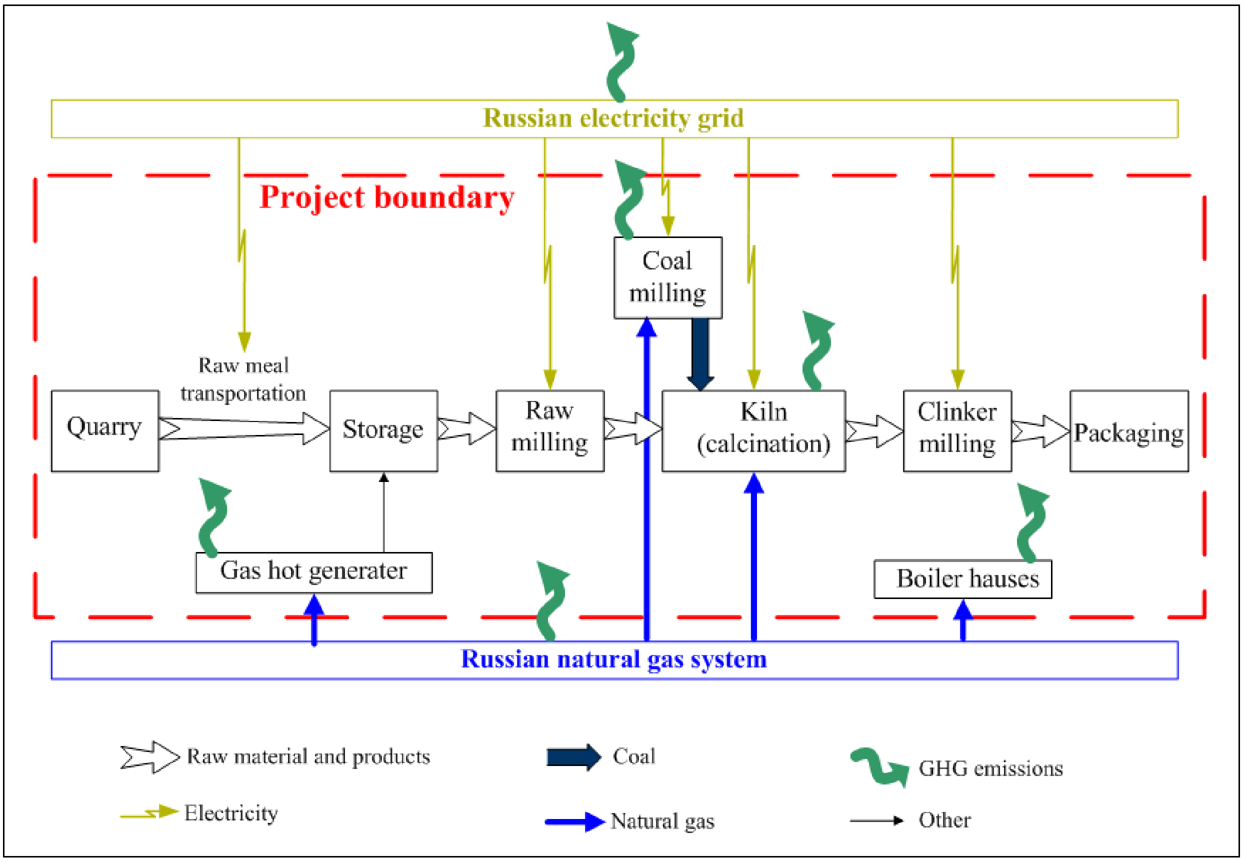
[23] Only $CO_2$ emissions are taken into account. $CH_4$ and $N_2O$ emissions are neglected and excluded for simplification. This is in line with relevant CDM approaches (for example, ACM0015 "Consolidated baseline and monitoring methodology for project activities using alternative raw materials that do not contain carbonates for clinker manufacturing in cement kilns --- Version 2, http://cdm.unfccc.int/methodologies/PAmethodologies/approved.html).

[24] Shchurovsky Cement does not have on-site power generation facilities.

| № | Source | Gas[23] | Included/ excluded | Justification/Explanation |
|---|---|---|---|---|
| 8 | Change in grid electricity consumption for cement production (including all stages of cement production from the raw meals preparation to cement packaging) | $CO_2$ | Included | • Emissions are calculated using a standardized Russian regional electricity emission factor. |
| 9 | Change in fossil fuel combustion in the kiln | $CO_2$ | Included | • The fossil fuel combustion will decrease. |
| 10 | Change in geogenic emissions (calcination) | $CO_2$ | Included | • In the project and the baseline scenarios the geogenic emissions from calcination will be different. |

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

***Figure B.3.2: Sources of emissions and project boundary***




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

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

**Date of completion of the baseline study: 25 September 2009**

Name of person/entity setting the baseline:
Alexey Varfolomeev
E-mail: varfolomeev@global-carbon.com

## SECTION C. Duration of the project / crediting period

### C.1. Starting date of the project:

Date of project start: 01/04/2007

### C.2. Expected operational lifetime of the project:

The operational lifetime of the project is 20 years or 240 months. This corresponds to the operational lifetime of the dry kiln – the biggest investment cost item.

### C.3. Length of the crediting period:

Start of crediting period: 01/10/2010
Length of crediting period: 2.25 years or 27 months

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

## SECTION D. Monitoring plan

### D.1. Description of monitoring plan chosen:

In accordance with paragraph 28 of the JISC's Guidance, as part of the PDD of a proposed JI project, a monitoring plan has to be established by the project participants in accordance with appendix B of the JI guidelines. In this context two options apply:

a) Project participants may apply approved CDM baseline and monitoring methodologies;
b) Alternatively, a monitoring plan may be established in accordance with appendix B of the JI guidelines, i.e. a JI specific approach may be developed. In this case, inter alia, selected elements or combinations of approved CDM baseline and monitoring methodologies may be applied, if deemed appropriate.

In this PDD, a JI specific approach regarding monitoring is used.

As elaborated in Section B.3 above, the project affects emissions related to the kiln fuel, calcination (decarbonisation), and the electricity consumption of the raw milling and the kilns. These emissions will be monitored in the project scenario and the baseline scenario.

The baseline emissions are determined on the following basis:

1. The estimation/calculation of the baseline emissions regarding the kiln fuel over the existing capacity is based on a three year kiln efficiency average and the carbon emission factor of the fuel (mix) used in the project scenario. This approach is comparable to the one applied for the JI project "Switch from wet-to-dry process at Podilsky Cement, Ukraine" (JI Track 2 reference number: 0001), for which the determination has been deemed final;
2. The baseline emissions of electricity consumption are established using the relevant regional Russian standardized grid emission factor, as described in Annex 2;
3. The baseline emissions of the incremental production are estimated/calculated using the combined margin approach, as elaborated in Annex 2.

Assumptions:

- The type of fuel combusted in the kiln(s) is not influenced by the project;
- The technical lifetime of the existing kilns extends to at least the end of the crediting period;
- Under the baseline scenario, all existing wet kilns will be operating and will produce at maximum technical capacity;
- No energy efficiency measures would be implemented in the existing wet kilns until the end of the crediting period.

General remarks:

- Social indicators, such as number of people employed, safety records, training records etc., will be available to the verifier, as required;
- Environmental indicators, such as dust, $NO_x$, or $SO_x$ emissions, will be available to the verifier, as required;
- Only $CO_2$ emissions are taken into account. Cement kilns normally have $CH_4$ emissions of 0.06 g/kg of clinker and $N_2O$ emissions of 0.001 g/kg of clinker, compared with more than 650 g $CO_2$/kg of clinker. Omitting these two emissions for a cement kiln is conservative, because they contribute less than 0.01 % of the total emissions, far below the confidence level for the $CO_2$ data calculations. This is confirmed in the VDZ Environmental Report 2001 (English) and 2004 (German). $CH_4$ and $N_2O$ emission reductions will not be claimed. This is conservative.

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

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

| ID number *(Please use numbers to ease cross-referencing to D.2.)* | Data variable | Source of data | Data unit | Measured (m), calculated (c), estimated (e) | Recording frequency | Proportion of data to be monitored | How will the data be archived? (electronic/ paper) | Comment |
|---|---|---|---|---|---|---|---|---|
| **P1** | $PE_y$ | Plant records | $tCO_2$ | C | Annually | 100% | Electronic | **-** |
| **P2** | $PE_{calc,y}$ | Plant records | tCO2 | C | Annually | 100% | Electronic | - |
| **P3** | $PE_{fuel,y}$ | Plant records | $tCO_2$ | C | Annually | 100% | Electronic | - |
| **P4** | $PE_{el,y}$ | Plant records | $tCO_2$ | C | Annually | 100% | Electronic | - |
| **P5** | $CLNK_{PR,y}$ | Plant records | tonnes | M/C | Annually | 100% | Electronic | **-** |
| **P6** | $PE_{fuel,y}^{kiln}$ | Plant records | $tCO_2$ | C | Annually | 100% | Electronic | - |
| **P7** | $PE_{fuel,y}^{boilers}$ | Plant records | $tCO_2$ | C | Annually | 100% | Electronic | - |
| **P8** | $PE_{fuel,y}^{coal\_mill}$ | Plant records | $tCO_2$ | C | Annually | 100% | Electronic | - |
| **P9** | $PE_{fuel,y}^{HGG}$ | Plant records | $tCO_2$ | C | Annually | 100% | Electronic | - |
| **P10** | $PF_{fuel\_i,y}^{kiln}$ | Plant records | tonnes or $m^3$ | M | Continuously | 100% | Electronic | - |
| **P11** | $NCV_{fuel\_i,y}$ | Plant records | GJ/(tonne or $m^3$) | M/C | Per shipment/ annually | 100% | Electronic | A weighted average of all |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | | shipments over a calendar year will be calculated for each fuel. |
| **P12** | $EF_{fuel\_i,y}$ | IPCC | $tCO_2$/GJ | C | Fixed ex-ante | 100% | Electronic | Default values (IPCC 2006) |
| **P13** | $PF_{fuel\_i,y}^{boilers}$ | Plant records | tonnes or $m^3$ | M | Continuously | 100% | Electronic | - |
| **P14** | $PF_{fuel\_i,y}^{coal\_mill}$ | Plant records | tonnes or $m^3$ | M | Continuously | 100% | Electronic | - |
| **P15** | $PF_{fuel\_i,y}^{HGG}$ | Plant records | tonnes or $m^3$ | M | Continuously | 100% | Electronic | - |
| **P16** | $EF_{el,y}$ | See Annex 2 | $tCO_2$/ MWh | C | Fixed ex-ante | 100% | Electronic | Standardized $CO_2$ emission factor of the relevant regional electricity grid (see Annex 2) |
| **P17** | $PEL_y$ | Plant records | MWh | C | Annually | 100% | Electronic | **-** |
| **P18** | $PEL_y^{CEM}$ | Plant records | MWh | M | Continuously | 100% | Electronic | - |
| **P19** | $PEL_y^{boilers}$ | Plant records | MWh | M | Continuously | 100% | Electronic | - |
| **P20** | $PEL_y^{coal\_mill}$ | Plant records | MWh | M | Continuously | 100% | Electronic | - |
| **P21** | $EF_{dec,y}$ | Cement Sustainability Initiative (CSI) of the World Business Council for Sustainable Development | - | E | Annual | 100% | Electronic | - |

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

$$PE_y = PE_{calc,y} + PE_{fuel,y} + PE_{el,y} \qquad (1)$$

Where:[25]

| | |
|---|---|
| $PE_y$ | Project emissions in year *y* ($tCO_2$); |
| $PE_{calc,y}$ | Project emissions due to calcination in year *y* ($tCO_2$); |
| $PE_{fuel,y}$ | Project emissions due to combustion of fuels in year *y* ($tCO_2$); |
| $PE_{el,y}$ | Project emissions due to electricity consumption for raw meal preparation (transportation, milling, handling), coal preparation (grinding, conveying), and grinding of clinker, as well as of the new kiln and boilers ($tCO_2$). |

**Project emissions due to calcination**

$$PE_{calc,y} = EF_{dec,y} \times CLNK_{PR,y} \qquad (2)$$

Where:

| | |
|---|---|
| $EF_{dec,y}$ | Default emission factor ($tCO_2$/t clinker)[26]; |
| $CLNK_{PR,y}$ | Production of clinker in year y (tonnes). |

[25] Each parameter of

[26] Cement Sustainability Initiative (CSI) of the World Business Council for Sustainable Development (WBCSD) 2005, $CO_2$ Accounting and Reporting Standard for the Cement Industry, www.wbcsd.org

**Project emissions due to fuel consumption**

There will be several consumers of fuels after project implementation: the new kiln and boiler houses, and the coal mill and hot gas generator (drying of raw material). Shchurovsky Cement plans to use coal in the kiln instead of natural gas starting from 2012. The emissions due to the combustion of fuels are estimated/calculated as follows:

$$PE_{fuel,y} = PE_{fuel,y}^{kiln} + PE_{fuel,y}^{boilers} + PE_{fuel,y}^{coal\_mill} + PE_{fuel,y}^{HGG} \quad (3)$$

Where:

$PE_{fuel,y}^{kiln}$ Project emissions from combustion of fuels in the new kiln in year *y* ($tCO_2$);

$PE_{fuel,y}^{boilers}$ Project emissions from combustion of fuels in the boiler houses in year *y* ($tCO_2$);

$PE_{fuel,y}^{coal\_mill}$ Project emissions from combustion of fuels in the coal mill in year *y* ($tCO_2$);

$PE_{fuel,y}^{HGG}$ Project emissions from combustion of fuels in the hot gas generator in year *y* ($tCO_2$).

Emissions of $CO_2$ due to combustion of fuels in the new kiln are calculated according to the following formula:

$$PE_{fuel,y}^{kiln} = \sum_i PF_{fuel\_i,y}^{kiln} \times EF_{fuel\_i} \times NCV_{fuel\_i,y} \quad (4)$$

Where:

$PF_{fuel\_i,y}^{kiln}$ Consumption of fuel of type *i* in the new kiln in year *y* (tonnes or $m^3$);

$NCV_{fuel\_i,y}$ Net calorific value of fuel of type *i* in year *y* (GJ/(tonne or $m^3$);

$EF_{fuel\_i}$ Emission factor of fuel of type *i* ($tCO_2$/GJ).

Emissions of $CO_2$ due to combustion of fuels in the boiler houses are calculated according to the following formula:

$$PE_{fuel,y}^{boilers} = \sum_i PF_{fuel\_i,y}^{boilers} \times EF_{fuel\_i} \times NCV_{fuel\_i,y} \qquad (5)$$

Where:

$PF_{fuel\_i,y}^{boilers}$ Consumption of fuel of type *i* in the boiler houses in year *y* (tonnes or $m^3$).

Emissions of $CO_2$ due to combustion of fuels in the coal mill are calculated according to the following formula:

$$PE_{fuel,y}^{coal\_mill} = \sum_i PF_{fuel\_i,y}^{coal\_mill} \times EF_{fuel\_i} \times NCV_{fuel\_i,y} \qquad (6)$$

Where:

$PF_{fuel\_i,y}^{coal\_mill}$ Consumption of fuel of type *i* in the coal mill in year *y* (tonnes or $m^3$).

Emissions of $CO_2$ due to combustion of fuels in the hot gas generator are calculated according to the following formula:

$$PE_{fuel,y}^{HGG} = \sum_i PF_{fuel\_i,y}^{HGG} \times EF_{fuel\_i} \times NCV_{fuel\_i,y} \qquad (7)$$

Where:

$PF_{fuel\_i,y}^{HGG}$ Consumption of fuel of type *i* in the hot gas generator in year *y* (tonnes or $m^3$).

**Project emissions due to electricity consumption**

The emissions due to the electricity consumption of raw material transportation to the site, of raw material preparation, of the new kiln, of coal preparation, of the boilers and of grinding clinker are estimated/calculated as follows:

$$PE_{el,y} = EF_{el,y} \times PEL_y \quad (8)$$

Where:

$EF_{el,y}$ Standardized $CO_2$ emission factor of the relevant regional electricity grid in year *y* ($tCO_2/MWh$), fixed ex-ante (see Annex 2);

$PEL_y$ Total electricity consumption in the project scenario in year *y* (MWh).

Where:

$$PEL_y = PEL_y^{CEM} + PEL_y^{boilers} + PEL_y^{coal\_mill} \quad (9)$$

Where:

$PEL_y^{CEM}$ Electricity consumption of cement production, including raw material transportation and preparation, new kiln and grinding clinker, in the project scenario in year *y* (MWh);

$PEL_y^{boilers}$ Electricity consumption of the boiler houses in the project scenario in year *y* (MWh);

$PEL_y^{coal\_mill}$ Electricity consumption of the coal mill in the project scenario in year *y* (MWh).

| D.1.1.3. Relevant data necessary for determining the baseline of anthropogenic emissions of greenhouse gases by sources within the project boundary, and how such data will be collected and archived: | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| ID number *(Please use numbers to ease cross-referencing to D.2.)* | Data variable | Source of data | Data unit | Measured (m), calculated (c), estimated (e) | Recording frequency | Proportion of data to be monitored | How will the data be archived? (electronic/ paper) | Comment |
| **B1** | $BE_{y}$ | Plant records | $tCO_2$ | C | Annually | 100% | Electronic | - |
| **B2** | $BE_{calc,y}$ | Plant records | $tCO_2$ | C | Annually | 100% | Electronic | - |
| **B3** | $BE_{fuel,y}$ | Plant records | $tCO_2$ | C | Annually | 100% | Electronic | - |
| **B4** | $BE_{el,y}$ | Plant records | $tCO_2$ | C | Annually | 100% | Electronic | - |
| **B5** | $BE_{incr,y}$ | Plant records | $tCO_2$ | C | Annually | 100% | Electronic | - |
| **B6** | $CLNK_{BL,y}$ | Plant records | tonnes | C | Annually | 100% | Electronic | - |
| **B7** | $CLNK_{BL\_cap}$ | Plant records | tonnes | C | Fixed ex-ante | 100% | Electronic | Maximum technical production capacity of the existing on-site wet kilns |
| **B8** | $CEM_{BL,y}$ | Plant records | tonnes | C | Annually | 100% | Electronic | - |
| **B9** | $CEM_{PR,y}$ | Plant records | tonnes | M | Annually | 100% | Electronic | - |
| **B10** | $BE_{fuel,y}^{kiln}$ | Plant records | $tCO_2$ | C | Annually | 100% | Electronic | - |
| **B11** | $BE_{fuel,y}^{boilers}$ | Plant records | $tCO_2$ | C | Annually | 100% | Electronic | - |
| **B12** | $BE_{fuel,y}^{coal\_mill}$ | Plant records | $tCO_2$ | C | Annually | 100% | Electronic | - |
| **B13** | $BE_{fuel,y}^{HGG}$ | Plant records | $tCO_2$ | C | Annually | 100% | Electronic | - |
| **B14** | $BKE_{BL}$ | Plant records | GJ/t of clinker | M/C | Fixed ex-ante | 100% | Electronic | See Annex 2 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **B15** | $RATIO_{fuel\_i,y}$ | Plant records | % | C | Annually | 100% | Electronic | - |
| **B16** | $BEL_y^{CEM}$ | Plant records | MWh | C | Annually | 100% | Electronic | - |
| **B17** | $BEL_y^{boiler}$ | Plant records | MWh | C | Annually | 100% | Electronic | - |
| **B18** | $BEL_y^{coal\_mill}$ | Plant records | MWh | C | Annually | 100% | Electronic | - |
| **B19** | $BELF_{el}$ | Plant records | MWh/t cement | M/C | Fixed ex-ante | 100% | Electronic | See Annex 2 |
| **B20** | $CEM_{BL\_incr,y}$ | Plant records | tonnes | C | Annually | 100% | Electronic | - |
| **B21** | $BEF_{incr,y}$ | Plant records | $tCO_2$/t cement | C | Annually | 100% | Electronic | See Annex 2 |
| **B22** | $OM_y$ | OJSC "NIICEMENT" | $tCO_2$/t cement | C | Annually | 100 % | Electronic | See Annex 2 |
| **B23** | $BM_y$ | OJSC "NIICEMENT" | $tCO_2$/t cement | C | Annually | 100 % | Electronic | See Annex 2 |
| **B24** | $EL_{OM,y}$ | OJSC "NIICEMENT" | MWh | M/C | Annually | 100 % | Electronic | See Annex 2 |
| **B25** | $CLNK_{OM,y}$ | OJSC "NIICEMENT" | tonnes | M/C | Annually | 100 % | Electronic | See Annex 2 |
| **B26** | $NCV_{fuel\_i,incr,y}$ | OJSC "NIICEMENT" | GJ/(tonne or $m^3$) | M/C | Annually | 100 % | Electronic | See Annex 2 |
| **B27** | $FUEL_{OM,i,y}$ | OJSC "NIICEMENT" | tonnes or 1000 $m^3$ | M/C | Annually | 100 % | Electronic | See Annex 2 |
| **B28** | $CEM_{OM,y}$ | OJSC "NIICEMENT" | tonnes | M/C | Annually | 100 % | Electronic | See Annex 2 |
| **B29** | $EL_{BM,y}$ | OJSC "NIICEMENT" | MWh | M/C | Annually | 100 % | Electronic | See Annex 2 |
| **B30** | $CLNK_{BM,y}$ | OJSC "NIICEMENT" | tonnes | M/C | Annually | 100 % | Electronic | See Annex 2 |
| **B31** | $FUEL_{BM,i,y}$ | OJSC "NIICEMENT" | tonnes or 1000 $m^3$ | M/C | Annually | 100 % | Electronic | See Annex 2 |
| **B32** | $CEM_{BM,y}$ | OJSC "NIICEMENT" | tonnes | M/C | Annually | 100 % | Electronic | See Annex 2 |
| **B33** | $PCF_{PR,y}$ | Plant records | t clinker/t cement | C | Annually | 100 % | Electronic | - |

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

As further described in Annex 2, the baseline emissions have two sources:

- Production at the existing kilns (replacement production);
- Production by other cement plants (incremental production).

The first three parameters in formula 10 reflect the baseline emissions connected with the existing on-site wet kilns, the last parameter refers to the baseline emissions of the incremental production.

$$BE_y = BE_{calc,y} + BE_{fuel,y} + BE_{el,y} + BE_{incr,y} \qquad (10)$$

Where:

| | |
|---|---|
| $BE_y$ | Baseline emissions in year *y* ($tCO_2$); |
| $BE_{calc,y}$ | Baseline emissions due to calcination in existing on-site wet kilns in year *y* ($tCO_2$); |
| $BE_{fuel,y}$ | Baseline emissions due to on-site combustion of fuels in year *y* ($tCO_2$); |
| $BE_{el,y}$ | Baseline emissions due to on-site electricity consumption in year *y* ($tCO_2$); |
| $BE_{incr,y}$ | Baseline emissions due to incremental production in year *y* ($tCO_2$) (see also Annex 2). |

**Clinker and cement production (on-site)**

In the baseline scenario, the existing wet kilns will continue production up to the maximum technical capacity. Clinker production on the existing wet kilns in the baseline scenario will be as follows:

$$CLNK_{BL,y} = MIN[CLNK_{PR,y}, CLNK_{BL\_cap}] \quad (11)$$

Where:

| | |
|---|---|
| $CLNK_{BL,y}$ | Clinker production in the baseline scenario on the existing kilns in year *y* (tonnes); |
| $CLNK_{BL\_cap}$ | Clinker technical production capacity of the existing kilns (tonnes). |

Cement production in the non-incremental part of the baseline scenario is calculated according to the following formula:

$$CEM_{BL,y} = \frac{CLNK_{BL,y}}{PCF_{PR,y}} \quad (12)$$

Where:

| | |
|---|---|
| $CEM_{BL,y}$ | Cement production in the baseline scenario on the existing kilns in year *y* (tonnes); |
| $CEM_{PR,y}$ | Cement production in the project scenario in year *y* (tonnes); |
| $PCF_{PR,y}$ | Project clinker factor (clinker to cement ratio). |

Where:

$$PCF_{PR,y} = \frac{CLNK_{PR,y}}{CEM_{PR,y}} \quad (13)$$

**Incremental cement production**

Cement production in the incremental part of the baseline scenario is calculated as follows:

$$CEM_{BL\_incr,y} = CEM_{PR,y} - CEM_{BL,y}\text{; if } CEM_{BL,y} > CEM_{PR,y} \text{ then } CEM_{BL\_incr,y} \text{ is equal zero.} \qquad (14)$$

Where:

$CEM_{BL\_incr,y}$ Incremental cement production in the baseline scenario in year *y* (tonnes).

**Baseline emissions due to calcination (on-site)**

The on-site baseline emissions due to calcination (decarbonisation) are calculated as follows:

$$BE_{calc,y} = EF_{dec,y} \times CLNK_{BL,y} \qquad (15)$$

Where:

$EF_{dec,y}$ Default calcination factor ($tCO_2$/t clinker)[27].

**Baseline emissions due to fuel consumption (on-site)**

$$BE_{fuel,y} = BE^{kiln}_{fuel,y} + BE^{boilers}_{fuel,y} + BE^{coal\_mill}_{fuel,y} + BE^{HGG}_{fuel,y} \qquad (16)$$

Where:

$BE^{kiln}_{fuel,y}$ Baseline emissions from combustion of fuels in the existing wet kilns in year *y* ($tCO_2$);

$BE^{boilers}_{fuel,y}$ Baseline emissions from combustion of fuels in the boiler houses in year *y* ($tCO_2$);

$BE^{coal\_mill}_{fuel,y}$ Baseline emissions from combustion of fuels in the coal mill in year *y* ($tCO_2$);

$BE^{HGG}_{fuel,y}$ Baseline emissions from combustion of fuels in the hot gas generator in year *y* ($tCO_2$).

---

[27] Cement Sustainability Initiative (CSI) of the World Business Council for Sustainable Development (WBCSD) 2005, $CO_2$ Accounting and Reporting Standard for the Cement Industry, www.wbcsd.org

Emissions of $CO_2$ due to combustion of fuels in the wet kilns are calculated using the average kiln efficiency, as fixed in Annex 2 on the basis of historic data, according to the following formula:

$$BE_{fuel,y}^{kiln} = BKE_{BL} \times CLNK_{BL,y} \times \sum_i (EF_{fuel\_i} \times RATIO_{fuel\_i,y}) \quad (17)$$

Where:

| | |
|---|---|
| $BKE_{BL}$ | Average kiln efficiency of existing on-site wet kilns (GJ/t clinker), fixed ex-ante (see Annex 2); |
| $RATIO_{fuel\_i,y}$ | Ratio of type *i* fuel consumption to total fuel consumption in year *y*. |

Where:

$$RATIO_{fuel\_i,y} = \frac{PF_{fuel\_i,y}^{kiln} \times NCV_{fuel\_i,y}}{\sum_i (PF_{fuel\_i,y}^{kiln} \times NCV_{fuel\_i,y})} \quad (18)$$

Fuel consumption in the boiler houses in the baseline scenario and in the project scenario is the same, therefore emissions of $CO_2$ due combustion of fuels in the boiler houses are equal in both scenarios.

$$BE_{fuel,y}^{boilers} = \sum_i PF_{fuel\_i,y}^{boilers} \times EF_{fuel\_i} \times NCV_{fuel\_i,y} \quad (19)$$

Where:

| | |
|---|---|
| $PF_{fuel\_i,y}^{boilers}$ | Consumption of fuel of type *i* in the boiler houses in year *y* (tonnes or $m^3$). |

Emissions of $CO_2$ due to combustion of fuels in the coal mill are calculated according to the following formula:

$$BE_{fuel,y}^{coal\_mill} = PE_{fuel,y}^{coal\_mill} \times \frac{BKE_{BL} \times CLNC_{BL,y}}{\sum_i (PF_{fuel\_i,y}^{kiln} \times NCV_{fuel\_i,y})} \quad (20)$$

Emissions of $CO_2$ due to combustion of fuels in the hot gas generator are calculated according to the following formula:

$$BE^{HGG}_{fuel,y} = PE^{HGG}_{fuel,y} \times \frac{CLNC_{BL,y}}{CLNC_{PR,y}} \qquad (21)$$

**Baseline emissions due to electricity consumption (on-site)**

Formula 20 is used to calculate the baseline emissions due to electricity consumption of raw material preparation, existing kilns, coal preparation, boilers and clinker grinding.

$$BE_{el,y} = EF_{el,y} \times (BEL^{CEM}_{y} + BEL^{boilers}_{y} + BEL^{coal\_mill}_{y}) \qquad (22)$$

Where:

$BEL^{CEM}_{y}$ Electricity consumption of cement production, including raw material transportation and preparation, kiln operation and grinding clinker, in the baseline scenario in year *y* (MWh);

$BEL^{boiler}_{y}$ Electricity consumption of the boiler houses in the baseline scenario in year *y* (MWh);

$BEL^{coal\_mill}_{y}$ Electricity consumption of the coal mill in the baseline scenario in year *y* (MWh).

Emissions of $CO_2$ due to electricity consumption of cement production, including raw material transportation and preparation, kiln operation and grinding clinker, are calculated according to the following formula:

$$BEL^{CEM}_{y} = BELF_{el} \times CEM_{BL,y} \qquad (23)$$

Where:

$BELF_{el}$ Average specific electricity consumption of historic cement production (MWh/t cement), fixed ex-ante (see Annex 2)

Emissions of $CO_2$ due to electricity consumption of the boiler houses and the coal mill are calculated according to the following formulae:

$$BEL^{boiler}_{y} = PEL^{boilers}_{y} \qquad (24)$$

$$BEL^{coal\_mill}_{y} = PEL^{coal\_mill}_{y} \times \frac{BKE_{BL} \times CLNC_{BL,y}}{\sum_{i}(PF^{kiln}_{fuel\_i,y} \times NCV_{fuel\_i,y})} \qquad (25)$$

**Baseline emissions due to incremental production**

$$BE_{incr,y} = CEM_{BL\_incr,y} \times BEF_{incr,y} \qquad (26)$$

Where:

$BEF_{incr,y}$ Baseline emission factor for incremental cement production in year *y* ($tCO_2$/t cement) (see Annex 2)

In accordance with the methodological approach elaborated in Annex 2, depending on whether recent cement capacity additions can be identified within a radius of 1,000 km, the baseline emission factor for incremental cement production is estimated/calculated in the following way:

$$BEF_{incr,y} = OM_y \quad \text{or} \quad BEF_{incr,y} = \frac{OM_y + BM_y}{2} \qquad (27)$$

Where:

$OM_y$ Operating margin (OM) emission factor of cement production at the cement plants in the OM in year *y* ($tCO_2$/t cement) (see Annex 2);

$BM_y$ Build margin (BM) emission factor of cement production at the cement plants in the BM in year *y* ($tCO_2$/t cement) (see Annex 2).

The OM emission factor is estimated/calculated in the following way:

$$OM_y = \frac{EF_{el,y} \times EL_{OM,y} + EF_{dec,y} \times CLNK_{OM,y} + \sum_i EF_{fuel\_i} \times NCV_{fuel\_i,incr} \times FUEL_{OM,i,y}}{CEM_{OM,y}} \quad (28)$$

Where:

$EL_{OM,y}$ Total electricity consumption at the cement plants in the OM in year *y* (MWh);

$CLNK_{OM,y}$ Total clinker production at the cement plants in the OM in year *y* (tonnes);

$NCV_{fuel\_i,incr}$ Net calorific value of kiln fuel *i* (GJ/tonne or 1000 $m^3$);

$FUEL_{OM,i,y}$ Total fuel consumption of kiln fuel *i* at the cement plants in the OM in year *y* (tonnes or 1000 $m^3$);

$CEM_{OM,y}$ Total cement production at the cement plants in the OM in year *y* (tonnes).

The BM emission factor is estimated/calculated in the following way:

$$BM_y = \frac{EF_{el,y} x EL_{BM,y} + EF_{dec,y} \times CLNK_{BM,y} + \sum_i EF_{fuel\_i} x NCV_{fuel\_i,incr} x FUEL_{BM,i,y}}{CEM_{BM,y}} \quad (29)$$

Where:

$EL_{BM,y}$ Total electricity consumption at the cement plants in the BM in year *y* (MWh);

$CLNK_{BM,y}$ Total clinker production at the cement plants in the BM in year *y* (tonnes);

$FUEL_{BM,i,y}$ Total fuel consumption of kiln fuel *i* at the cement plants in the BM in year *y* (tonnes or 1000 $m^3$);

$CEM_{BM,y}$ Total cement production at the new cement plants in the BM in year *y* (tonnes).

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

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

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

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

Not applicable

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

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

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

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

Not applicable

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

$$ER_y = BE_y - PE_y \quad (29)$$

Where:

$ER_y$ Emission reductions of the proposed JI project in year $y$ ($tCO_2$)

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

The main relevant Russian Federation environmental regulations:

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

Atmospheric emissions are the only important source of pollution at Shchurovsky Cement that has an impact on the local environment. According to the national requirements, atmospheric emissions have to be measured by taking samples. Shchurovsky Cement systematically collects data on the pollutants that may have a negative impact on the local environment. As of February 2009, the environmental laboratory of the Environmental Department of Shchurovsky Cement and the third party organization “Center of Hygiene and Epidemiology of the Moscow Region”, designated by Shchurovsky Cement, perform measurements of the following pollutants:

**Gaseous pollutants ($NO_x$ and $SO_x$)**

Gaseous pollutants are measured by means of a mobile gas spectrometer. It is used to measure the gaseous emissions every two months by taking samples. Currently, there is a negligible level of $SO_x$ emissions at Shchurovsky Cement, but the existing gas spectrometer will measure $SO_x$ emissions, if they appear.

**Solid pollutants**

The main solid pollutant on-site is inorganic dust. The emissions of dust are measured using the weighing method. The level of dust is measured by weighing a filter installed for a certain time in the exhaust air flow. Samples are taken on a monthly basis.

**Monitoring at dry kiln**

In case of the proposed JI project, the two existing wet kilns will be dismantled, and only the new dry kiln will be in operation. The existing scheme of air pollution measurement will also be used in the project scenario. The gaseous pollutants ($NO_x$ and $SO_x$, if any) will be measured every two months. Dust measurements will be made by the plant's environmental laboratory using the weighing method on a monthly basis.

Shchurovsky Cement has ISO 14001:2004 certificate.

| **D.2. Quality control (QC) and quality assurance (QA) procedures undertaken for data monitored:** | | |
|---|---|---|
| Data *(Indicate table and ID number)* | Uncertainty level of data (high/medium/low) | Explain QA/QC procedures planned for these data, or why such procedures are not necessary. |
| **P5** | Medium | Clinker production is calculated as a difference between the cement produced and the additives used in the cement production process. The weighting method will be used to identify the amount of cement and additives. The independent company will calibrate the meters. Total clinker production is derived from the daily reports treated by the Burning department. The Planning Department is responsible for registration and archiving data. |
| **P10** | Medium | The weighting method will be used to identify the amount of coal consumption. The independent company will calibrate the meters. Measurement will be carried out automatically. Results of measurement will be recorded and archived in electronic system of the plant.<br>The natural gas (fuel) consumption will be measured continuously. The existing gas flow meters will be used. The independent company will calibrate the meters. Measurement will be carried out automatically. Results of measurement will be recorded and archived in electronic system of the plant.<br>The Department of Chief Energy Manager is responsible for registration and archiving data. |
| **P11** | Medium | An independent certification company will take samples of each shipment of coal and will issue a certificate of the net calorific value of each shipment. The natural gas supplier's laboratory will carry out measurements of NCV of the gas supplied and issue a certificate.<br>The natural gas net calorific value is taken from the Certificate of natural gas supplier. The natural gas supplier issues it on monthly basis.<br>The Department of Chief Energy Manager will store these certificates and will calculate the weighted average net calorific value at the end of each year. |
| **P13** | Medium | QA/QC is similar P10. Boiler houses use natural gas. |
| **P14** | Medium | QA/QC is similar P10. |
| **P15** | Low | QA/QC is similar P10. |

| | | |
|---|---|---|
| **P18** | Low | The electricity consumption is measured continuously. The independent company calibrates the meters. Measurement is carried out automatically. Results of measurement are recorded and archived in electronic system of the plant. The Department of Chief Energy Manager is responsible for registration and archiving data. |
| **P19** | Low | The electricity consumption is measured continuously. The independent company calibrates the meters. Measurement is carried out automatically. Results of measurement are recorded and archived in electronic system of the plant. The Department of Chief Energy Manager is responsible for registration and archiving data. |
| **P20** | Low | The electricity consumption is measured continuously. The independent company calibrates the meters. Measurement is carried out automatically. Results of measurement are recorded and archived in electronic system of the plant. The Department of Chief Energy Manager is responsible for registration and archiving data. |
| **B9** | Medium | The weighting method is used to identify the amount of cement. The independent company calibrates the meters. Measurement is carried out automatically. Results of measurement are recorded and archived in electronic system of the plant. The Planning Department is responsible for registration and archiving data. |

**Internal quality system at Shchurovsky Cement**
The internal quality system at Shchurovsky Cement is functioning in accordance with the national standards and regulations in force.

The plant will be equipped with all required instrumentation and field devices for the process interlocking, measurements and protection. The instrumentation and field devices will include all the instrumentation and field devices and all electrical equipment in the field necessary for accurate analogue and digital measuring required for the control and supervision. Modern Plant Automation and Control Networks based on Siemens Cemat will be introduced.

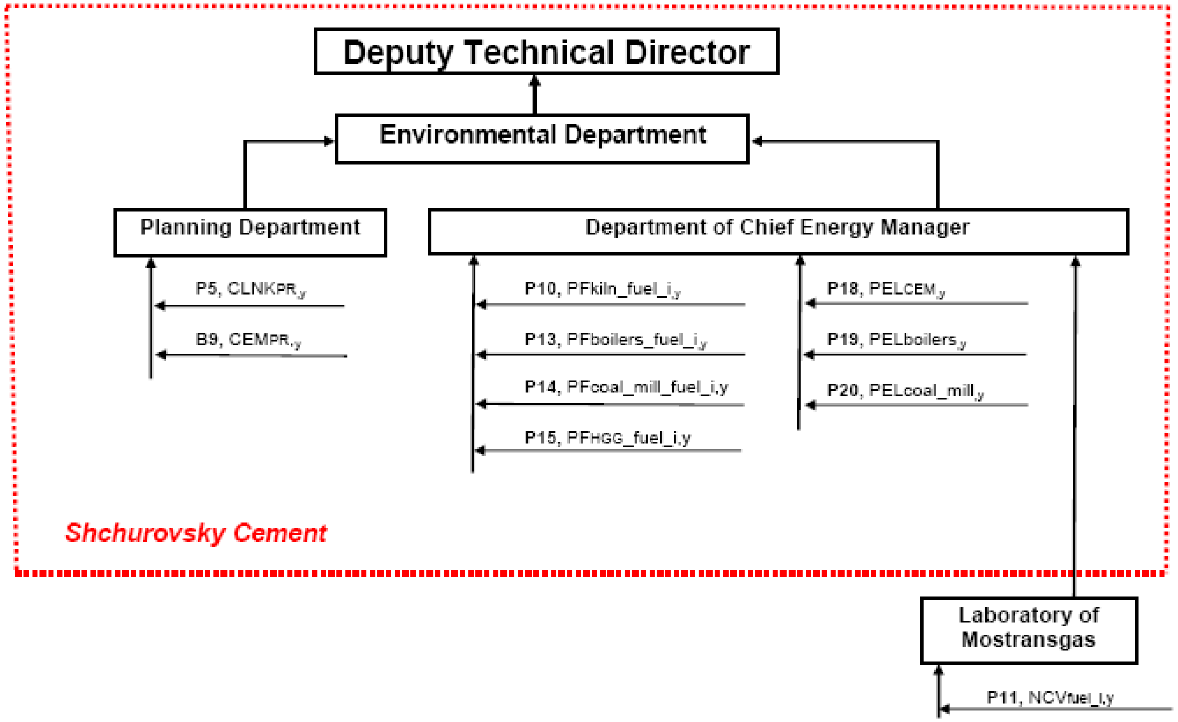
The plant's Department of the Control and Measuring devices is in charge of the efficient supervision of measuring devices operation and performance. It checks and replaces the devices (adjusted and calibrated) if necessary.

Calibration of the metering devices is made in accordance with the calibration schedule. It is approved every year. The metering devices are calibrated by the independent entity which has a state licence. Currently it is Kolomensky branch of Federal State Body "Mendeleevcky Centre of Standardization and Metrology".

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

The scheme of monitoring data collection at Shchurovsky Cement is described in Figure D.3.1.

***Figure D.3.1: Scheme of monitoring data collection at Shchurovsky Cement***




*Source: Shchurovsky Cement*

Three units of Shchurovsky Cement will be responsible for collecting information for monitoring purposes:

*1) Department of Chief Energy Manager*

The Department of Chief Energy Manager is responsible for controlling fuel and electricity consumption at Shchurovsky Cement. It collects data from the individual electricity meters installed at the production units that consume electricity and data of the commercial electricity meter that belongs to the regional power distribution company, and measures the overall electricity consumption at the plant. The data from the individual electricity meters is cross-checked with the data of the commercial meter. For the purposes of monitoring, the energy department will report the level of electricity consumption of the kiln system and the raw milling system, and provide it to the environmental unit.

*2) Planning Department*

The Planning Department is responsible for accounting, controlling and planning used and produced materials. It collects and stores data on purchased, used, produced and sold materials of the plant. These data include volumes of used limestone and clay, corrective additives, clinker and grey cement.

*3) Environmental Department*

The Environmental Department has the overall responsibility for the implementation of the monitoring plan, i.e. for organizing and storing the data and the calculation of the emission reductions. It will also prepare the annual monitoring reports to be presented to the verifier of the emission reductions. Other departments of Shchurovsky Cement will submit relevant data to the Environmental Department. In addition to the preparation of the monitoring reports, the department will conduct an internal audit annually to assess project performance and, if necessary, make corrective actions.

In addition to the internal departments of Shchurovsky Cement, two independent external organizations will provide the data necessary for monitoring plan implementation:

*1) Laboratory of the gas transportation organization (Mostransgas, division of Gasprom)*

The laboratory will provide data on the net calorific value of the natural gas supplied.

*2) Independent laboratory*

An independent laboratory will provide data on the net calorific value of coal supplied.

The data from two external organizations will be collected by the Environmental Department of Shchurovsky Cement for monitoring purposes. For the usual routine procedures, all the data have to be stored for three years for the purposes of independent financial audits. For the purpose of monitoring system implementation, the collected data will be stored by the Environmental Department at least until two years after the last transfer of ERUs associated with the project.

For a detailed description of each parameter monitored, please refer to Sections D.1 and D.2.

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

- OJSC "Shchurovsky Cement"[28], Ms. Natalia Makarenko, Head of the Environmental Department
  E-mail: Natalja.Makarenko@acem.ru

- Global Carbon BV, Mr Alexey Varfolomeev, Senior JI Consultant
  E-mail: varfolomeev@global-carbon.com

[28] Shchurovsky Cement is a project participant.

## SECTION E. Estimation of greenhouse gas emission reductions

### E.1. Estimated project emissions:

*Table E.1.1: Estimated project emissions within the crediting period*

| Project emissions | Unit | 2010 | 2011 | 2012 |
|---|---|---|---|---|
| Kiln fuel | [$tCO_2$/y] | 153,163 | 609,947 | 609,947 |
| Calcination | [$tCO_2$/y] | 218,846 | 875,385 | 875,385 |
| Electricity | [$tCO_2$/y] | 27,786 | 111,144 | 111,144 |
| Total | [$tCO_2$/y] | 399,796 | 1,596,476 | 1,596,476 |
| Total 2010 - 2012 | [$tCO_2$] | 3,392,748 | | |

*Table E.1.2: Estimated emissions after the crediting period*

| Project emissions | Unit | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 |
|---|---|---|---|---|---|---|---|---|---|
| Kiln fuel | [$tCO_2$/y] | 609,947 | 609,947 | 609,947 | 609,947 | 609,947 | 609,947 | 609,947 | 609,947 |
| Calcination | [$tCO_2$/y] | 875,385 | 875,385 | 875,385 | 875,385 | 875,385 | 875,385 | 875,385 | 875,385 |
| Electricity | [$tCO_2$/y] | 111,144 | 111,144 | 111,144 | 111,144 | 111,144 | 111,144 | 111,144 | 111,144 |
| Total | [$tCO_2$/y] | 1,596,476 | 1,596,476 | 1,596,476 | 1,596,476 | 1,596,476 | 1,596,476 | 1,596,476 | 1,596,476 |
| Total 2013 - 2020 | [$tCO_2$] | 12,771,808 | | | | | | | |

### E.2. Estimated leakage:

Not applicable

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

*Table E.3.1: Estimated project emissions inclusive leakage within the crediting period*

| Project emissions | Unit | 2010 | 2011 | 2012 |
|---|---|---|---|---|
| Kiln fuel | [$tCO_2$/y] | 153,163 | 609,947 | 609,947 |
| Calcination | [$tCO_2$/y] | 218,846 | 875,385 | 875,385 |
| Electricity | [$tCO_2$/y] | 27,786 | 111,144 | 111,144 |
| Total | [$tCO_2$/y] | 399,796 | 1,596,476 | 1,596,476 |
| Total 2010 - 2012 | [$tCO_2$] | 3,392,748 | | |

*Table E.3.2: Estimated project emissions inclusive leakage after the crediting period*

| Project emissions | Unit | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 |
|---|---|---|---|---|---|---|---|---|---|
| Kiln fuel | [$tCO_2$/y] | 609,947 | 609,947 | 609,947 | 609,947 | 609,947 | 609,947 | 609,947 | 609,947 |
| Calcination | [$tCO_2$/y] | 875,385 | 875,385 | 875,385 | 875,385 | 875,385 | 875,385 | 875,385 | 875,385 |
| Electricity | [$tCO_2$/y] | 111,144 | 111,144 | 111,144 | 111,144 | 111,144 | 111,144 | 111,144 | 111,144 |
| Total | [$tCO_2$/y] | 1,596,476 | 1,596,476 | 1,596,476 | 1,596,476 | 1,596,476 | 1,596,476 | 1,596,476 | 1,596,476 |
| Total 2013 - 2020 | [$tCO_2$] | 12,771,808 | | | | | | | |

## E.4. Estimated baseline emissions:

***Table E.4.1: Estimated baseline emissions within the crediting period***

| Project emissions | Unit | 2010 | 2011 | 2012 |
|---|---|---|---|---|
| Kiln fuel (on-site) | [$tCO_2$/y] | 157,130 | 625,815 | 625,815 |
| Calcination (on-site) | [$tCO_2$/y] | 136,332 | 545,326 | 545,326 |
| Electricity (on-site) | [$tCO_2$/y] | 23,460 | 93,838 | 93,838 |
| Emissions from incremental production | [$tCO_2$/y] | 164,529 | 658,116 | 658,116 |
| Total | [$tCO_2$/y] | 481,451 | 1,923,096 | 1,923,096 |
| Total 2010 - 2012 | [$tCO_2$] | 4,327,642 | | |

***Table E.4.2: Estimated baseline emissions after the crediting period***

| Project emissions | Unit | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 |
|---|---|---|---|---|---|---|---|---|---|
| Kiln fuel (on-site) | [$tCO_2$/y] | 625,815 | 625,815 | 625,815 | 625,815 | 625,815 | 625,815 | 625,815 | 625,815 |
| Calcination (on-site) | [$tCO_2$/y] | 545,326 | 545,326 | 545,326 | 545,326 | 545,326 | 545,326 | 545,326 | 545,326 |
| Electricity (on-site) | [$tCO_2$/y] | 93,838 | 93,838 | 93,838 | 93,838 | 93,838 | 93,838 | 93,838 | 93,838 |
| Emissions from incremental production | [$tCO_2$/y] | 658,116 | 658,116 | 658,116 | 658,116 | 658,116 | 658,116 | 658,116 | 658,116 |
| Total | [$tCO_2$/y] | 1,923,096 | 1,923,096 | 1,923,096 | 1,923,096 | 1,923,096 | 1,923,096 | 1,923,096 | 1,923,096 |
| Total 2010 - 2012 | [$tCO_2$] | 15,384,766 | | | | | | | |

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

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

| Emission reductions | Unit | 2010 | 2011 | 2012 |
|---|---|---|---|---|
| Total | [$tCO_2$/y] | 81,655 | 326,620 | 326,620 |
| Total 2010 - 2012 | [$tCO_2$] | 734,894 | | |

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

| Emission reductions | Unit | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 |
|---|---|---|---|---|---|---|---|---|---|
| Total | [$tCO_2$/y] | 326,620 | 326,620 | 326,620 | 326,620 | 326,620 | 326,620 | 326,620 | 326,620 |
| Total 2013 - 2020 | [$tCO_2$] | 2,612,958 | | | | | | | |

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

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

| Year | Estimated project emissions (tonnes of $CO_2$ equivalent) | Estimated leakage (tonnes of $CO_2$ equivalent) | Estimated baseline emissions (tonnes of $CO_2$ equivalent) | Estimated emission reductions (tonnes of $CO_2$ equivalent) |
|---|---|---|---|---|
| Year 2010 | 399,796 | 0 | 481,451 | 81,655 |
| Year 2011 | 1,596,476 | 0 | 1,923,096 | 326,620 |
| Year 2012 | 1,596,476 | 0 | 1,923,096 | 326,620 |
| Total (tonnes of CO2 equivalent) | 3,592,748 | 0 | 4,327,642 | 734,894 |

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

| Year | Estimated project emissions (tonnes of $CO_2$ equivalent) | Estimated leakage (tonnes of $CO_2$ equivalent) | Estimated baseline emissions (tonnes of $CO_2$ equivalent) | Estimated emission reductions (tonnes of $CO_2$ equivalent) |
|---|---|---|---|---|
| Year 2013 | 1,596,476 | 0 | 1,923,096 | 326,620 |
| Year 2014 | 1,596,476 | 0 | 1,923,096 | 326,620 |
| Year 2015 | 1,596,476 | 0 | 1,923,096 | 326,620 |
| Year 2016 | 1,596,476 | 0 | 1,923,096 | 326,620 |
| Year 2017 | 1,596,476 | 0 | 1,923,096 | 326,620 |
| Year 2018 | 1,596,476 | 0 | 1,923,096 | 326,620 |
| Year 2019 | 1,596,476 | 0 | 1,923,096 | 326,620 |
| Year 2020 | 1,596,476 | 0 | 1,923,096 | 326,620 |
| Total (tonnes of $CO_2$ equivalent) | 12,771,808 | 0 | 15,384,766 | 2,612,958 |

## 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:**

Cement production has a certain impact on the local environment. In Russia emission levels in industry are regulated by operating licenses issued by the regional offices of the Ministry of Natural Resources and Environment of the Russian Federation on an individual basis for every enterprise that has significant impact on the environment. The current levels of emissions of the main pollutants (dust, sulphur oxides and nitrogen oxides) are in compliance with the requirements of the plant's operating license.

The types of atmospheric emissions (as listed in the operating licence) and relevant measurement techniques are presented below.

The project foresees the introduction of modern auxiliary equipment, designed to meet the strongest pollution regulations (mainly enhanced bag filtering systems), instead of the existing worn out electrostatic precipitators and other outdated systems.

It is also important to note that due to an approximately 50% improved kiln energy efficiency, less fuel will be combusted.

New burners with modern control systems will allow to maintain an optimal combustion mode, thus contributing to a reduction of such pollutants like CO and $NO_x$.

Currently, Shchurovsky Cement is in process of receiving state approval of the environmental impact assessment of the new dry cement production line.

**Dust**

Dust, emitted from cement production processes, is not a toxic substance, but is considered a nuisance. The main sources of dust from cement production are the raw materials mill, the kiln, the clinker coolers and the cement mills. Dust emissions by Shchurovsky Cement are monitored on a regular basis in compliance with the norms and regulations in force.

Dust concentration in the exhaust gases is determined on the basis of changes in filter weight, measured in a flow of a dust-laden gas for certain period of time. Dust is sampled by applying the gravimetric method, in accordance with the national "Methodology of dust concentration measurement in dust-laden process gases". Accuracy of the measurement is within +/-25%. Testing (calibration) of measurement equipment used to measure dust emissions is carried out once a year by an independent state body (Federal Agency on Technical Regulation and Metrology, Russian Federation).

After the installation of the new kiln, new dust filters will be installed. These will reduce emissions from the raw materials mill, the kiln and the clinker cooler. With the implementation of the proposed JI project, emissions of kiln dust are expected to decrease significantly.

**Nitrogen and sulphur oxides**

$NO_x$ is formed due to the inevitable oxidation reaction of the atmospheric nitrogen at high temperatures in the cement kiln. It is expected that the emissions will meet the requirements of the Russian legislation and will be within the range of the Best Available Technology levels defined by the IPCC[29].

$SO_2$ emissions in the cement production originate mainly from the raw materials and also from coal with sulphur content. After the project implementation the clay with high sulphur content will not be used anymore has reducing $SO_2$ emissions significantly. $SO_2$ monitoring will be executed using gas analyzing equipment

Conclusion of Federal Supervision Service on Consumer Rights Protection and Human Wellbeing N 5.99.04.000.T.001125.03.09, 24 March 2009 states that project activity to the Sanitarian and Epidemiologic Regulations of Russian Federation.

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

The estimations of expected emissions after project implementation show that the sanitary zone of the plant will be decrease from 500 m (normative) to 50-200 m. The surface concentration of pollutants on the border of the sanitary zone of the plant will be lower than the maximum permissible concentrations (defined by Russian legislation). They will constitute from 0 to 0.9 of the maximum permissible concentrations.

After the project implementation the environmental monitoring will take place twice a year (warm and cold seasons) on the border of the plant sanitary zone. $NO_x$ and $SO_2$ concentrations in the stack will be measured and monitored regularly.

An environmental impact assessment (Russian abbreviation: "OVOS") of the project was prepared in 2008. It was submitted and approved Rospotrebnadzor of Moscow region in March 2009. Public hearings were held on 14 May 2009[30].

Shchurovsky Cement submitted a Design Document for this project to the Federal State Institution "The Main Agency of the State expertise" (FGU "Glavgosexpertiza" in Russian abbreviation) and received an approval in Jule 2009 (Positive conclusion of FGU "Glavgosexpertiza" N 394-09/ГГЭ-5625/03, 01 July 2009).

[29] IPPC, Reference Document on Best Available Techniques in the Cement and Lime Manufacturing Industries (December 2001)

[30] Conclusion of Committee on Public Hearings of Kolomna City Administration N 51, 14 May 2009

## SECTION G. Stakeholders' comments

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

Proposed JI projects are not required to go through a local stakeholder consultation process. However, Shchurovsky Cement plans to present the project to the local authorities and the community of Kolomna town at a later stage. In the course of obtaining the construction permit, Shchurovsky Cement will actively provide project information to the stakeholders. Shchurovsky Cement has already held public hearings[31] on the construction of the belt conveyor, and made several publications about the project in local mass media and an interview with the local TV channel.

[31] Conclusion of Committee on Public Hearings of Kolomna City Administration N 51, 14 May 2009

Annex 1

**CONTACT INFORMATION ON PROJECT PARTICIPANTS**

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Annex 2

**BASELINE INFORMATION**

# Project design

**Current situation**

Currently, Shchurovsky Cement operates two wet process rotary kilns. Kiln № 5 has a design capacity of 1680 t clinker/day, kiln № 6 a design capacity of 1668 t clinker/day. The runtime factor of the wet rotary kilns is 0.850[32]. Therefore, the maximum technical production capacity of the existing installation is 1,038,717 tonnes of clinker per year. With a clinker factor of 0.794 t clinker/t cement the existing capacity can produce 1,308,208 tonnes of cement per year.

**Proposed new kiln and process layout**

One new dry process kiln with a capacity of 5,500 t clinker/day will be installed, while the two existing wet kilns will be dismantled. The new process layout would result in an increase in the production of clinker and cement. The dry rotary kiln runtime factor will be 0.831[33]. Therefore, the technical production capacity of the new dry installation will be approximately 1,667,400 tonnes of clinker or 2.1 million tonnes of cement per year.

# Baseline

A baseline for a JI project has to be set in accordance with appendix B of the annex to decision 9/CMP.1 (hereinafter referred to as “JI guidelines”), and, in particular, the “Guidance on criteria for baseline setting and monitoring”[34] developed by the Joint Implementation Supervisory Committee (JISC) (hereinafter referred to as “Guidance”).

A baseline shall be established on a project-specific basis and/or using a multi-project emission factor.

If a baseline is established on a project-specific basis, the project participants may apply approved CDM baseline and monitoring methodologies (paragraph 20 (a) of the Guidance) or establish a baseline that is in accordance with appendix B of the JI guidelines, also using selected elements or combinations of approved CDM baseline and monitoring methodologies or approved CDM methodological tools, as appropriate (paragraph 20 (b) of the Guidance).

For the cement industry four approved CDM baseline and monitoring methodologies exist: ACM0003, ACM0015 (consolidating AM0033 and AM0040) and AM0024. None of these methodologies can be applied directly to the project which foresees a process switch combined with an increase in production, but these methodologies have been carefully studied to identify the main principles underlying the approach to baseline setting, additionality and monitoring.

[32] Though it is possible to increase clinker production at the existing plant to a certain extent by increasing the number of run-days and decreasing the duration of stops, a conservative approach has been applied.

[33] Data provided by Shchurovsky Cement.

[34] See http://ji.unfccc.int/Ref/Guida.html.

Furthermore, the approach regarding baseline setting applied for the JI project “Switch from wet-to-dry process at Podilsky Cement, Ukraine” (JI Track 2 reference number: 0001), for which the determination has been deemed final, has been taken into account with respect to production at the maximum technical capacity.

On this basis, a JI specific approach regarding baseline setting and monitoring has been developed in accordance with appendix B of the JI Guidelines and the JISC’s Guidance.

**Approach to identify the baseline**

The baseline for a JI project is the scenario that reasonably represents the anthropogenic emissions by sources (or anthropogenic removals by sinks) of GHGs that would occur in the absence of the proposed project.

If no approved CDM baseline and monitoring methodology is applied, in accordance with paragraph 21 (b) of the Guidance, plausible future scenarios have to be identified and listed on the basis of conservative assumptions. These alternatives are assessed whether or not to be credible and reasonable and the most plausible alternative is identified as the baseline. Consistency between the baseline scenario and the additionality assessment shall be checked.

As shown in Section B.1 above, the most plausible baseline scenario is that the existing cement production lines would be kept and third Party producers would satisfy cement demand instead.

In this case, the baseline consists of two parts:

- Production at the existing kilns (replacement production);
- Production by other cement plants (incremental production)

***Replacement production***

The clinker production in the non-incremental part of the baseline scenario has to be defined. It is assumed that, in the baseline scenario, the existing facility would work at maximum technical capacity, if the actual production in the project scenario exceeds the existing maximum technical capacity.

The baseline production on the existing kilns is calculated as follows:

$$\mathrm{CLNK}_{BL,y} = \mathrm{CLNK}_{PR,y}\text{; with a maximum of } CLNK_{BL\_cap} \qquad (1)$$

Where:

$CLNK_{BL,y}$ Clinker production in the baseline scenario on the existing kilns in year *y* (tonnes);

$CLNK_{PR,y}$ Clinker production in the project scenario in year *y* (tonnes);

$CLNK_{BL\_cap}$ Clinker technical production capacity of the existing kilns (tonnes).

Cement production in the non-incremental part of the baseline scenario is calculated according to the following formula.

$$CEM_{BL,y} = \frac{CEM_{PR,y}}{CLNK_{PR,y}} \times MIN[CLNK_{PR,y}, CLNK_{BL\_cap}] \qquad (2)$$

Where:

| | |
|---|---|
| $CEM_{BL,y}$ | Cement production in the baseline scenario on the existing kilns in year *y* (tonnes); |
| $CEM_{PR,y}$ | Cement production in the project scenario in year *y* (tonnes); |
| $\frac{CEM_{PR,y}}{CLNK_{PR,y}}$ | Clinker factor (clinker to cement ratio). |

Regarding the replacement of the existing production capacity, in the baseline the characteristics of the existing facility are used.

The parameters and formulae applied to calculate the emissions of the non-incremental part of the baseline scenario are presented in Section D above.

In this context, some baseline factors are calculated by determining a three year average prior to project start regarding the existing kiln, as described below.

**Baseline kiln energy efficiency**

The baseline kiln energy efficiency is calculated as an average of the data for the most recent three years according to the following formula:

$$BKE_{BL} = \sum_{y} \frac{FC_y \times NCV_y}{CLNK_y} \times \frac{1}{3} \qquad (3)$$

Where:

| | |
|---|---|
| $BKE_{BL}$ | Average kiln energy consumption per tonne of clinker (GJ/t clinker); |
| $y$ | Years 2005, 2006 and 2007; |
| $FC_y$ | Quantity of fossil fuel combusted for clinker production in year *y* (1000 $Nm^3$); |
| $NCV_y$ | Net calorific value of fossil fuel in year *y* (GJ/1000 $Nm^3$); |
| $CLNK_y$ | Amount of clinker produced in year *y* (t clinker). |

The project-specific results are presented below in Table Anx.2.1 below:

***Table Anx.2.1: Baseline kiln energy efficiency***

| Year | 2005 | 2006 | 2007 | Average |
|---|---|---|---|---|
| $BKE_{BL,y}$ (GJ/t clinker) | 5.948 | 5.935 | 5.913 | 5.931 |

The average kiln energy consumption per tonne of clinker ( $BKE_{BL}$ ) has been fixed ex-ante.

**Baseline electricity consumption**

The average specific electricity consumption has been calculated on the basis of annual cement production and electricity consumed during the most recent three years.

The project-specific results are presented in a Table Anx.2.2 below:

***Table Anx.2.2: Baseline specific electricity consumption***

| Year | 2005 | 2006 | 2007 | Average |
|---|---|---|---|---|
| $BELF_y$ (MWh/t cement) | 0.138 | 0.138 | 0.131 | 0.135 |

The average specific electricity consumption ( $BELF_{el}$ ) has been fixed ex-ante.

## *Incremental production*

<u>Theoretical approach</u>

The cement production in the incremental part of the baseline scenario is calculated as follows:

$$CEM_{BL\_incr,y} = CEM_{PR,y} - CEM_{BL,y}\text{; } if\ CLNK_{PR,y} > CLNK_{BL\_cap} \quad (4)$$

Where:
$CEM_{BL\_incr,y}$ Incremental cement production in the baseline scenario in year *y* (tonnes)

The baseline emissions of the incremental production are calculated on the basis of displaced cement production by third party producers. An approach needs to be developed how such a counterfactual situation can be constructed while remaining transparent and conservative.

The cement industry is a transparent market where standardized types of cement products exist. Within a certain region or country cement can be transported from the producer to the consumer.

A similar situation exists in an electricity system where electricity can be transported from the producer to the consumer without significant transmission constraints. Given the similarity, the following approach takes into account the underlying principles of the "Tool to calculate the emission factor for an electricity system" (version 01.1) (hereinafter referred to as "CDM Tool"), adopted by the CDM Executive Board, which deals with capacity additions to the electricity grid.

However, it has to be considered that cement, inter alia due to transportation costs, is not delivered over huge distances. In Russia the average distance of cement deliveries is approximately 500 km.[35] Therefore, it is assumed that new cement capacities can have a potential effect on the production of other cement capacities within a radius of 1,000 km. In general, an impact is the more likely, the nearer the plant.

[35] See OJSC "NIICEMENT" annual statistical report "Russian Cement Industry in 2006".

If the JI project is not implemented, the incremental production will be covered by other cement producers and result in corresponding emissions, i.e.:

1. Other cement plants that exist within a radius of 1,000 km (operating margin or OM);
2. New cement capacity additions (to be) built within a radius of 1,000 km (build margin or BM).[36]

**Operating margin (OM) emission factor**

It is not feasible to define exactly which other existing cement plants would produce the incremental amount of cement. The most transparent approach is to calculate the weighted average of specific $CO_2$ emissions of the nearest 19 cement plants within a radius of 1,000 km. The result will be an emission factor expressed in $tCO_2$/t cement.

The OM emission factor is calculated by taking into account the following emissions:

1. Emissions from fuel consumption;
2. Emissions from calcination;
3. Emissions from electricity consumption.

$$OM_y = \frac{\sum EF_{el\_j,y} x EL_{OM\_k,y} + 0.525 x CLNK_{OM,y} + \sum_i EF_{fuel\_i} x NCV_{fuel\_i,incr} x FUEL_{OM,i,y}}{CEM_{OM,y}} \qquad (5)$$

Where:

$EL_{OM\_k,y}$ Total electricity consumption at the cement plant *k* in the OM in year *y* (MWh)[37];

$EF_{el\_j,y}$ Grid emission factor of a regional energy system *j* in year *y* used for cement plant *k* located in this area ($tCO_2$/MWh)[38];

*0.525* Calcination emission factor ($tCO_2$/t clinker)[39];

$CLNK_{OM,y}$ Total clinker production at the cement plants in the OM in year *y* (tonnes);

$EF_{fuel\_i}$ Carbon emission factor of kiln fuel *i* ($tCO_2$/GJ);

$NCV_{fuel\_i,incr}$ Net calorific value of kiln fuel *i* (GJ/tonne or 1000 $m^3$);

$FUEL_{OM,i,y}$ Total fuel consumption of kiln fuel *i* at the cement plants in the OM in year *y* (tonnes or 1000 $m^3$);

$CEM_{OM,y}$ Total cement production at the cement plants in the OM in year *y* (tonnes).

The $OM_y$ emission factor can either be calculated and fixed ex-ante for the whole crediting period, or estimated ex-ante and monitored and calculated ex-post.

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[36] The BM defines the new capacity additions that might have been constructed in project absence. This is estimated based on information about the most recently built plants/capacity additions.

[37] The data of annual cement and clinker production and annual fuel and electricity consumption at Russian cement plants are taken from the OJSC “NIICEMENT” annual statistical report “Russian Cement Industry in 2006”.

[38] The data of grid emission factors for the nearest 19 cement plants within a radius of 1,000 km from the project are taken from the study “Development of grid GHG emission factors for power systems of Russia” commissioned by “Carbon Trade and Finance” in 2008. Amounts of grid emission factors are presented in Annex 2 below.

[39] WBCSD, $CO_2$ Accounting and Reporting Standard for the Cement Industry (2005)

**Build margin (BM) emission factor**

In absence of the project, a competitor could decide to build a new cement plant or extend an existing cement production capacity to meet the market demand. It is not feasible to define exactly which new cement plant/capacity addition would be built and produce the incremental amount of cement. Four options can be applied to calculate the BM emissions:

a) The five most recent capacity additions built within the last 10 years within a radius of 1,000 km are taken into account. This approach is applicable if relevant capacity additions can be observed;
b) Alternatively, five new capacity additions planned for the near future within a radius of 1,000 km can be taken into account, if their implementation is realistic/probable. If more capacity additions are planned proximity is decisive;
c) Provided objective data exist, it can be assumed, for reasons of conservativeness, that an installation would be built based on Best Available Technology (BAT) of cement production;
d) If no recent capacity additions have occurred within a radius of 1,000 km and it is unclear which new installations will be built or when, it is reasonable and most realistic to assume the BM emission factor to be zero ex-ante, but monitor it during the crediting period ex-post. In this context, the five most recent capacity additions built within the last 10 years within a radius of 1,000 km (or all, if less than 5 exist) are taken into account, in accordance with the formula below.

$$BM_y = \frac{\sum EF_{el\_j,y} x EL_{BM\_k,y} + 0.525 x CLNK_{BM,y} + \sum_i EF_{fuel\_i} x NCV_{fuel\_i,incr} x FUEL_{BM,i,y}}{CEM_{BM,y}} \qquad (6)$$

Where:

$EL_{BM,y}$ Total electricity consumption at the cement plant *k* in the BM in year *y* (MWh);

$CLNK_{BM,y}$ Total clinker production at the cement plants in the BM in year *y* (tonnes);

$FUEL_{BM,i,y}$ Total fuel consumption of kiln fuel *i* at the cement plants in the BM in year *y* (tonnes or 1000 $m^3$);

$CEM_{BM,y}$ Total cement production at the new cement plants in the BM in year *y* (tonnes).

The $BM_y$ emission factor can either be calculated and fixed ex-ante for the whole crediting period, or estimated ex-ante and monitored and calculated ex-post in case of option a), it is fixed ex-ante in case of options b) and c), and it is monitored and calculated ex-post in case of option d).

**Combined margin (CM) emission factor**

The CM emission factor is calculated by weighing the OM emission factor and the BM emission factor on a 50 % / 50 % basis, as recommended by the CDM Tool.

$$CM_y = \frac{OM_y + BM_y}{2} \qquad (7)$$

Where:

$CM_y$ CM emission factor for incremental cement production ($tCO_2$/t cement)

The CM emission factor is used for estimating/calculating the baseline emissions of the incremental production, unless the BM emission factor is zero, as described in option d) above. In the latter case, only the OM emission factor is taken into account.

In principle, the CM emission factor can either be calculated and fixed ex-ante for the whole crediting period, or estimated ex-ante and monitored and calculated ex-post.

JI projects with a final positive determination under the JI Track 2 procedure and projects approved under the JI Track 1 procedure[40] and shown accordingly on the UNFCCC JI website are excluded from the sample units for the OM/BM/CM emission factor calculation.

If the data required to calculate the OM/BM/CM emission factors for year y is usually only available later than six months after the end of year y, alternatively the emission factors of the previous year (y-1) may be used. If the data is usually only available more than 18 months after the end of year y, the emission factors of the year preceding the previous year (y-2) may be used. The same data vintage (y, y-1 or y-2) should be used throughout the crediting period.

This methodological approach can be freely reproduced and used for JI projects if proper reference to the source is made.

[40] Under the JI Track 1 procedure, it is the sole responsibility of the host Party to verify emission reductions (or enhancements of removals) as being additional to any that would otherwise occur.

Application of methodological approach

**Background data for the calculation of the OM emission factor**

Information on the nearest nineteen cement plants within a radius of 1,000 km from the project site is presented in Table Anx.2.3 below:

***Table Anx.2.3: Background information on the nearest nineteen cement plants***

| No. | Plant | Production method | Fuel | Cement production in 2006 (thousand tonnes) |
|---|---|---|---|---|
| 1 | Belgorodsky Cement | Wet | gas | 2,195.9 |
| 2 | Oskolcement | Wet | gas | 3,386.4 |
| 3 | Maltsovsky Portlandcement (Bryansk) | Wet | gas | 3,514.3 |
| 4 | Podgorensky Cementnik (Voronezh) | Dry | gas, coal | 387.0 |
| 5 | Lipetskcement | Dry | gas | 1,453.0 |
| 6 | Voskresenskcement | Wet | gas | 1,613.0 |
| 7 | Podolskcement | Wet | gas | 135.2 |
| 8 | Ulyanovskcement | Wet | gas | 1,523.6 |
| 9 | Mikhailov Cement (Ryazan) | Wet | gas | 1,577.4 |
| 10 | Mordovcement | Wet | gas | 2,867.6 |
| 11 | Savinsky cement plant | Wet | coal | 825.1 |
| 12 | Pikalevsy cement | Wet | gas | 1,598.0 |
| 13 | Volhovsky cement plant | Wet | gas | 241.7 |
| 14 | Slantsevsky cement plant | Dry | slate | 728.8 |
| 15 | Zhigulevskiye stroymaterialy | Wet | gas | 1,248.9 |
| 16 | Volskcement | Wet | gas | 2,388.1 |
| 17 | Volsky plant ATSI | Wet | gas | 219.5 |
| 18 | Uluanovskshifer (Sengileevsky) | Wet | gas | 82.7 |
| 19 | Sebryakovcement | Wet | gas | 3,117.0 |
| Total cement production in 2006 | | | | 29,103.2 |

*Source: OJSC "NIICEMENT" annual statistical report "Russian Cement Industry in 2006"*

An investigation was conducted to assess the average kiln efficiencies of these cement plants and the average electricity consumption. The data were processed accordingly to obtain the OM emission factor in 2006, which is equal to 0.831 $tCO_2$/t cement.

The $OM_y$ emission factor is estimated ex-ante and monitored and calculated ex-post.

**Background data for the calculation of the BM emission factor**

Only three new kilns were constructed in Russia from 1992:
- in the Central part of Russia: one kiln at Mordovcement (2008, dry);

- in the Ural region: two kilns at JSC "Soda" (2007, dry) and at Magnitogorsky cement plant (2007, wet).

New kilns at JSC "Soda" and at Magnitogorsky cement plant are located out of the relevant geographical area with radius of 1,000 km from the project site (more than 1,100 and 1,300 km, accordingly). And only Mordovcement project of new dry kiln may get JI status. Therefore no new cement capacity additions without JI status can be observed during the last 10 years within relevant geographical area. Some new cement capacity additions were planned in the relevant region, but, in particular also due to the economic crisis, it is unclear whether they will be implemented at all or at least in the near future.

Therefore, it is reasonable and most realistic to assume the BM emission factor to be zero ex-ante, but monitor it during the crediting period ex-post. In this context, the five most recent capacity additions built within the last 10 years within a radius of 1,000 km (or all, if less than 5 exist) are taken into account.

**OM or CM emission factor**

The OM emission factor is estimated ex-ante and monitored and calculated ex-post.

For the reasons mentioned above, the BM emission factor is set to be zero ex-ante, but monitored during the crediting period ex-post. If no relevant capacity additions can be identified, the OM emission factor is applied, otherwise the CM emission factor is used on a 50:50 basis.

The data vintage y-2 is used throughout the crediting period.

The baseline emission factor for the incremental cement production ( $BEF_{incr,y}$ ) is therefore estimated ex-ante at a value of 0.831 $tCO_2$/t, the level of the ex-ante OM emission factor. During the crediting period it is either the relevant ex-post OM or CM emission factor, in accordance with the definitions above.

**The technical transmission and distribution losses of electricity**

Total quantity of project electricity consumption is 211,300 MWh per year (for 2011).

In the baseline there are two components of cement production:

- Replacement (1.3 mln. tonnes of cement per year);
- Incremental (0.8 mln. tonnes of cement per year).

Baseline electricity consumption for replacement part of cement production is 178,400 MWh per year (for 2011).

For estimation of electricity consumption for incremental part of cement production the average specific factor of electricity consumption is used. This factor was defined as weighted average value of the nearest nineteen cement plants located within a radius of 1,000 km from the project. It is equal 110 MWh/t cement (please see Table Anx.2.4).

*Table Anx.2.4: Specific factor of electricity consumption at the nearest nineteen cement plants*

| N | Cement plants | Cement production | Specific factor of electricity consumption |
|---|---|---|---|
| | | thous.tonn | kWh/t cement |
| 1 | Belgorodsky Cement | 2,195.9 | 84.5 |
| 2 | Oskolcement | 3,386.4 | 100.6 |
| 3 | Maltsovsky Portlandcement | 3,514.3 | 108.5 |
| 4 | Podgorensky Cementnik | 387.0 | 111.5 |
| 5 | Lipetskcement | 1,453.0 | 124.0 |
| 6 | Voskresenskcement | 1,613.0 | 121.5 |
| 7 | Podolskcement | 135.2 | 90.5 |
| 8 | Ulyanovskcement | 1,523.6 | 108.0 |
| 9 | Mikhailov Cement (Ryazan) | 1,577.4 | 116.0 |
| 10 | Mordovcement | 2,867.6 | 107.8 |
| 11 | Savinsky cement plant | 825.1 | 118.0 |
| 12 | Pikalevsy cement | 1,598.0 | 130.0 |
| 13 | Volhovsky cement plant | 241.7 | 110.0 |
| 14 | Slantsevsky cement plant | 728.8 | 118.8 |
| 15 | Zhigulevskiye stroymaterialy | 1,248.9 | 125.0 |
| 16 | Volskcement | 2,388.1 | 116.0 |
| 17 | Volsky plant ATSI | 219.5 | 103.0 |
| 18 | Uluanovskshifer (Sengileevsky) | 82.7 | 115.6 |
| 19 | Sebryakovcement | 3,117.0 | 103.5 |
| **Average** | | | **110,0** |

Baseline electricity consumption for replacement part of cement production is:
110 MWh/t cement × 0.8 mln. tonnes of cement per year = 87,112 MWh.

And total baseline electricity consumption is 178,400 + 87,112 = 265,512 MWh.

The project electricity consumption is less than baseline electricity consumption and the project technical transmission and distribution losses are less than the baseline technical transmission and distribution losses.

Therefore the technical transmission and distribution losses were not have taken into account in emission calculations. It is conservative.

# Standardized grid emission factors

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

Standardized $CO_2$ emission factors were elaborated for the power systems of Russia in a study "Development of grid GHG emission factors for power systems of Russia" (further in the text – Study) commissioned by "Carbon Trade and Finance" in 2008.

On the basis of the approved CDM "Tool to calculate the emission factor for an electricity system" (version 01.1), operating, build and combined margin emission factors were calculated for the 7 regional Russian electricity systems (RESs). Within these RESs no major transmission constraints exist, while they operate at the same time relatively "independently" from each other (i.e. the electricity exchange between the regional systems is rather insignificant).

This Study recommends to use the operating margin emission factor for baseline GHG emission calculation if JI project reduces the electricity consumption. After project electricity consumption will be decreased in comparison with baseline, as shown above. Therefore the operating margin emission factors were used for emission calculation.

The operating margin emission factors were used for emission calculation both in the project and baseline. It is conservative.

For the calculation of emissions related to electricity consumption in the project and baseline scenarios for replacement part of cement production, the operating margin emission factor for RES "Centre" was applied as grid emission factor and fixed ex-ante:

$EF_{el\_j,y}$ = 0.526 $tCO_2/MWh$.

For the calculation of emissions related to electricity consumption in the baseline scenarios for incremental part of cement production, the corresponding operating margin emission factors (for RES "Centre", RES "Mid Volga", RES "North-West" and RES "South") were applied as grid emission factors.

The grid emission factor of RES "Centre" was used emission calculation at:

- Belgorodsky Cement;
- Oskolcement;
- Maltsovsky Portlandcement;
- Podgorensky Cementnik;
- Lipetskcement;
- Voskresenskcement;
- Podolskcement;
- Mikhailov Cement.

The grid emission factor of RES "Mid Volga" (0.534 $tCO_2/MWh$) was used for emission calculation at:

- Ulyanovskcement;
- Mordovcement;
- Zhigulevskiye stroymaterialy;
- Volskcement;

- Volsky plant ATSI;
- Uluanovskshifer.

The grid emission factor of RES “North-West” (0.591 $tCO_2$/MWh) was used for emission calculation at:
- Savinsky cement plant;
- Pikalevsy cement;
- Volhovsky cement plant;
- Slantsevsky cement plant.

The grid emission factor of RES “South” (0.602 $tCO_2$/MWh) was used for emission calculation at:
- Sebryakovcement.

The whole Study is available on request.

Annex 3

## MONITORING PLAN

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