



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

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**SECTION A. General description of the project****A.1. Title of the project:**

Slag usage and switch from wet to dry process at Yugcement, Ukraine.

Sectoral scope 4: Manufacturing industries¹

PDD version 1.2 dated 18 March 2008.

A.2. Description of the project:

Cement production is a highly energy intensive process that generates significant emissions of greenhouse gases, in particular CO₂. There are three main sources of CO₂ emissions in the cement production process. The first source is fossil fuel combustion and the second source is the chemical decomposition of the limestone into calcium oxide and carbon dioxide. The third source, being smaller as to compare with the first two, is the grid emissions due to electricity consumption of plants motor drives (e.g. kiln rotation, pumping, fans) and other power consumers.

The project aims to significantly decrease the emissions of the first two sources (fossil fuel combustion and calcination) at Yugcement plant factory in Ukraine.

Yugcement is the largest plant of the building materials industry in the south of Ukraine with design production capacity more than 1.25 million tons of cement per year. It uses a wet process and runs two kilns. It was commissioned in the beginning of 1970-s and traditionally serves the southern Ukrainian regions (Mykolayiv, Kherson, Crimea, Odessa).

Kilns installed	Process type	Design clinker capacity, t/h each
#1, 2	Wet	72

Table 1. Existing production capacity

The project foresees the adoption of blast furnace slag (BFS) as decarbonised raw material in the raw meal fed to the kilns. According to the plan, BFS will be added starting from 1 July 2008 on. It is foreseen that the slag addition would be implemented in two steps. Under the first step some 4% of unground BFS will be added. The second step will follow when all technical issues related to slag adoption will be solved and foresees addition of ground (milled) BFS and increase its proportion to some 15%. Addition of slag reduces both, the emission due to the calcinations (or decarbonisation) process and fuel consumption. At the moment, slag has not been added to the raw materials for the kilns.

Further on, it is planned to build a new dry kiln and switch from wet to dry process from beginning of 2012. A principle decision on switch from wet to dry, however, is still to be made. So only the slag addition is the subject of this PDD.

Effect of slag addition occurs due to the following:

- less CO₂ is emitted during calcination process in the kiln as slag contains less CaCO₃ which decomposes to CaO and CO₂ at high temperature.
- less heat and subsequently less kiln fuel is required for decomposition of limestone in the kiln. Therefore, less CO₂ emissions from fuel combustion occurs.

¹ <http://cdm.unfccc.int/DOE/scopelst.pdf>



- Slag reduces the overall moisture content of the slurry therefore less kiln fuel is consumed to evaporate moisture from it. Less CO₂ is emitted from fuel combustion.

A.3. Project participants:

Party involved	Legal entity <u>project participant</u> (as applicable)	Kindly indicate if the Party involved wishes to be considered as <u>project participant</u> (Yes/No)
Ukraine (Host party)	JSC Yugcement	No
Germany	Dyckerhoff AG	No
Netherlands	Global Carbon BV	No

Table 2. Project Participants.

Role of the Project Participants:

- JSC Yugcement is the legal entity operation and owning the cement plant. Yugcement will be implementing the proposed JI project;
- Dyckerhoff AG is the mother company owning JSC Yugcement. Dyckerhoff will provide the financial means for the JI project and will provide the specific technologies;
- Global Carbon BV is responsible for the preparation of the investment as a JI project including PDD preparation, obtaining Party approvals, monitoring and transfer of ERUs;
- The fourth legal entity (not a Project Participant) is Dyckerhoff Ukraine which is the management company of Yugcement.

A.4. Technical description of the project:**A.4.1. Location of the project:**

The project is located at village of Olshanske, about 35 km. from Mykolayiv – one of regional centres of Southern Ukraine, 450 km south from Kyiv.



Figure1: Ukraine, the project location and neighbouring countries

A.4.1.1. Host Party(ies):

Ukraine

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

Mykolayiv oblast (region) in the south of Ukraine.

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

Village of Olshanskoye is located about 35 km north-west from Mykolayiv, one of regional centres of Southern Ukraine.

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

Cement factory is located close to main railroad station. The site co-ordinates are: 47°11' N, 31°47' E. Own limestone quarries are located 2.5 km from the plant site. The region is rich in mineral resources

like limestone and clay, agriculture is developed in the region as well. Mykolayiv, the regional capital is well known as a shipbuilding and export-import trans-shipment centre.

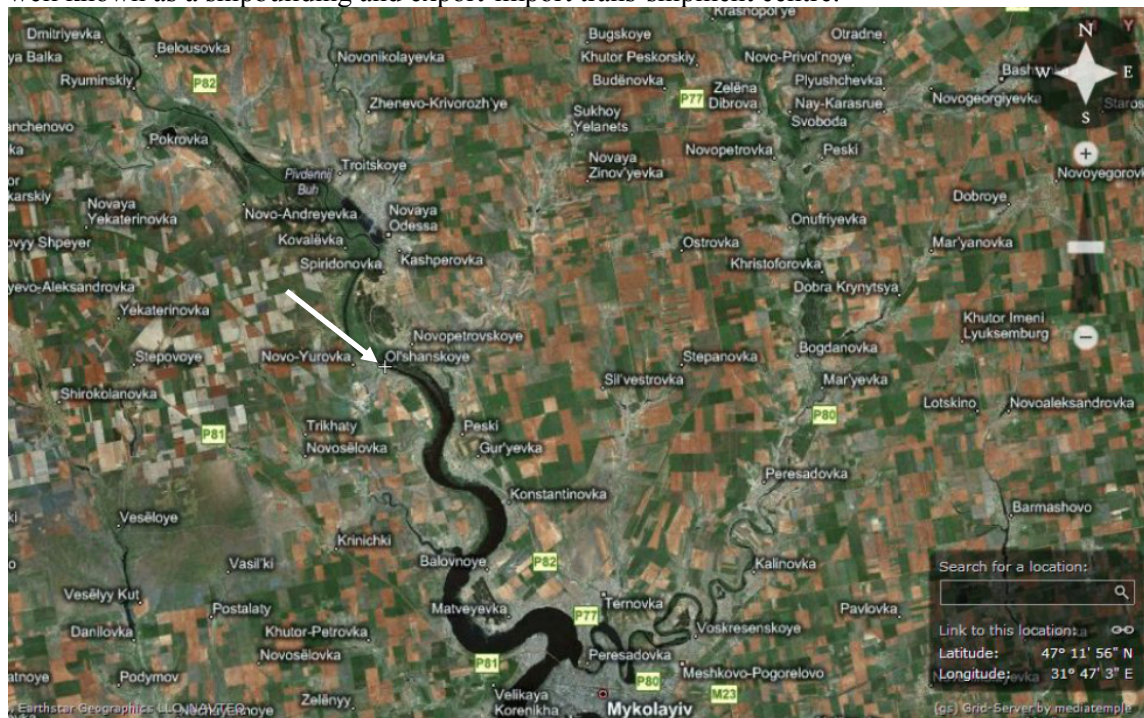


Figure 2: The town of Olshanskoye near Mykolayiv².

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

General description of cement production

The cement production cycle can be divided into four steps:

1. Raw materials extraction

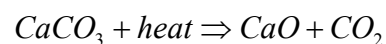
The main chemical compounds necessary for cement production are contained in limestone or chalk (CaCO_3) and clay or loam (SiO_2 , Fe_2O_3 and Al_2O_3). Limestone (or chalk) and clay (or loam) are extracted from natural deposits, crushed and transported to the cement production site.

2. Processing of raw materials

Crushed limestone and clay are mixed in defined proportion in function of raw material content. 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 on the preparation stage.

3. Clinker burning (pyroprocessing)

The raw meal is passed to a rotary kiln. Under the influence of high temperatures, limestone (calcium carbonate) is calcined into lime (calcium oxide) and carbon dioxide:



² Flashearth.com

This chemical reaction is one of the two main sources of carbon dioxide during cement production. The other main source of CO₂ is fuel burning in order to heat the materials. After the calcination, the calcium oxide reacts with the other chemical compounds present at the temperatures between 1400 – 1450°C. This reaction is called sintering. The final product of these reactions is called clinker. Clinker that comes out of the kiln is cooled and heat returned to the process by clinker coolers.

4. Making cement from clinker

The last stage of 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 situation at Yugcement is presented in the figure below. Currently all the existing two wet rotary kilns are in operation, each of them producing about 68 tonnes of clinker/hour. All kilns use natural gas as fuel. Similarly to many of Ukrainian cement plants, the use of coal instead of gas is planned in the nearest future (scheduled from July 2009 onwards).

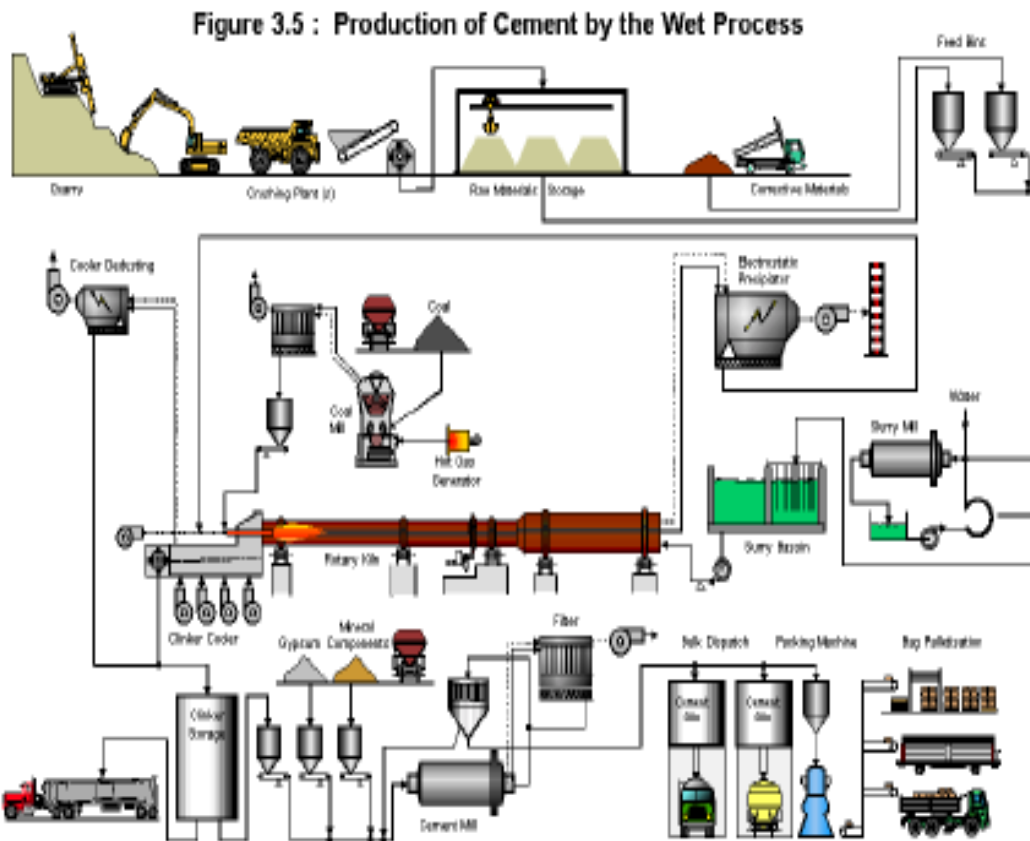


Figure 3: Existing wet cement production process at Yugcement.

Raw materials are individually crushed. They are mixed and milled to slurry with the addition of water in the raw mills. After homogenisation in slurry basins, the kiln feed slurry is fed into rotary wet kilns. de-carbonated materials, like slag is not added to the slurry. The first process in the kiln is the evaporation of water. Thereafter, with the mineralogical/chemical reactions of calcination and sintering, clinker is formed. The clinker is then passed to the cooler, and further to cement grinding.



Wet rotary kilns can be operated some 315 to 320 days per year. The total production capacity of the existing installation can be up to approximately 1.1 million tonnes of clinker per year. With existing clinker factor of 0.73 t clinker/t cement the existing capacity can produce up to some 1.5 million tonnes of cement annually (see annex 2).

Situation after project implementation

In the case of proposed JI project BFS will be added to the raw material to replace part of limestone. At first stage the BFS will be dried before addition. Gas fired dryer, conveying and feeding equipment will be installed to allow of addition of some 4% of unground slag. At second stage the slag mill and auxiliaries will be installed to grind the slag before addition and slag percentage will be increased to approximately 15%.

Addition of BFS would lead to reduction of kiln fuel consumption to some 1480 kcal/kg of clinker after the first stage is implemented and further reduced to some 1270 kcal/kg of clinker at second stage. Due to this, CO₂ emissions from kiln fuel combustion would decrease. Additional significant decrease of CO₂ emission will be reached due to less calcinations if raw materials in the kiln. It is expected, that addition of BFS would reduce CO₂ from 0.525 to 0.504 after first stage and to 0.44625 tCO₂ per ton of clinker after second stage. Electricity consumption is expected to increase due to additional milling and handling of slag.

The production of clinker will be at the level of 1 million tons a year.

Fuels in the cement sector

In the former Soviet Union natural gas has been subsidised, allowing cement factories to continue using natural gas whereas in Western Europe coal has been the main source of fuel³ due to the higher cost of natural gas. Over past 3 years all the cement plants in the country have been facing an increasing price of natural gas. During 2005-2007 a doubling of gas prices occurred for the industrial consumers and it is very unlikely that gas prices will not only return to previous level, but even stay at the current level⁴.

As for January 2008 the cost price of natural gas is close to 100% higher than the cost price of coal. As the fuel cost is an important factor in the production cost of cement, the Board of Dyckerhoff decided in 2007 to install a coal milling and handling system at Yugcement to enable the factory to switch to coal in the middle of 2009. The coal mill shall be fully commissioned in spring 2009.

The trend of the price of natural gas is upwards and will, in time, approach a level similar to those of Western and Central Europe. It is therefore unrealistic to assume that Yugcement will continue using natural gas as main kiln fuel after the commissioning of the coal mill (for reference: the conventional fuel in cement factories in Western Europe, USA, China and India is coal). Due to these factors only coal can be regarded as credible type of fuel in both, baseline and project scenarios.

Maintenance of new equipment

Maintenance planning is carried out on the basis of annual schedules of equipment maintenance that are made on the basis of national maintenance standards. Routine maintenance work is done by the qualified personnel of Yugcement. In the case maintenance procedures cannot be done internally, an external company is contracted to do the maintenance work.

The plant provides the external contractor with design and technical documentation, necessary materials and spare parts. The plant is obliged to provide a contractor with compressed air from plant network, oxygen, water, electric power, hoisting machines during preparatory and maintenance work. In case the

³ "Best Available Techniques" for the cement industry, CEMBUREAU, 1999

⁴ http://en.wikipedia.org/wiki/Russia-Ukraine_gas_dispute



contractor is using his own energy recourses the plant pays for them according to contractor estimates and prices.

After the final acceptance of the new installation Yugcement is fully responsible for its employees' safety, for proper and safe operation of all power circuits and communications. The contractor is obliged to carry out the maintenance works closely according to design estimates and technical documentation, provided by the plant (maintenance schedule, financial estimates, and drawings). The contracting organization must remove all defects at its own expense in case if maintenance was not fulfilled in compliance with a standard.

Training for the project

The project does not involve fully new technology to Ukraine and therefore extensive training programme is not necessary. Training will be provided by suppliers of equipment once it is installed during and after commissioning. The chosen supplier of the equipment will also be contracted by Dyckerhoff AG to provide additional on-site assistance.

Risks of the project

The risks of the project are summarised in the following table:

Risks	Mitigation
<i>1. Financial risk</i>	
The financial performance of the proposed project is not meeting the requirements of the owner, the BFS prices have risen approximately 5 times during 2007 and the growth will most probably continue	Dyckerhoff AG is willing to provide long-term financing for the project in case investment criteria are met.
<i>2. Technological risk</i>	
Addition of slag is not a common practice in Ukrainian cement industry. Trials of addition of slag made in 2003 showed it's negative influence on kiln performance.	Dyckerhoff AG has experience within the group of addition of non-carbonated raw material, including slag. It will assist Yugcement in overcoming the technological risk.
<i>3. Market risk</i>	
Yugcement is producing cement for the national market in Ukraine with little export share. Cement production levels are directly related with the market demand. Economic recession might lead to the less production levels than expected.	Conservative market forecasts were taken to estimate production levels during the crediting period.
<i>4. JI approval risk</i>	
There is a risk of no approval of the (JI) project by Ukrainian government as the regular approval procedure may experience changes due to transfer of responsibilities from Ministry of Environment to National Environmental Investment Agency.	Yugcement has held consultations with the authorities on the regional level and also obtained Letter of Endorsement for the project from Ministry of Environment of Ukraine.

Table 3: Summary of project risks

Apart of the significant reduction of emission of GHG-gasses, the project will also decrease the emissions of dust. The effect of the project on the emissions is described in section F.

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

The project will allow to significantly reduce the emissions of CO₂ due to less raw material to be calcinated in the kiln and reduction of kiln fuel consumption as effects of slag addition to the raw mill.

Although addition of slag has some significant advantages, the project faces three important barriers:

Financial and economic barrier

The slag addition project, however being not capital intensive is not profitable without JI revenues.

Lack of experience and technology in Ukraine

Using BFS as part of raw material is not common in Ukrainian cement industry.

Technological risk

Addition of BFS may result in technical problems with the kiln refractory and also negatively influence on the kiln output and availability. Trials were made during 2003-2004 with adoption of unground BFS which were considered unsuccessful and addition of BFS was stopped due to:

- Stacking of slag into feeding line which resulted in unevenness of its addition in the slurry which impacts the clinker composition
- Negative influence on kiln refractory

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

	Years
Length of the period within which <u>emission reduction units</u> are to be earned	4,5
Length of the <u>crediting period</u>	4,5
Year	Estimate of annual emission reductions in tonnes of CO ₂ equ.
Year 2008	14 306
Year 2009	117 913
Year 2010	128 533
Year 2011	128 533
Year 2012	128 533
Total estimated emission reductions over the period within which <u>emission reduction units</u> are to be earned (tonnes of CO ₂ equiv.)	517 818
Total estimated emission reductions over the <u>crediting period</u> (tonnes of CO ₂ equiv.)	517 818
Annual average of estimated emission reductions over the <u>crediting period</u> /period within which <u>emission reduction units</u> are to be earned (tonnes of CO ₂ equiv.)	115 071

Table 4: Estimated emission reduction



A.5. Project approval by the Parties involved:

The Project Idea Note had been submitted for review of the Ministry of Environment of Ukraine. Positive Letter of Endorsement # 12325/11/10-07 was issued 5 December 2007.

After the project has gone through the determination process, the PDD and the Determination Protocol will be presented to the Ministry of Environment of Ukraine to obtain a Letter of Approval. Subsequently a Letter of Approval of Germany will be obtained.

**SECTION B. Baseline****B.1. Description and justification of the baseline chosen:**

Any baseline for a JI project should be set in accordance with the “Guidance on criteria for baseline setting and monitoring”⁵. In accordance with this Guidance, the project participants may use approved CDM methodologies (article 20 (a) of the Guidance) or can establish a baseline in accordance with appendix B of the JI guidelines using selected elements or combinations approved CDM baseline and monitoring methodologies (...) as appropriate (article 20 (b) of the Guidance).

For the cement industry four approved methodologies exist being ACM0003, ACM0005, AM0024 and “Consolidated baseline and monitoring methodology for project activities using alternative raw materials that do not contain carbonates for clinker manufacturing in cement kilns” ACM0015.

None of these methodologies can be applied directly to the project, but these methodologies have been carefully studied to identify the main principles underlying the approach to baseline setting, additionality and monitoring.

Furthermore the approach for baseline setting in the JI project JI0001 “Switch from wet-to-dry process at Podilsky Cement, Ukraine”, for which the determination has been made final, has been applied over the existing capacity.

Finally, for proving the additionality of the project the most recent “Tool for the demonstration and assessment of additionality (version 04)” has been applied. Please refer to section B.2.

While identifying the baseline and project emissions, the general principles of appendix B of the JI guidelines (in particular: project-specific approach, taking conservative assumption, and taking into account relevant policies) have been adhered to.

Approach to select the baseline scenario

The baseline is the scenario that reasonably represents the anthropogenic emission by source of greenhouse gases that would in absence of the proposed project⁶. As a first step a list of plausible future scenarios are identified and listed (article 21 (b) of the Guidance). The proposed project, not developed as a JI project, has been included as an alternative as well as a continuation of the current practice. These alternatives are assessed whether or not these alternatives are credible and plausible. The consistency between the baseline scenario determination and additionality determination has been checked.

The approach described above has been used to identify the baseline scenario for Yugcement.

Identification of alternative baseline scenarios

At Yugcement several options for substitution of traditional raw materials are technically feasible and are discussed below.

1. Using no slag in raw material mix which represents continuation of existing situation
2. Using 4% unground slag
3. Using 15% unground slag
4. Using 4% ground (milled) slag
5. Using 15% ground (milled) slag

⁵ <http://ji.unfccc.int/Ref/Guida.html>

⁶ JI guidelines, appendix B



The five alternatives are described below in more detail

1) Production of clinker without slag addition

Yugcement started producing cement by applying traditional raw material mix since the very beginning in the 1970-s. The wet process was the predominant technology that was implemented in the Soviet Union. The main reason to use a traditional wet process was the ease in raw material handling and to control the quality of the cement. Second important reason was the natural moisture of raw materials which reaches 24%. Energy efficiency was not considered to be high priority at that time.

Slag would not be added to the raw material mix.

The two existing kilns can be operated at least till 2012. The clinker production, given all the existing kilns will be operated as they do now, could be up to 1.1 million ton a year.

This scenario constitutes of continuation of the current situation at Yugcement.

2) Production of clinker adding 4% of unground slag to the raw mix

Slag would be added to raw material mix for all kilns at a level of approximately 4%. The incentive for slag addition is the reduction of fuel consumption at the existing kilns due to lower calcinations of raw materials in the kiln. The slag would be dried but not milled prior to addition. To secure the uniform and uninterrupted feeding of slag special dosing equipment would be installed which would allow controlling the ratio of slag in the slurry.

The two existing kilns can be operated at least till 2012. The clinker production, given all the existing kilns will be operated as they do now, could be up to 1.1 million ton a year.

3) Production of clinker adding 15% of unground slag to the raw mix

Similarly to Alternative 2 above, the clinker production will use all existing wet kilns. Unground BFS would be added to raw material mix in bigger volumes of approximately 15%. The incentive for this alternative is the reduction of fuel consumption at the existing kilns due to lower calcinations of raw materials in the kiln.

Similarly to alternative 1 above the slag dosing equipment would be installed.

4) Production of clinker adding 4% of ground slag to the raw mix

Similarly to the alternatives above, the clinker production will use all existing wet kilns. BFS being additionally ground in a mill would be added to raw material mix at approximately 4% level. For that special slag mill and auxiliary equipment would be installed. Milling of slag allows for better mixing it with raw materials and better clinker quality. The incentive for this alternative is the reduction of fuel consumption at the existing kilns due to lower calcinations of raw materials in the kiln.

5) Production of clinker adding 15% of ground slag to the raw mix

Similarly to the alternatives above, the clinker production will use all existing wet kilns. BFS ground in a mill would be added to raw material mix at a higher proportion of approximately 15% level. The



incentive for this alternative is the reduction of fuel consumption at the existing kilns due to lower calcinations of raw materials in the kiln.

This Alternative represents the proposed JI project in which Yugcement would introduce the addition of slag. It does not take any JI incentive (transferring ERUs) into account. The required investment would be approximately 2.5 million Euro. It consists of two parts. The first part of approximately 1 million Euro is required to install and commission slag drying and dosing equipment as a first stage of the project. This would allow to start adding BFS from 0% to some 4% and adopt the technology. The second part of approximately 1.5 million Euro is required to install and commission slag milling equipment. It would allow further increase of slag proportion to some 15%. This alternative would become possible with completion of installation of slag drying, dosing, preparation and handling equipment and following adjustment during first half of 2008 and expected start from 1 July 2008.

Assessment of the alternative scenarios

Yugcement is producing cement for the Ukrainian market. Within this market Yugcement should work within the following constraints:

- The cement market is a competitive market;
- The factory should meet the quality requirements of its clients;
- The factory should be able to meet the growing demand for cement on the Ukrainian market;
- And the factory should be profitable at the same time.

Yugcement started producing cement by applying a wet process since the very beginning. The wet process was the predominant technology that was implemented in the Soviet Union. The main reason to use a wet process was the ease in raw material handling and to control the quality of the cement. Second important reason was the natural moisture of raw materials which reaches 24%. Energy efficiency, nor CO₂ emissions, was not considered to be high priority at that time.

All the two existing kilns can be operated at least till 2012. The clinker production, given all the existing kilns will be operated as they do now, will be up to approximately 1.1 million ton a year.

Assessment of alternative 1: Production of clinker without slag addition and using existing wet process

The wet process is the predominant cement making technology in Ukraine and Yugcement can continue to use the wet process. Slag addition is also not common to most of plants. There are no legal or other requirements which would enforce Yugcement to discontinue using wet production process or add slag into raw mix. The existing kilns can continue operation till at least 2012. This alternative constitute in continuation of existing situation at Yugcement, it is a reasonable and feasible alternative.

Assessment of alternative 2: Production of clinker adding 4% of unground slag to the raw mix and using existing wet process

Similarly to Alternative 1, Yugcement could continue producing clinker at the existing facilities and start using slag as a part of raw mix in some 4% proportion. The trials made during 2004-2004 with adoption of unground blast furnace slag of 2-4% proportion were however not successful. Moreover, as described in section B2 this alternative is not an economic attractive course of action.

Assessment of alternative 3: Production of clinker adding 15% of slag to the raw mix and using existing wet process.

Increasing significantly the proportion of unground slag could face difficulties (see A.4.3.). Also very important is the weak financial performance of slag addition due to rise of blast furnace slag cost happened during 2007. Please, refer to section B2 where the proof of non-profitability of slag increase is provided. Hence, the alternative 3 is not reasonable.



Assessment of alternative 4: Production of clinker adding 4% of ground slag to the raw mix and using existing wet process

Yugcement could continue producing clinker at the existing facilities and start using prepared (ground) slag as a part of raw mix in some 4% proportion. As described in section B2, addition of unground slag is not profitable. Grinding the slag will increase its cost at the kiln due to additional electricity cost for milling and therefore will make the slag addition more expensive. From this point of view, Alternative 4 is not feasible to undertake.

Assessment of alternative 5: Production of clinker adding 15% of ground slag to the raw material mix

This Alternative represents the proposed JI project in which Yugcement would start adding prepared (ground) slag into approximately 15% proportion to the raw mix. This alternative would start in July 2008 by means of adding some 4% of unground slag and would become fully possible in 2009 with the increase of slag addition to 15% of ground slag. However, in section B.2 it is proven that this Alternative is not an economically attractive course of action and faces barriers.

Conclusion

Only Alternatives 1 and 5 are realistic and credible alternatives. In accordance with many CDM methodologies, “when more than one credible and plausible alternative remains, as a conservative consumption, use the alternative baseline scenario that results in the lowest baseline emissions as the most likely baseline scenario”⁷.

Alternative 1 is the remaining realistic and credible alternative with the lowest emissions and is identified as the baseline scenario.

The baseline emissions of alternative 1 are elaborated in section D.

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

The latest “Tool for demonstration and assessment of additionality (version 04)” has been applied to show that the anthropogenic emissions of the greenhouse gases are reduced below those that would have occurred in the absence of the JI project.

Preliminary screening

a) The project activity has not been started yet and the JI activity will start after 1st July 2008. The construction of the project is expected to start, pending JI and board approval, in 2008.

b) The JI project is currently being considered by Dyckerhoff. Due to the expected low economic performance of the investment into the slag introduction project additional revenue from JI has been taken into account from the very beginning of the project development activities. The following documents are available providing evidence:

1. On the 6th of June 2007 a report was prepared for Dyckerhoff to make a preliminary assessment of the JI eligibility of the project and to estimate of the emission reduction potential;
2. On the 3rd of July 2007 a presentation concerning Kyoto and JI was given to the management of Dyckerhoff;
3. In October 2007 a Project Idea Note was prepared and presented to the Ukrainian Ministry of Environment (MoE);
4. On the 5 of December 2007 the MoE had issued a Letter of Endorsement #12325/11/10-07 supporting the project at Yugcement

⁷ AM0040, page 5.

Step 1. Identification of alternatives to the project activity

The identified alternatives are identical to the alternatives mentioned in section B.1.

Step 2. Investment analysis**Sub-step 2a. Determination of the analysis method**

This project generates cost savings so cost analysis (sub-step 2b Option I) of the CDM Additionality tool version 04) can not be used. The investment options (alternative scenarios) considered above, are unlikely to be implemented so investment analysis (Option II), based on comparison of NPV and other indicators for different project options is not applicable. Thus in line with the CDM Additionality Tool version 04 only Option III – benchmark analysis - is relevant for the presented subprojects. The mentioned above document recommends to use three methodological approaches for IRR benchmark definition specified in Section 4 – 4a, 4b, 4c.

The 4a approach of Option III is usually used in the absence of 4b and 4c opportunities. Conversion from dry to semi dry method of cement production is not a common practice in Ukraine. So it is not possible to find the risk factor or IRR benchmark for similar projects in Ukraine and use directly or make necessary adjustments. It implies that in line with the mentioned above document approach 4a and 4b for sub-step 2b Option III can not be used. All investment decisions in Dyckerhoff AG are taken in line with internal document “Capex guideline: Dyckerhoff AG and subsidiaries” where the discount rate for the calculation NPV of project assessed is specified. Thus in the additionality analysis presented below approach 4c for sub-step 2b of Option 3 III will be applied (company internal benchmark).

Sub-step 2b. Application of the benchmark analysis

Dyckerhoff AG Capex Guidelines specify the discount rate of 15 % for project NPV calculation. This means that the company does not consider the investment projects proposals generating positive discounted cash flow with IRR less than 15%.

Sub-step 2c. Calculation and comparison of the indicators

In line with the project description above cash flow analysis is performed for 2 steps:

Step 1 – 4% slag increase;

Step 2 – 15% slag increase.

The investment cost amounts to Euro 1 million in the first case and to Euro 2.4 million in the second case. Investment cost may be increased 15-20% during procurement deals negotiations. But in cash flow analysis the conservative investment cost assessments are used.

The key assumptions for the project cash flow analysis for both steps are presented below:

1. All prices and rates are taken constant as per 1 January 2008;
2. Clinker production is based on full technical capacity (taking into account necessary repair time and other factors) use;
3. Project lifetime is 10 years;
4. Conversion from gas to coal takes place before these subprojects are implemented so all cost and savings calculations are coal based only;
5. The change of slag composition from 4 to 15% causes savings in coal, chalk, clay and loam and cost increase of kaolin and Fe oxide.

The subprojects have the following financial indicators specified in the table below:

Project/Indicator	IRR (%)	Payback Period (years)
Slag project 4%	Does not exist (NPV is never positive)	Is longer than the project life time



Slag project 15%	Does not exist (NPV is never positive)	Is longer than the project life time
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Table 5: Project Financial indicators, base case

Project cash flows do not look financially attractive given full capacity is used and current prices are taken as constant.

Sub-step 2d. Sensitivity analysis

The following scenarios were considered in the sensitivity analysis:

- Scenario 1 – coal price up 20%;
- Scenario 2 – slag price 20% down;
- Scenario 3 – raw materials price 20% up.

The company expects around 10% coal price growth next year. But we considered even 20% increase to demonstrate the robustness of the cash flows.

A 10% price growth for the other raw materials (except slag) per year is realistic as it is lower than expected inflation rate. We used the same approach as for coal. The kaolin and Fe oxide cost growth does not contribute much to the cash flow result and were not included in the Sensitivity analysis.

The slag price more than doubled in 2007 and continues to grow. But we decided to try the case of its overestimation due to the current slag deficit and reduces slag price 20%.

The sensitivity analysis results for Step 1 are summarised in a table below.

Scenario/Indicator	IRR (%)	Payback period (years)
Scenario 1	9	Longer than the project life time
Scenario 2	14	Longer than the project life time
Scenario 3	Does not exist	Longer than the project life time

Table 6: Sensitivity Analysis Summary for Step 1

Cash flows are sensitive to the slag price decrease and IRR becomes close to the benchmark in case of a 20% decrease. But in current trend of slag price growth (January 2008 prices are 10% higher than end of December 2007 prices that were taken) this situation is unlikely.

The sensitivity analysis results for Step 2 are summarised in a table below.

Scenario/Indicator	IRR (%)	Payback period (years)
Scenario 1	Does not exist	Longer than the project life time
Scenario 2	Does not exist	Longer than the project life time
Scenario 3	Does not exist	Longer than the project life time

Table 7: Sensitivity Analysis Summary for Step 2

As it can be seen from the table above quite significant price fluctuations of the main cost components do not make both project options (4% and 15% slag use increase) more financially attractive thus proving the robustness of cash flows and his additionality in line with the CDM Additionality Tool version 04.



Step 3. Barrier analysis

Sub-step 3a. Identification of barriers that would prevent the proposed JI project

Investment barriers.

The estimated investment cost to be allocated by Dyckerhoff into Yugcement reaches is 2.4 million Euro for BFS addition into the raw mix. The project economy is not satisfactory as described in sub-step 2 above. BFS market prices grew up significantly since beginning of 2007 (approximately 5 to 7 times during 9 months of 2007).

Low profitability of slag project and uncertainty of slag prices constitutes a barrier for the proposed project activity.

Technological barriers and prevailing practice barriers:

Blast furnace slag, however known in the country cement sector, is predominantly used as mineral additives to produce cement at final process stage by milling slag together with clinker. Usage of slag as raw material is very limited and only several examples can be identified. One of them, the Yugcement plant, owned by the Dyckerhoff AG group, uses some 4% of unground BFS. Yugcement made trials to adopt unground BFS into the raw material mix during 2003-2004, but had discontinued it due to increase of kiln feed system outages caused by stacking of slag and also due to difficulties in maintaining the stable composition of raw mix at the kiln entrance.

Therefore, the prevailing practice of wet process and lack of technical expertise for dry and semi-dry process in addition to difficulties of slag usage and represent a barrier to the proposed JI project activity.

Step 4: Common practise analysis

Addition of blast furnace slag into the raw material mix can be observed at few cement plants out of 16 existing in Ukraine. One of them, Yugcement, owned by Dyckerhoff group, second known is Kryvyi Rih cement plant, owned by Heidelberg Cement. Both are using small percentage of BFS added into raw material mix. Therefore, addition of BFS into raw mix is not a common practice in the Ukrainian cement sector.

The proposed JI project activity is not common practice.

Conclusion

The registration of the proposed JI activity will:

- Allow for one of the largest single investment in the Ukrainian cement industry since it's independence to be made;
- Give the Yugcement access to the necessary modern technology and experience.

Conclusion: the impact of the proposed JI project activity will alleviate the economic/financial hurdle and will alleviate barriers to the project. The project is additional.

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:

- Fuel combustion;
- Geogenic emission from the calcination (decarbonisation) process;
- GHG emission in the Ukrainian Power grid as a result of electricity consumption.



In the table below an overview of all emission sources in the cement production process are given. The following approach has been used in determining whether they have been included in the project boundary:

- All sources of emissions that are not influenced by the project have been excluded;
- All sources of emissions that are influenced by the project have been included.

No	Source	Gas ⁸			Justification/Explanation
1	Change in fuel consumption at the quarry and raw material transport	CO ₂	Direct	Excluded	<ul style="list-style-type: none"> • Fossil fuel consumption will decrease⁹
2	Change in grid electricity consumption at the quarry	CO ₂	Indirect	Excluded	<ul style="list-style-type: none"> • Electricity consumption will decrease¹⁰
3	Change in grid electricity in the raw material transport:	CO ₂	Indirect	Included	<ul style="list-style-type: none"> • The electricity consumption will decrease • Emissions calculated using standardized electricity baseline Ukraine¹¹
4	Change in grid electricity consumption at the raw milling preparation:	CO ₂	Indirect	Included	<ul style="list-style-type: none"> • The electricity consumption will decrease • Emissions calculated using standardized electricity baseline Ukraine¹²
5	Change in electricity consumption of the kiln (e.g. motors for rotation, fans)	CO ₂	Indirect	Included	<ul style="list-style-type: none"> • The electricity consumption will decrease • Emissions calculated using standardized electricity baseline Ukraine
6	Change in fossil fuel combustion in kiln	CO ₂	Direct	Included	<ul style="list-style-type: none"> • The fossil fuel combustions will decrease
7	Change in grid electricity consumption at the coal mill	CO ₂	Indirect	Included	<ul style="list-style-type: none"> • The electricity consumption will decrease • Emissions calculated using standardized electricity baseline Ukraine
8	Fuel combustion to dry the coal	CO ₂	Direct	Included	<ul style="list-style-type: none"> • The fuel consumption will decrease in the project scenario
9	Change in geogenic emission (calcination)	CO ₂	Direct	Included	<ul style="list-style-type: none"> • The specific geogenic emission from calcination will be decreased due to

⁸ Only CO₂ emissions are taken into account. CH₄ and N₂O emission reduction are omitted. This is conservative and is in line with all cement CDM methodologies mentioned in section B.1. Please refer also to the general remarks in section D.1.

⁹ Raw material extraction will decrease as it will be partially replaced by slag. Therefore, fuel and electricity consumption at the quarry will decrease as well. Not taking the decrease into account is conservative.

¹⁰ Raw material extraction will decrease as it will be partially replaced by slag. Therefore, fuel and electricity consumption at the quarry will decrease as well. Not taking the decrease into account is conservative.

¹¹ Yugcement does not have on-site power generation facilities.

¹² Yugcement does not have on-site power generation facilities.

					use of slag in raw material.
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Table 8: Sources of emissions

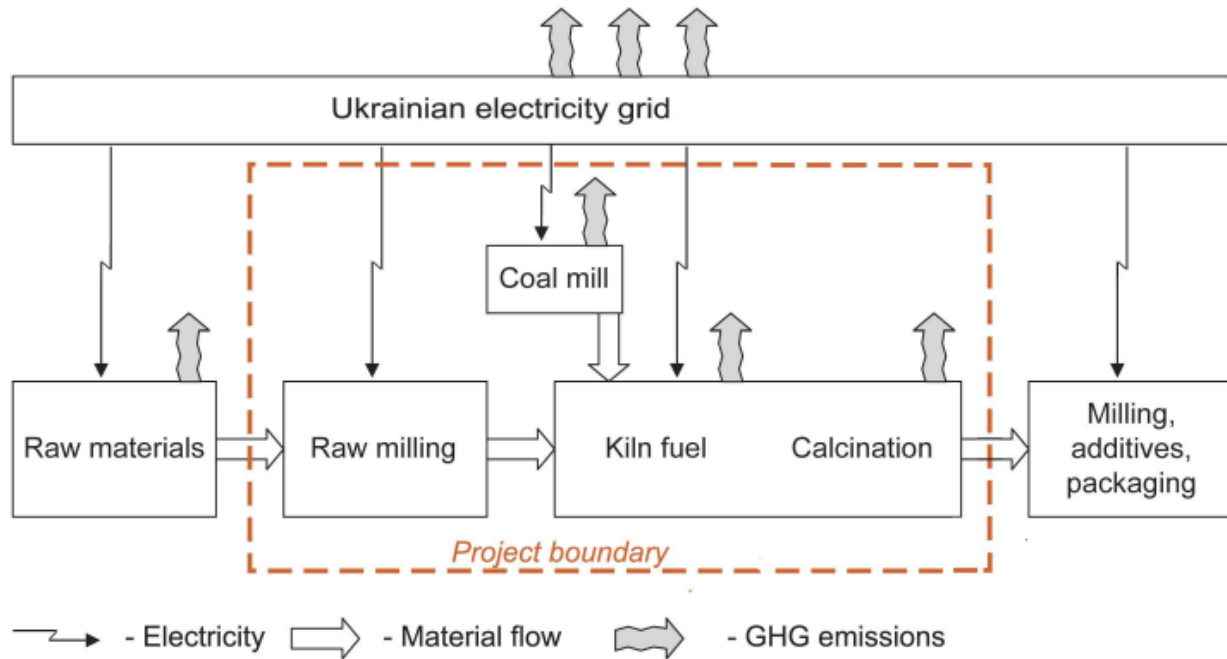


Figure 4: Sources of emissions and project boundary

Please see section E for detailed data of 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: 18 March 2008

Name of person/entity setting the baseline:
Global Carbon BV

See annex 1 for detailed contact information.

**SECTION C. Duration of the project / crediting period****C.1. Starting date of the project:**

Date of commissioning: 1 July 2008 for increase of slag addition as raw material.

One of the key factors determining the investment decision and, as a consequence, the date of commissioning, is JI project approval. For the purpose of setting the length of the crediting period the most optimistic scenario, being 1 July 2008, has been selected.

C.2. Expected operational lifetime of the project:

At least 25 years.

Essentially this is a project for a kiln and raw mill system. The lifetime achieved of such systems is in excess of 30 years, with many examples exceeding even 40 years. Operating kilns within the Dyckerhoff AG group include the following:

Name of Plant	Country	Kiln	Age
Geseke	Germany	Kiln#1	1962
Deuna	Germany	Kiln#2	1976
Göllheim	Germany	Kiln#2	1965
Lengerich	Germany	Kiln#1	1978

Table 9: Some examples of operating dry process kilns within the Dyckerhoff Group

Slag handling and preparation equipment like drying drums, mills and dosing equipment, except for conveyors, can operate at least 25 years.

C.3. Length of the crediting period:

Within the first commitment period:

- Four and a half years (1/7/2008 – 31/12/2012)

Within any relevant agreement under the UNFCCC from 2013 onwards:

- For the duration of the agreement but not more than the remaining operational lifetime of the project (twenty six years)¹³

¹³ As discussed by the JISC in its third meeting.

**SECTION D. Monitoring plan****D.1. Description of monitoring plan chosen:**

As elaborated in section B.3 the project activity only affects the emissions related to the kiln fuel, calcination (decarbonisation), the electricity consumption of the raw milling, the kilns and the coal mill, plus the emission from the heat generator of the coal mill. For the purpose of establishing the baseline emissions and to monitor the project emissions, only these emissions will be monitored.

The baseline emissions are established in the following way:

1. The baseline emission of the kiln fuel over the existing capacity is based on a three years average kiln efficiency and the carbon emission factor of the (mix of) fuel used in the project scenario. This approach is identical to the approach used in the project JI0001 “Switch from wet-to-dry process at Podilsky Cement” which determination was made final;
2. The baseline emission of the calcination component over the existing capacity is based on a three years average of the raw meal prior to project implementation. This approach is identical to the approach used in ACM0015;
3. The baseline emissions of the grid are established using the Ukrainian standardized grid factor as mentioned in annex 2

Assumptions:

- The emissions at the quarry are not influenced by the project;
- The type of fuel combusted in the kiln is not influenced by the project;
- The technical life time of the existing kiln 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 will be implemented on the existing wet kilns until the end of the crediting period.

General remarks:

- In consultation with the verifier, the monitoring plan will be updated prior to the commissioning of the project;
- Social indicators such as number of people employed, safety record, training records, etc, will be available to the verifier if required;
- Environmental indicators such as dust emissions, NO_x, or SO_x will be available to the verifier if required;
- For the greenhouse gas emissions only the CO₂ emissions are taken into account. Cement kilns normally have a CH₄ emission of 0.06 g/kg of clinker and N₂O emissions of 0.001 g/kg of clinker compared with more than 650 g CO₂ / kg of clinker. Omitting these two emissions for a cement kiln is conservative, because they contribute to less than 0.01% of the total emissions, far below the confidence level for the CO₂ data calculations. This is confirmed in the VDZ Environmental Report 2001 (English) and 2004 (German). The CH₄ and N₂O 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 this data will be archived:**

ID number <i>(Please use numbers to ease cross-referencing to D.2)</i>	Data variable	Source of data	Data unit	Measured (m), calculated (c) or 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	tCO ₂	C	Annually	100%	Electronic	
P3	PE _{kiln,y}	Plant records	tCO ₂	C	Annually	100%	Electronic	
P8	PE _{RM,y}	Plant records	tCO ₂	C	Annually	100%	Electronic	
P9	PE _{coal,y}	Plant records	tCO ₂	C	Annually	100%	Electronic	
P10	PE _{coal_electr,y}	Plant records	tCO ₂	C	Annually	100%	Electronic	
P11	PE _{coal_fuel,y}	Plant records	tCO ₂	C	Annually	100%	Electronic	
P12	PE _{slag,y}	Plant records	tCO ₂	C	Annually	100%	Electronic	



P13	$EF_{el,y}$	Plant records	tCO ₂ /MWh	C	Annually	100%	Electronic	Baseline carbon emission factors for JI projects reducing electricity consumption ¹⁴ . See annex 2.
P14	$EF_{fuel,i,y}$	Plant records	tCO ₂ /GJ	C	Annually	100%	Electronic	
P15	$NCV_{fuel,i}$	Plant records	GJ/tonne	m/c	Per shipment	100%	Electronic	Weighted average of all shipments will be taken over a calendar year for each fuel.
P16	$CLNK_{PR,y}$	Plant records	tonnes	M	Annually	100%	Electronic	
P17	$CaO_{clnk,y}$	Plant records	%	M	daily	100%	Electronic	Yugcement plant laboratory measurement
P18	$MgO_{clnk,y}$	Plant records	%	M	daily	100%	Electronic	Yugcement plant laboratory measurement
P19	$RM_{PR,y}$	Plant records	tonnes	M	Annually	100%	Electronic	
P20	$CaO_{RM,y}$	Plant records	%	M	daily	100%	Electronic	Yugcement plant laboratory measurement
P21	$MgO_{RM,y}$	Plant records	%	M	daily	100%	Electronic	Yugcement plant laboratory measurement
P22	$FF_{fuel,i,y}$	Plant records	tonnes	M	continuously	100%	Electronic	The metering of fuel consumption will be designed consistent with the monitoring plan.

¹⁴ “Operational Guidelines for Project Design Documents of Joint Implementation Projects”, Version 2.3



P23	EL _{RM,y}	Plant records	MWh	M	Continuously	100%	Electronic	The monitoring of electricity consumption will be designed consistent with the monitoring plan. Calibration frequency will be in accordance with instructions of suppliers.
P24	EL _{mill&conway,y}	Plant records	MWh	M	Continuously	100%	Electronic	The monitoring of electricity consumption will be designed consistent with the monitoring plan. Calibration frequency will be in accordance with instructions of suppliers.
P25	FC _{dryer,y}	Plant records	GJ	m/c	Continuously	100%	Electronic	Fuel for dryer's heat generator can be both, natural gas or coal
P26	EL _{slag,y}	Plant records	MWh	M	Continuously	100%	Electronic	The monitoring of electricity consumption will be designed consistent with the monitoring plan. Calibration frequency will be in accordance with instructions of suppliers.
P27	FC _{slag,y}	Plant records	GJ	M	continuously	100%	Electronic	The monitoring of fuel consumption will be designed consistent with the monitoring plan. Calibration frequency of the meter will be in accordance with instructions of suppliers.

Table 10: Data to be collected in order to monitor emissions from the project

D.1.1.2. Description of formulae used to estimate project emissions (for each gas, source etc.; emissions in units of CO₂ equivalent):
--

$$PE_y = PE_{calc,y} + PE_{kiln,y} + PE_{RM,y} + PE_{coal,y} + PE_{slag,y} \quad (1)$$

Where:

PE_y Project emission in year y (tCO₂)

PE_{calc,y} Project emission due to calcinations in year y (tCO₂)



$PE_{kiln,y}$ Project emission from combustion of kiln fuels in year y (tCO₂)

$PE_{RM,y}$ Project emission due to fuel and electricity consumption for raw meal preparation (drying, milling, handling) and kiln electricity consumption (tCO₂)

$PE_{coal,y}$ Project emission due to kiln fuel (coal) preparation (grinding, drying, conveying) in year y (tCO₂)

$PE_{slag,y}$ Project emission due to slag preparation in year y (tCO₂)

Calcination

During processing (pyroprocessing) of raw materials mix into a rotary kiln decomposition of limestone at high temperature takes place and CO₂ is released. The amount of CO₂ released is defined as follows:

$$PE_{calc,y} = 0.785(CLNK_{PR,y} \times CaO_{CLNK,y} - RM_{PR,y} \times CaO_{RM,y}) + 1.092(CLNK_{PR,y} \times MgO_{CLNK,y} - RM_{PR,y} \times MgO_{RM,y}) \quad (2)$$

Where:

0.785	is the stoichiometric emission factor for CaO (tCO ₂ /tCaO)
1.092	is the stoichiometric emission factor for MgO (tCO ₂ /tMgO)
CaO _{CLNK,y}	is the non-carbonate CaO content in clinker in % in year y
CaO _{RM,y}	is the non-carbonate CaO content in raw meal in % in year y
MgO _{CLNK,y}	is the non-carbonate MgO content in clinker in % in year y
MgO _{RM,y}	is the non-carbonate MgO content in raw meal in % in year y
CLNK _{PR,y}	is the annual production of clinker in wet kilns in year y (tonnes)
RM _{PR,y}	is the annual consumption of raw meal of wet kilns in year y (tonnes)

Kiln fuel

There can be different kind of fuels used at the same time; therefore the emissions of each of fuels will be taken into account.

The emissions due to combustion of fuel of type i in kilns are defined as follows:

$$PE_{kiln,y} = \sum_i FF_{fuel_i,y} \times EF_{fuel_i,y} \times NCV_{fuel_i,y} \quad (3)$$



Where:

$FF_{fuel_i,y}$ is the kiln fuel of type i consumption in year y (tonnes)
 $NCV_{fuel_i,y}$ is the Net Calorific Value of fuel of type i in year y (GJ/ton)
 $EF_{fuel_i,y}$ fuel of type i Emission Factor (tCO₂/GJ)

Raw mill preparation and kiln electricity consumption

The formula below is used to calculate the emission due to electricity consumption of raw material preparation and kilns electricity consumption.

$$PE_{RM,y} = EF_{el,y} \times EL_{RM,y} \quad (4)$$

Where:

$EF_{el,y}$ is the carbon emission factor of electricity grid of Ukraine in year y (tCO₂/MWh)
 $EL_{RM,y}$ is the electricity consumption of raw meal preparation and electricity consumption of wet kilns in year y (MWh)

$$PE_{RM,y} = EF_{el,y} \times EL_{RM,y} \quad (5)$$

Coal preparation

$$PE_{coal,y} = PE_{coal_electr,y} + PE_{coal_fuel,y} \quad (6)$$

Where $PE_{coal_electr,y}$ and $PE_{coal_fuel,y}$ are the project emissions due to electricity consumption for coal milling and conveying and fuel consumption by heat generator used to dry the coal in year y (tCO₂). They are defined as follows:

$$PE_{coal_electr,y} = EF_{el,y} \times EL_{mill\&convey,y} \quad (7)$$

Where:

$EF_{el,y}$ is the carbon emission factor of electricity grid of Ukraine in year y (tCO₂/MWh)
 $EL_{mill\&convey,y}$ is the electricity consumption for coal milling and conveying in year y (MWh)

$$PE_{coal_fuel,y} = EF_{fuel_i,y} \times FC_{dryer,y} \quad (8)$$

Where:



$EF_{fuel_i,y}$ is the emission factor of fuel of type i used in heat generator for drying the coal in year y (tCO₂/GJ)

$FC_{dryer,y}$ is the fuel consumption of heat generator used for drying the coal in year y (GJ)

Slag preparation

The slag preparation and handling require heating and the second stage also grinding which therefore results in additional fuel and electricity consumption

$$PE_{slag,y} = EL_{slag,y} \times EF_{el,y} + FC_{slag,y} \times EF_{fuel_i} \quad (9)$$

Where:

$PE_{slag,y}$ is the project emission due to slag preparation in year y (tCO₂)

$EL_{slag,y}$ is the electricity consumption due to slag milling and handling in year y (MWh)

$EF_{el,y}$ is the carbon emission factor of electricity grid of Ukraine in year y (tCO₂/MWh)

$FC_{slag,y}$ is the fuel consumption of slag dryer in year y (GJ)

EF_{fuel_i} is the carbon emission factor of fuel combusted in slag dryer, (tCO₂/GJ)

D.1.1.3. Relevant data necessary for determining the <u>baseline</u> 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	$BE_{kiln,y}$	Plant records	tCO ₂	C	annually	100%	electronic	
B4	$BE_{RM,y}$	Plant records	tCO ₂	C	annually	100%	electronic	



B5	$BE_{\text{coal},y}$	Plant records	tCO2	C	annually	100%	electronic	
B6	$BE_{\text{coal_electr},y}$	Plant record	tCO2	C	annually	100%	electronic	
B7	$BE_{\text{coal_fuel},y}$	Plant records	tCO2	C	annually	100%	Electronic	
B8	$CLNK_{BL,y}$	Plant records	tonnes	C	annually	100%	Electronic	
B9	$CLNK_{CAP}$	Plant records	tonnes	C	annually	100%	Electronic	Maximum capacity of all kilns operating in the baseline scenario, see annex 2.
B10	$RM_{BL,y}$	Plant records	tonnes	C	annually	100%	Electronic	
B11	BKE_{wet}	Plant records	GJ/tonne of clinker	m/c	annually	100%	Electronic	This value has been fixed using the average of 2005,2006 and 2007. See annex 2
B12	$EF_{\text{fuel}_i,y}$	Plant records	tCO2/ GJ	m/c	Per shipment	100%	Electronic	Weighted average of all shipments will be taken over a calendar year.
B13	BEL_{RM}	Plant record	MWh/ton of clinker	m/c	annually	100%	Electronic	This value has been fixed using the average of 2005, 2006 and 2007. See annex 2
B14	$ELSP_{\text{coalmill_PR},y}$	Plant record	MWh/ton of coal	C	annually	100%	Electronic	
B15	$FC_{\text{coal_BL},y}$	Plant record	Tonnes of coal	C	annually	100%	Electronic	



B16	$FSP_{heat_gen_i_PR,y}$	Plant record	GJ/ton of coal	m/c	annually	100%	Electronic	
B17	$EF_{el,y}$	Plant record	tCO ₂ /MWh	C	Annually	100%	Electronic	Baseline carbon emission factors for JI projects reducing electricity consumption ¹⁵ . See annex 2.

Table 11: Relevant data necessary for determining the baseline of anthropogenic emissions by sources of GHGs within the project boundary

D.1.1.4. Description of formulae used to estimate baseline emissions (for each gas, source etc.; emissions in units of CO₂ equivalent):

As further described in Annex 2

$$BE_y = BE_{calc,y} + BE_{kiln,y} + BE_{RM,y} + BE_{coal,y} \quad (10)$$

Where:

BE_y Baseline emission in year y (tCO₂)

$BE_{calc_wet,y}$ Baseline emission due to raw mill calcination in kilns in year y (tCO₂)

$BE_{kiln_wet,y}$ Baseline emission from combustion of fuels in year y (tCO₂)

$BE_{RM_wet,y}$ Baseline emission due to fuel and electricity consumption for raw meal preparation (drying, milling, handling) and kiln electricity consumption in wet kilns (tCO₂)

$BE_{coal,y}$ Baseline emission due to kiln fuel (coal) preparation (grinding, drying, conveying) in year y (tCO₂)

$BE_{slag,y}$ Baseline emission due to slag preparation in year y (tCO₂)

Calcination baseline

According to ACM0015 the emission from calcinations (decarbonisation) of raw material containing CaCO₃ and MgCO₃ into the CaO and MgO with release of CO₂ in the kiln is defined as follows:

$$BE_{calc_wet} = 0.785(CLNK_{BL,y} \times CaO_{CLNK_BL} - RM_{BL,y} \times CaO_{RM_BL}) + 1.092(CLNK_{BL,y} \times MgO_{CLNK_BL} - RM_{BL,y} \times MgO_{RM_BL}) \quad (11)$$

Where:

¹⁵ “Operational Guidelines for Project Design Documents of Joint Implementation Projects”, Version 2.3



0.785	is the stoichiometric emission factor for CaO (tCO ₂ /tCaO)
1.092	is the stoichiometric emission factor for MgO (tCO ₂ /tMgO)
CaO _{CLNK_BL}	is the baseline non-carbonate CaO content in clinker produced by kilns in %
CaO _{RM_BL}	is the baseline non-carbonate CaO content in raw meal in %
MgO _{CLNK_BL}	is the baseline non-carbonate MgO content in clinker in %
MgO _{RM_BL}	is the baseline non-carbonate MgO content in raw meal in %
CLNK _{BL,y}	is the clinker production in baseline scenario in year y (tonnes) ¹⁶
RM _{BL,y}	is the consumption of raw meal in baseline scenario in year y (tonnes).

Kiln fuel baseline

Emission of CO₂ due to combustion of fuel in the kilns is calculated using the fixed in the annex 2 value of kiln efficiency for existing on site wet kilns and volume of clinker produced in the baseline scenario on year y according to the following formula¹⁷:

$$BE_{kiln} = EF_{fuel_i,y} \times BKE_{wet} \times CLNK_{BL,y} \quad (12)$$

Where:

BKE _{wet}	is the average for 3 years baseline kiln efficiency for existing on site wet kilns (GJ/ton of clinker)
CLNK _{BL,y}	is the production of clinker in the baseline scenario in year y (tonnes)
EF _{fuel_i,y}	is the fuel of type <i>i</i> Emission Factor in year y (tCO ₂ /GJ)

Raw meal preparation and kiln electricity consumption baseline

$$BE_{RM,y} = EF_{el,y} \times BEL_{RM} \times CLNK_{BL,y} \quad (13)$$

Where:

BE _{RM,y}	is the baseline emission due to electricity consumption for preparation of raw meal and kilns electricity consumption in year y (tCO ₂)
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¹⁶ CLNK_{BL,y}=CLNK_{PR,y} as described in annex2

¹⁷ JI0001



$EF_{el,y}$	is the carbon emission factor of electricity grid of Ukraine in year y (tCO ₂ /MWh)
BEL_{RMt}	is the average for 3 last years specific electricity consumption of equipment for raw meal preparation and electricity consumption of existing on site wet kilns. See annex 2. (MWh/ton of clinker)
$CLNK_{BL,y}$	is the production of clinker in the baseline scenario on wet kilns in year y (tonnes)

Coal preparation baseline

$$BE_{coal,y} = BE_{coal_electr,y} + BE_{coal_fuel,y} \quad (14)$$

Where $BE_{coal_electr,y}$ and $BE_{coal_fuel,y}$ are the baseline emissions due to electricity consumption (for coal milling and conveying) and fuel consumption by heat generator used to dry the coal in year y (tCO₂). They are defined as follows:

In the baseline scenario the coal mill would have to mill more coal than compared to the project scenario for the same amount of clinker produced because of lower kiln efficiencies.

$$BE_{coal_el,y} = ELSP_{coalmill_PR,y} \times FC_{coal_BL,y} \times EF_{el,y} \quad (15)$$

Where:

$EF_{el,y}$	is the carbon emission factor of electricity grid of Ukraine in year y (tCO ₂ /MWh)
$ELSP_{coalmill_PR,y}$	is the specific electricity consumption for coal milling and coal conveying in year y (MWh/ton of coal)
$FC_{coal_BL,y}$	is the baseline consumption of coal for wet kilns in year y(tonnes)

In the baseline scenario no exhaust gases from the kilns can be used to dry the coal. Therefore in the baseline scenario a heat generator will be installed. The heat generator will start operating at the same time with the coal mill will be put into operation in the middle of 2009 and will continue operating under baseline scenario. The fuel for heat generator will be either natural gas or coal, or mixture of both. Similar to electricity consumption of coal mill, in the baseline scenario the coal dryer would have to dry more coal than in the project scenario for the same amount of clinker produced. And, therefore, the baseline emissions for heat generator fuel consumption are calculated by monitoring the actual fuel consumption by the heat generator and calculating it's specific fuel consumption as follows:

$$BE_{coal_fuel,y} = \sum_i FSP_{heat_gen_i_PR,y} \times FC_{coal_BL,y} \times EF_{fuel_i,y} \quad (16)$$



Where:

$EF_{fuel_i,y}$ is the emission factor of fuel of type i used in heat generator for drying the coal in year y (tCO₂/GJ)
 $FC_{coal_BL,y}$ is the baseline consumption of coal for kilns in year y (tonnes)
 $FSP_{coalmill_PR,y}$ is the specific consumption of fuel of type i for heat generator drying the coal (GJ/ton of coal)

$FC_{heat_gen_i_PR,y}$ is defined the following way:

$$FC_{coal_BL,y} = BKE_{wet} \times CLNK_{PR,y} \tag{17}$$

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

Not applicable.

D.1.2.1. Data to be collected in order to monitor emission reductions from the <u>project</u>, and how these data will be archived:									
ID number <i>(Please use numbers to ease cross-referencing to D.2.)</i>	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 CO₂ 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 CO₂ equivalent):

Due to reduced coal consumption, fewer emissions will occur in the coal mining and the transport to the plant. This leakages has not been taken into account for simplicity and to be conservative. Other leakages were not identified.

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 CO₂ equivalent):

$$ER_y = BE_y - PE_y \quad (18)$$

Where:

ER_y is emission reduction of the JI project in year y (tCO₂e)

BE_y is the baseline emissions in year y (tCO₂e)

PE_y is the project emissions in year y (tCO₂e)

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:

Atmospheric emissions are the only important source of pollution at Yugcement that has an impact on the local environment. According to the national requirements, atmospheric emissions have to be measured by making samples on the quarterly basis. Yugcement systematically collects data on the pollutants



that have an impact on the local environment. As of November 2007 the environmental laboratory of Yugcement is making measurements of the following emissions:

Gaseous pollutants (NO_x & SO_x)

Gaseous pollutants are measured by means of a mobile gas spectrometer. It is used to measure the gaseous emissions periodically every three months by taking samples with. Currently there are little emissions of SO_x at Yugcement, but the existing gas spectrometers would measure SO_x emissions should they appear.

Dust emissions

The emissions of dust are measured by the laboratory of Yugcement using the weighing method. The level of dust is being measured by weighing a filter installed for a certain time in the exhaust air flow. Samples are taken on a monthly basis.

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.
Table 11		
P14 $EF_{fuel_i,y}$	0.5%	An independent certification company will take samples of coal with frequency defined after the commissioning and will issue a certificate of the Net Calorific Value of each shipment. The IPCC default factors then will be used to calculate the EF. The financial department will store these certificates and will calculate the weighted average value of the Carbon Emission Factor (and the Net Calorific Value) at the end of each year. The natural gas supplier's laboratory will carry out measurement of NCV of gas supplied and issue a certificate. The financial department will store these certificates and will calculate the weighted average value of the Carbon Emission Factor (and the Net Calorific Value) at the end of each year.
P15 NCV_{fuel_i}	0.5%	Please, refer to P14



P16 $CLNK_{PR,y}$	2%	Annual sum of daily reports of kiln department. The measurements are based on constant measurement of slurry consumed by each rotary kiln and takes into account composition, moisture content and loss of Ignition (LOI) of slurry. These properties of slurry are tested every 4 hours by laboratory of Yugcement.
P17 $CaO_{clnk,y}$	0.3%	Accredited laboratory of Yugcement is taking samples and conduct the test. The data are archived. Frequency of tests every 4 hours. The laboratory department will calculate the weighted average.
P18 $MgO_{clnk,y}$	0.2%	Accredited laboratory of Yugcement is taking samples and conduct the test. The data are archived. Frequency of tests is every 4 hours. The laboratory department will calculate the weighted average.
P19 $RM_{PR,y}$	2%	Annual sum of daily reports of quarrying and raw material departments. See P23.
P20 $CaO_{RM,y}$	See P17	Please refer to P17. Frequency of testing once a day.
P21 $MgO_{RM,y}$	See P18	Please refer to P17. Frequency of testing once a day.
P22 $FF_{fuel,i,y}$	1%	Before each kiln, a coal weighting system will be installed to measure coal consumption of each kiln individually. The coal consumption will be metered and stored in electronic form. Calibration procedure to be done with respect to suppliers requirements by an authorized organization.
P23 $EL_{RM,y}$	1% or better	Individual electricity meters will be installed at the raw mill conveying and preparation and kiln system, enabling continuous measurement of the electricity consumption. Electricity meters are calibrated once every 3-6 years depending on the model selected; calibration is done by an authorized organization. The data metered will be supplied by the energy department to the Financial department.
P24 $EL_{mill\&conway,y}$	1% or better	Please refer to P37



P25 FC _{dryer,y}	1%	Fuel for heat generator of coal dryer can be both coal or natural gas. Coal consumption to the heat generator will be measured by weighting system. In case of gas consumed as fuel, gas meter will be used. Metered data will be supplied by the energy department to the Financial department.
P26 EL _{slag,y}	1%	Individual electricity meters will be installed to measure electricity consumption for slag milling and conveying. Electricity meters are calibrated once every 3-6 years depending on the model selected; calibration is done by an authorized organization. The data metered will be supplied by the energy department to the Financial department.
P27 FC _{slag,y}	1%	Fuel for heat generator of slag dryer will be gas. It's consumption to the heat generator will be measured by gas flow meter. Metered data will be supplied by the energy department to the Financial department.
Table 12		
B14 ELSP _{coalmill_PR,y}	1%	The metering system will be designed according to the monitoring plan to allow measurement of electricity consumption of coal milling and conveying and to measure the volume of coal milled. Therefore the specific value can be calculated.
B15 FSP _{heat_gen_PR, y}	1%	The metering system will be designed according to the monitoring plan to allow measurement of fuel consumed by heat generator of coal mill and to measure the volume of coal milled. Therefore the specific value will be calculated.

Table 12: Quality control (QC) and quality assurance (QA) procedures are being undertaken for data monitored

Internal quality system at Yugcement

The internal quality system at Yugcement is functioning in accordance with the national standards and regulations in force. The quality of cement, clinker and all raw components is continuously controlled by the laboratory of the plant. The laboratory is certified by the Mykolayiv Regional State Metrology, Standardisation and Accreditation Agency of Ukraine, certificate №PH-0116 /2006.

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

Three departments of Yugcement will be responsible for collecting the information for monitoring purposes.

**The laboratory of Yugcement**

The laboratory of Yugcement is responsible for quality control of cement, clinker and raw components.

Energy department

The energy department is responsible for control of fuel and electricity consumption at Yugcement. It collects data from the individual electricity meters installed at the production units that consume electricity, and the 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 individual electricity meters is cross-checked with the data of the commercial meter. For the purposes of monitoring, the energy department will report electricity consumption level of the kiln system and the raw milling system, and provide it to the financial department.

Financial department

The financial department is responsible for accounting, controlling and planning/ It will hold the overall responsibility for implementation of the monitoring plan, like organizing and storing the data and calculation the emission reductions. The financial department will also prepare the annual Monitoring Protocols, to be presented to a Verifier of the emission reductions. Other departments of Yugcement will submit relevant data to the financial department for the monitoring purposes. In addition to the preparation of the Annual Monitoring Protocols, the laboratory will conduct an internal audit annually to assess project performance and if necessary make corrective actions.

Apart of internal departments of Yugcement, three independent external organizations will be contracted to provide the data necessary for monitoring plan implementation:

The laboratory of the Mykolayiv regional gas distribution system of

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

Independent certification body

This body will be contracted by Yugcement to measure the net calorific value of fuel delivered.

Independent surveying company

This company will be contracted if needed, to supervise and approve the in-house survey of the opening (and closing) stocks of coal, cement, clinker, and mineral components.

The data from all external organizations will be collected by the laboratory of Yugcement for monitoring purposes. For the usual routine procedures all the data has to be stored for three years for the purposes of the independent financial audit. For the purpose of the monitoring system implementation, the collected data



will be stored by the Laboratory department at least for two years after the end of the crediting period – i.e. at least until 2014. For a detailed description of each measured value, please refer to section D.2.

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

- JSC Yugcement
- Global Carbon B.V.

For contact details refer to annex 1.

**SECTION E. Estimation of greenhouse gas emission reductions****E.1. Estimated project emissions:**

Project emissions			2008	2009	2010	2011	2012	
1	from calcination	[tCO ₂ /yr]	514 500	446 250	446 250	446 250	446 250	
2	from kiln fuel	[tCO ₂ /yr]	335 791	414 348	523 387	523 387	523 387	
3	from electricity consumed by kiln and raw material preparation	[tCO ₂ /yr]	77 444	77 444	77 444	77 444	77 444	
4	from coal preparation	[tCO ₂ /yr]	0	3 694	7 387	7 387	7 387	
5	from slag preparation	[tCO ₂ /yr]	884	8 994	11 361	11 361	11 361	
6	Total	[tCO ₂ /yr]	928 618	950 730	1 065 830	1 065 830	1 065 830	
7	Total 2008-2012	[tCO ₂]	5 076 838					

Table 13: Estimated project emissions

E.2. Estimated leakage:

0

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

Project emissions			2008	2009	2010	2011	2012	
1	from calcination	[tCO ₂ /yr]	514 500	446 250	446 250	446 250	446 250	
2	from kiln fuel	[tCO ₂ /yr]	335 791	414 348	523 387	523 387	523 387	
3	from electricity consumed by kiln and raw material preparation	[tCO ₂ /yr]	77 444	77 444	77 444	77 444	77 444	
4	from coal preparation	[tCO ₂ /yr]	0	3 694	7 387	7 387	7 387	
5	from slag preparation	[tCO ₂ /yr]	884	8 994	11 361	11 361	11 361	
6	Total	[tCO ₂ /yr]	928 618	950 730	1 065 830	1 065 830	1 065 830	
7	Total 2008-2012	[tCO ₂]	5 076 838					

Table 14: Estimated project emissions

E.4. Estimated baseline emissions:

Baseline emissions			2008	2009	2010	2011	2012	
1	from calcination	[tCO ₂ /yr]	525 000	525 000	525 000	525 000	525 000	
2	from kiln fuel	[tCO ₂ /yr]	340 480	462 080	583 680	583 680	583 680	
3	from electricity consumed by kiln and raw material preparation	[tCO ₂ /yr]	77 444	77 444	77 444	77 444	77 444	
4	from coal preparation	[tCO ₂ /yr]	0	4 119	8 238	8 238	8 238	
5	Total	[tCO ₂ /yr]	942 924	1 068 643	1 194 363	1 194 363	1 194 363	
6	Total 2008-2012	[tCO ₂]	5 594 656					

Table 15: Estimated baseline emissions

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

Reductions		2008	2009	2010	2011	2012
Total	[tCO ₂ /yr]	14 306	117 913	128 533	128 533	128 533
Total 2008 - 2012	[tCO₂]	517 818				

*Table 16: Difference representing the emission reductions of the project***E.6. Table providing values obtained when applying formulae above:**

Year	Estimated project emissions (tonnes of CO ₂ equ.)	Estimated leakage (tonnes of CO ₂ equ.)	Estimated baseline emissions (tonnes of CO ₂ equ.)	Estimated emission reductions (tonnes of CO ₂ equ.)
Year 2008	928 618	0	942 924	14 306
Year 2009	950 730	0	1 068 643	117 913
Year 2010	1 065 830	0	1 194 363	128 533
Year 2011	1 065 830	0	1 194 363	128 533
Year 2012	1 065 830	0	1 194 363	128 533
Total (tonnes of CO ₂ equ.)	5 076 838		5 594 656	517 818

*Table 17: Overview of project, baseline, and emission reductions***Risks and uncertainties**

The estimation of the emissions reductions of this project is based on several assumptions. The following factors are of influence of the actual emission reductions. The assumptions are given that have been used for the estimation:

- Commissioning date of the slag subproject first stage is 1/7/2008
- Clinker production will be at the level of 930 ktonnes annually
- Kiln economy of wet kilns is 6.08 GJ/t clinker without addition of slag into raw meal
- Fuel Carbon Emission Factor of coal fuel is 0.096 tCO₂/GJ

The first two assumptions are not within the full control of Yugcement as clinker (cement) production depends on the development of the cement market in Ukraine and the commissioning data depends on obtaining JI approval. The other three factors have a higher certainty.

**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 certain impact on the local environment. In Ukraine emission levels in industry are regulated by operating licenses issued by regional offices of the Ministry for Environmental Protection on the individual basis for every enterprise that has significant impact on the environment. The current levels of the emissions of the main pollutants (dust, sulphur oxides and nitrogen oxides), are in compliance with the requirements of the plant's operational license.

Types of atmospheric emissions (as described in the operational licence) and relevant measurement techniques are presented below.

The project foresees introduction of modern auxiliary equipment, designed to meet the strongest pollution restrictions. New burners to be installed having modern control systems will allow to better maintain optimal combustion mode thus contributing to reduction of such pollutants, like CO and NO_x.

Currently the design of the slag addition equipment has been started and will be followed by detailed assessment of environmental impact (OVNS in Ukrainian abbreviation) when complete.

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, clinker coolers and cement mills. Dust emissions from Yugcement are monitored on a regular basis in compliance with 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 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 (State Organization for Standardization, Metrology and Certification).

Dust emissions are expected not to be influenced by the slag addition project.

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 after project commissioning the emissions will stay the requirements of the Ukrainian legislation and within the range the Best Available Technology¹⁸ levels of IPPC.

SO_x emissions in cement production originate mainly from raw material and also from coal with sulphur content combustion. The sulphur content in the raw materials used at Yugcement is insignificant and SO_x emissions are not observed and should not increase after the implementation of the project. However, the gas analyzing equipment of Yugcement will allow monitoring the gaseous emissions of sulphur oxide in case they will appear.

¹⁸ IPPC Reference Document on Best Available Techniques in the Cement and Lime Manufacturing Industries, December 2001



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 environmental impacts of the project are positive as the project expects to reduce the impact of the existing facility. An Environmental Impact Assessment is not necessary at this stage of project development. The impact on the environment of the project will be assessed by the Ukrainian authorities in the following way.

The environmental impacts will be assessed before obtaining a construction permit. The general principles of evaluating the environmental impact (OVNS, which is the Ukrainian abbreviation) procedure in Ukraine are described by the national laws “On the environmental protection” and “On the environmental expertise”. According to the national legislation in force, every project or new activity that can be potentially harmful for the environment, must evaluate the environmental impact^{19 20}.

These environmental impacts are analysed after the development of the detailed project design in order to obtain a construction permit. The OVNS document must provide a list of viable project alternatives, a description of the current state of local environment, description of the main pollutants, risk evaluation and an action plan for pollution minimisation. The final OVNS document has to be presented as a separate volume of the project documentation for the evaluation by a state expert company and, optionally may be the subject of public hearing.

The national procedure for receiving the construction permit in general cases is described below.

1. Approval by the local authorities

On the initial stage of the project design preparation Yugcement will conduct consultations with the local authorities, namely the council of town Olshanske and the administration of the Mykolayiv region (oblast). Local authorities will be provided with the general information (the so-called notification on the planned activity) about the envisaged project.

2. Setting requirements for the project

In the case of positive conclusion of the consultations, local authorities will issue approval for developing: a) general project design; b) architectural and planning document; c) terms of reference for the project. These three documents are to contain specific environmental, sanitary, architectural and other requirements for the project.

3. Project design phase

Upon the formulation of the requirements from the local authorities and developing the terms of reference, Yugcement will contract a design institute to prepare the project design documentation package. This package has to include:

- general project description;
- assessment of environmental impact (OVNS);
- time schedule for the construction works;
- project budget;
- blueprints of the architectural design, general planning and transport.
- Project evaluation

¹⁹ The Law of Ukraine “On the environmental expertise”, Articles 8, 15, 36

²⁰ The Law of Ukraine “On the environmental protection”, Article 51



After the preparation of the full project design documentation, as elaborated above, Yugcement will contract an authorized state company to conduct independent evaluation of the project. The evaluation procedure includes receiving of approvals from the following state authorities:

- sanitary authority;
- state authority on environmental protection;
- fire prevention authority;
- energy saving authority;
- labour safety authority.

One of the mandatory parts of the state evaluation procedure is the stakeholder consultation process. All interested parties can submit their comments to the project to the company performing the evaluation process. National regulations do not formulate how the stakeholder consultations have to be held. However, Yugcement is committed to actively publish the information about potential impacts of the project (including the environmental impact) and will take into account the comments from all stakeholders.

4. Construction design

Either after receiving positive conclusion of the state evaluation or in parallel with the evaluation process, Yugcement can start the design of construction documentation. The construction documents shall include construction blueprints, specifications of the equipment and construction materials, construction budget, etc.

5. Receiving the construction permit

The package of construction design documents, project design documentation and positive conclusions of the state evaluation have to be submitted to the local authority on the construction and architecture, which finally issues the construction permit.

The preliminary schedule for the preparation of the project to Ukrainian permitting requirements is as follows:

- Preliminary Discussion with Local Authorities January 2008
- Preliminary Engineering January 2008
- Permit Application Procedure February-March 2008
- Permit Application Evaluation March 2008
- Detailed construction design March-April 2008
- Grant of Permit April 2008
- Construction Start April 2008

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

JI projects are not required to go through a (local) stakeholders' consultation. However, Yugcement and Dyckerhoff are planning to present the project to the regional authorities at a later stage. In the course of obtaining the construction permit, Yugcement will actively publish information about the project to stakeholders.

Annex 1**CONTACT INFORMATION ON PROJECT PARTICIPANTS**

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Annex 2**BASELINE INFORMATION****Capacity of existing wet kilns****Existing wet kilns**

Since beginning of 1970s Yugcement operates two wet process rotary kilns. The kilns have design capacity of 72 t clinker/hour each. Wet rotary kilns can be operated some 315 to 320 days per year. The kiln run factor can be within 0.94-0.96. The total production capacity of the existing installation is approximately 1.1 million tonnes of clinker per year ($CLNK_{CAP}$). Over past years, however the utilisation of capacity was lower. The baseline clinker production in year y $CLNK_{BL,y}$ will be equal to the clinker production measured in year y $CLNK_{PR,y}$ with maximum $CLNK_{CAP}$.

Determination of baseline factors

Adoption of BFS into a raw material mix results in reduction of CO₂ emission from calcination and also from kiln fuel combustion for both, wet and dry processes.

Baseline kiln economy of wet kilns

The baseline kiln economy BKE is determined by taking the average of the most recent three years available measurements by the following formula:

$$BKE_{wet} = \sum_y \frac{FC_y \times NCV_y}{CLNK_y} \times \frac{1}{3} \quad (19)$$

Where:

- BKE_{wet} Average baseline kiln economy per tonne of clinker (GJ/t clinker)
 y Years 2005, 2006 and 2007
 FC_y Quantity of fossil fuel burnt for clinker production in year y (1000 Nm³)
 NCV_y Net calorific value fossil fuel in year y (GJ/1000 Nm³)
 $CLNK_y$ Amount of clinker produced in year y (tonne of clinker)

The result is presented below in the table:

Year	2005	2006	2007	Average
Kiln economy (GJ/t clinker)	6.08	6.01	6.15	6.08

Table 18: Measured kiln economy and calculated average

As can be seen in the table above, the kiln economy is rather a stable figure with small fluctuations. Therefore the baseline kiln economy can be established by taking the historic average value of the kiln economy and the BKE_{wet} is taken as 6.08 GJ/tonne of clinker.

Baseline content of CaO and MgO in the raw meal and in the clinker

The content of CaO and MgO in the raw material mix and in the clinker produced has been determined by extrapolating historic measured content.

Year	2005		2006		2007		Average	
	CaO	MgO	CaO	MgO	CaO	MgO	CaO	MgO
Content in raw meal, %	42.19	1.36	42.31	1.31	42.40	0.83	42.3	1.167
Content in clinker	64.96	2.09	65.19	2.04	65.56	1.29	65.24	1.81



Table 19: Measured CaO and MgO content

As shown in the table below, the fluctuation of Ca and Mg oxides content in raw meal fluctuates in a narrow range and therefore the average values will be taken as 42.3 % for $\text{CaO}_{\text{RM_BL}}$ and 1.167 % for $\text{MgO}_{\text{RM_BL}}$. Similarly, for the clinker the values are fixed as 65.24 and 1.81%.

Baseline electricity consumption raw milling and kiln drives for wet kilns

The specific electricity consumption of the raw milling and the kiln $\text{BEL}_{\text{RM_wet}}$ (MWh/t clinker) has been determined by extrapolating historic measured consumption.

The specific data are presented in a table below.

Year	2005	2006	2007	Average
$\text{BEL}_{\text{RM_wet}}$, kWh/t clinker	98	81,3	80	86,43

Table 20: Measured electricity consumption of raw milling and kiln drives and calculated average

The average $\text{BEL}_{\text{RM_wet}}$ is 51.65 kWh/t clinker.

Baseline electricity consumption coal mill

The electricity consumption of the coal mill in the baseline scenario will be calculated as described in section D.1.1.4. For the purpose of estimating the emission reduction potential in section E, the electricity consumption of the coal mill in the baseline scenario has been set at 17 kWh/t coal, based on preliminary equipment specifications.

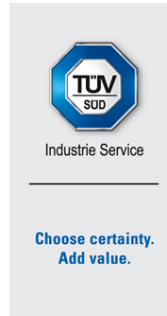
Baseline specific fuel consumption heat generator coal mill

The specific natural gas consumption of the heat generator $\text{FSP}_{\text{coalmill_PR,y}}$ (GJ/tonne coal) will be determined by taking actual measurements of operation of the heat generator (since second half of 2009 onwards), after commissioning of the coal mill, and before commissioning of the semi-dry kiln.

For the purpose of estimating the emission reduction potential in section E, the specific fuel consumption $\text{FSP}_{\text{coalmill_PR,y}}$ has been set at 0.3 GJ/tonne coal based on 12% coal moisture content assumption.

Baseline electricity factor

The baseline emission factor of the Ukrainian grid $\text{EF}_{\text{el,y}}$ is taken as 0.896 tCO₂/MWh as set in the standardised baseline factor for Ukrainian electricity grid for JI projects reducing electricity consumption in years 2008-2012 and presented in the document below.



Ukraine - Assessment of new calculation of CEF

Introduction

Many Joint Implementation (JI) projects have an impact on the CO₂ emissions of the regional or national electricity grid. Given the fact that in most Economies in Transition an integrated electricity grid exists, a standardized baseline should be used to estimate the amount of CO₂ emission reductions on the national grid.

The Ukraine is one of the major JI host countries where many grid related projects have been developed or will be implemented. In order to enhance the project development and reliability in emission reductions from the Ukraine a standardized and common agreed grid factor expressing the carbondioxid density per kWh is crucial.

Objective

Global Carbon B.V. is one of the pioneers developing JI projects in Ukraine who has developed a baseline approach for determining the Ukrainian grid factor. The approach is implied from the approved CDM methodology ACM0002.

The team of Carbon Management Service (CMS) of TÜV SÜD Industrie Service GmbH with its accredited certification body "Climate and Energy" has been ordered to verify the developed approach and the calculated grid factor.

Once an approach is agreed it should be used for calculating the grid by using current available data served from the Ukraine Ministry for Fuel and Energy.

Such annual grid factor shall be used as a binding grid factor for JI projects developed in the Ukraine.

Scope

The baseline approach to which this confirmation is referring is attached. The confirmation includes the inherent approach if the algorithms are developed reasonable and from a technical point of view correct. Furthermore the verified the

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The test results refer exclusively to the units under test.

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Headquarters: Munich

Trade Register: Munich HRB 96 869





Our reference/Data: IS-USC-MUC/ / 17.08.2007



Industrie Service

origin of the data. The team consists of:

- Werner Betzenbichler (Head of the certification Body "Climate and Energy"),
- Thomas Kleiser (Head of division JI/CDM, GHG-Auditor and Project Manager)
- Markus Knödseder (GHG-Auditor and Project Manager)

Mr. Kleiser and Betzenbichler assessed the baseline approach and agreed with Global Carbon on the conclusive approach. Mr. Kleiser and Mr. Knödseder assessed the calculation model whereas Mr. Knödseder interviewed also Mr. Nikolay Andreevich Borisov, Deputy Director for Strategic Development in Ministry of Fuel and Energy (+380 (44) 2349312 // borisov@mintop.energy.gov.ua) who explained the process of data gathering in the Ukraine. He also confirmed that GlobalCarbon B.V. uses the served data.

Conclusion

The conclusive assessment does not include potential uncertainties that might be occurred in the data gathering process of the ministry. Considering that we confirm that applied data served by Ministry of Fuel and Energy are reliable and correctly used.

Based on submitted calculation method, developed baseline study (see attachment), applied data and written confirmation from Ministry of Fuel and Energy (see attached documents) the team of Carbon Management Service of TÜV SÜD Industrie Service GmbH with its accredited certification body "Climate and Energy" confirms further that developed approach is eligible to determine the Ukrainian electricity grid factor as a standard value for JI project in the Ukraine.

The team recommends updating the calculation annually depending on point of time when national consolidated data are available.

Munich, 17/08/2007

Markus Knödseder
GHG-Auditor and Project Manager

Munich, 17/08/2007

Werner Betzenbichler
Head of the certification Body "Climate and Energy" and Carbon Management Service



Annex 3

MONITORING PLAN

See Section D for the monitoring plan