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

CONTENTS

Annexes

SECTION A. General description of the project

A.1. Title of the project:

Ivano-Frankivsk Cement Switch from Wet-to-Dry Cement and fuel savings for coal drying, Ukraine. Version 1.4, August 26, 2009.The sectoral scope of the project is scope (8) Mining/mineral production.

A.2. Description of the project:

(a) Situation existing prior to the start of the project: Cement manufacturing is a highly complex process which requires the consumption of substantial amounts of energy. As a result of having high energy consumption, cement manufacturing produces significant amounts of greenhouse gas (GHG), specifically CO_2 emissions. Cement production generally creates three main sources of emissions which are a result of the following main activities; (1) Combustion of fossil fuel (2) Electricity consumption, and (3) Chemical decomposition of limestone (referred to as the calcination process). This project aims at substantially reducing the first two streams of emissions by implementing two primary project activities, as follows:

1) Switch from wet-to-dry cement production (including capacity expansion) resulting in significant fuel savings
2) Utilization of waste heat for processing coal drying

JSC Ivano-Frankivsk Cement (IF Cement) has been producing cement since 1964. Currently the company produces approximately 450 000 tonnes of clinker per year using the wet technology for cement production. The current 450 000 tonnes of clinker are produced by three separate wet kilns.

(b) Description of baseline scenario: The baseline scenario identified for the project is a hybrid between a project-specific and sector-wide baseline. This is due to a clinker production capacity expansion in project which must be compared against a sector-wide energy intensity, using the assumption that if the additional capacity had not been produced at the IF Cement facility, it would have been produced by other production facilities in the Ukraine. Therefore, for all production capacity up to 450 000 tonnes clinker/year (i.e. the previous production capacity) the baseline is derived from the energy intensity of the previous wet production process. For all increases in production beyond 450 000 tonnes clinker/year, the baseline is derived from the energy intensity in a sector wide baseline that has been estimated in the Volyn Cement PDD[1].

(c) Project scenario: Under the project IF Cement will decommission one wet kiln and replace it with a new in-line dry technology kiln. The old wet kiln, with a 160 000 tonne clinker capacity,

[1] Adapted from Volyn-Cement Project Design Document, PDD version 1.5, January 30, 2008, http://ji.unfccc.int/UserManagement/FileStorage/UWCFRFLURJEJMZ0SELJI9F7ECR33CU accessed on April 1, 2009

will be decommissioned as part of the project activity while the remaining two kilns will remain in operation while gradually reducing their production levels as the dry kiln replaces their capacity. Only one wet kiln, either wet kiln 1 or wet kin 2, will be running in unison with the new dry kiln; as all three kilns will not be operated simultaneously. In addition to the wet-to-dry switch, this component of the project will also result in a capacity expansion of more than 500 000 tonnes of clinker, all produced with the dry clinker production process.

The main component of the project is the set up and launch of a 4 stage In-Line Calciner kiln with dryer crusher, which represents Best Available Technology (BAT)[2]. The new kiln will affect the whole production process, especially a) crushing, storage, grinding and drying of raw materials, b) raw meal silo and kiln feed system c) the preheater, calciner and clinker cooler. When fully implemented, energy consumption and carbon emissions from fuel combustion per tonne of clinker will be reduced significantly compared with the wet process. Overall annual production capacity will be increased from 450 000 tonnes of clinker to approximately 950 000 tonnes, as the new dry kiln has a production capacity of 750 000 tonnes clinker per year. As the dry kiln comes on line the remaining wet kilns will be used less and may eventually be put out of service, making the ultimate plant capacity 750 000 tonnes of clinker per year[3]. Figure 1 shows the process of in-line calcining using a cyclone pre-heater and kiln.

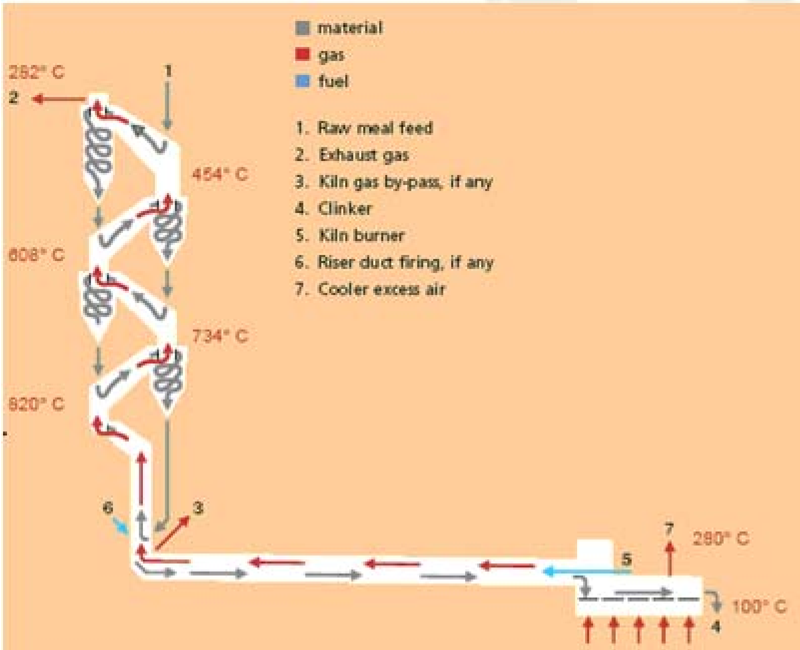

Figure 1: Schematic of in-line calciner[4]

Secondly, process changes in coal drying will utilize waste heat from the new dry kiln to eliminate the need to use natural gas for the purpose of drying. The moisture content of the coal

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[2] Best Available Techniques have been identified as dry to semi-dry processes. The most prevalent processes in CEMBUREAU countries are semi-dry processes. UKEEP Energy Assessment at JSC Ivano-Frankivskcement, Ukraine, report prepared for EBRD and BMF by denkstatt IC Consulenten.

[3] Capacity values provided by IF Cement from manufacturers specifications

[4] Online resource adapted from FLSmidth. http://www.flsmidth.com/FLSmidth/English/Product/Machines/Kiln+Systems/Preheater+kiln.htm

requires that it be passed through a drying/crushing process before being used within the kilns. Under the project scenario waste heat from the new dry kiln will be utilized as opposed to drying coal via the combustion of natural gas for this process.

Brief Summary of JI Project History

The use of JI mechanism was considered by IF Cement at the early stages of developing the project. The UKEEP energy efficiency programme has commissioned an energy audit report from IC Consulenten. The UKEEP report has covered the possibility of ERU commercialization from wet-to-dry conversion, and provided initial projections of the emission reductions. The Project Idea Note of IF Cement was submitted to the DFP of Ukraine in August 2008. A Letter of Endorsement (reference 668/23/7) has been provided to IF cement on August 8, 2008. The host country letter of approval is expected after completing of the determination process.

A.3. Project participants:

Party Involved	Legal entity project participant (as applicable)	Please indicate if the Party involved wishes to be considered as project participant (Yes/No)
Ukraine (Host Party)	JSC Ivano-Franchivsk Cement	No
Netherlands, Spain, Switzerland	Stichting Carbon Finance (SCF)	No
Ukraine	Ukreximbank	No

A.4. Technical description of the project:

A.4.1. Location of the project:

The Ivano-Frankivsk Cement plant is located in Western Ukraine in the Ivano-Frankivsk Region. The geographic location of the project is shown within the map below.

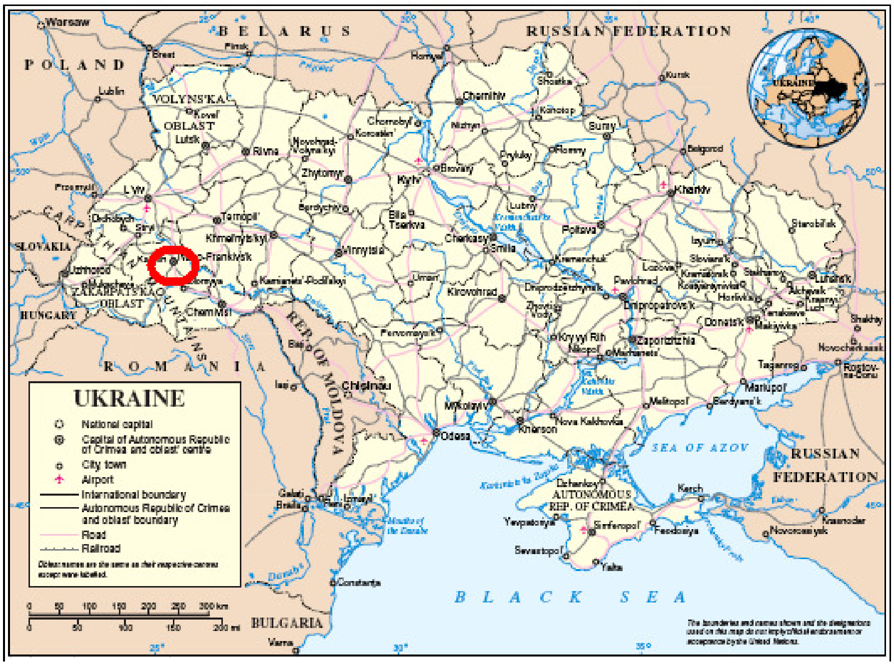

Figure 2: Geographic location of Ivano-Frankivsk Cement plant

A.4.1.1. Host Party(ies):

Ukraine

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

Ivano-Frankivsk Region

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

vil Yamnytsya, Tysmenytsya district

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

The IF Cement Plant is located at the following physical location:

48° 58'47.96 N 24°24'47.27 E

A physical image has been provided below.

Figure 3: Aerial photograph of Ivano-Frankivsk Cement plant [5]

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

The cement production cycle

The general process for cement production will remain the same from baseline to project with differences in the technology and an operational change being the main differences. The four main steps outlined below will remain the same.

Extraction

The major chemical compounds necessary for cement production are $CaCO_3$, SiO_2, Fe_2O_3 and Al_2O_3. The first compound can be found in limestone (or chalk) and the others are contained in marl (clay or loam). Therefore first these materials must be extracted from natural deposits and then crushed and transported to the cement production site.

Processing

Once the limestone and marl are crushed they are mixed in a proportion of approximately 3:1[6]. The processing can take place through two different processes, either in a wet kiln or a dry kiln. In wet production technology water is added to the crushed limestone and marl to form a slurry. The water is later evaporated in the drying section of the rotary kiln. Water is not added in the dry process, rather the raw materials are mixed, milled and homogenized. The waste heat from the dry kiln can be used to dry the raw materials before processing. The use of waste heat and the dry kiln are the measures and technology changes respectively that will be implemented by the project.

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[5] Image taken from Google Maps. www.google.ca/maps

[6] UKEEP Energy Assessment at JSC Ivano-Frankivskcement, Ukraine, report prepared for EBRD and BMF by denkstatt IC Consulenten,

Calcination and Sintering
This step is also called pyroprocessing because it uses heat to initiate a chemical reaction. The raw material moves to a rotary kiln where it is exposed to high temperatures. This produces the following chemical reaction:

$$CaCO_3 + heat = CaO + CO_2$$

The heat reacts with calcium carbonate to produce calcium oxide (lime) and carbon dioxide. Calcination is followed by a process called sintering where calcium oxide is exposed to high temperatures (between 1400-1450ºC) and reacts with the other chemical compounds present at these temperatures. These chemical reactions produce clinker. The clinker is then cooled and heat returned to the process by a clinker cooler.

Cement Production

To get to the final product, cement, the clinker must be finely milled into powder in the cement mills. In this final step mineral components such as fly ash or slag are added to the clinker and milled together in order to produce different types of cement.[7]

Technology employed prior to project implementation

Wet cement production technology is the conventional technology of cement production in Ukraine. IF Cement has operated three wet kilns since 1964. Two kilns have the capacity of 432 tonnes of clinker /day and the other has a capacity of 480 tonnes of clinker /day[8]. All kilns use coal as the main fuel source which is common practice in Ukraine. Other fuels are also used depending on availability and price.

As outlined in the four steps above, wet cement production begins with the preparation of raw material. Limestone and marl (clay or loam) are crushed and mixed in the raw mill. As seen in Figure 4, initially IF Cement used the wet process in which water is added to the raw mill. The raw material and water produce slurry. The slurry is further homogenized and moved into the kilns at high temperatures. As the slurry moves into the kiln there is a drying zone where the water is evaporated. Further into the kiln at extremely high temperatures calcination and sintering occur and clinker is produced. Evaporation of the wet slurry at the kiln inlet consumes significant amounts of energy. The average energy consumption at IF Cement over the years 2005, 2006, and 2007 was 6.82 GJ[9] per tonne of clinker produced.

[7] Adapted from Volyn-Cement Project Design Document, PDD version 1.5, January 30, 2008, http://ji.unfccc.int/UserManagement/FileStorage/UWCFRFLURJEJMZ0SELJI9F7ECR33CU accessed on April 1, 2009

[8] Kiln capacities provided by IF Cement based on manufacturing specifications and historic production capacity

[9] Calculated from fuel use and clinker production data in supporting spreadsheet #1

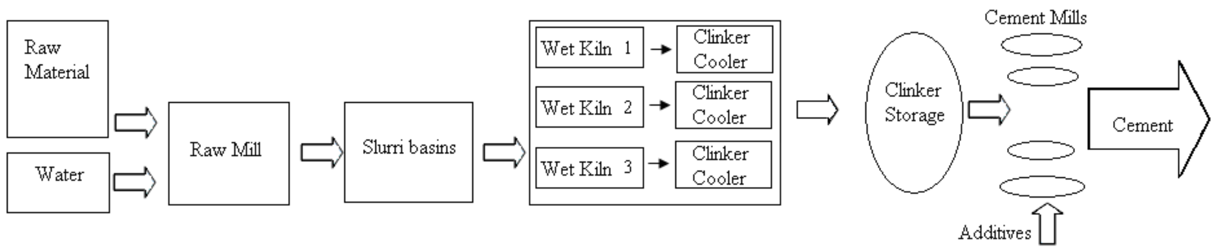

Figure 4: Wet cement production at IF Cement prior to project activities

The wet rotary kilns can operate 340 days per year. The total production capacity of the wet process is approximately 450 000[10] tonnes of clinker/year. The related quantity of cement depends on the clinker factor (i.e. tonne clinker/tonne cement) which depends on the blend of cement being produced. The existing clinker factors range from 0.78 to 0.94 t clinker/t cement for the years 2005 to 2007[11]. The quantity of clinker in cement is typically determined by customer orders and is not typically controlled by the producer.

Technology employed after project implementation

The project consists of two main activities. The first is employing a new technology and the second is implementing a new measure in the process. First of all, one of the wet kilns will be replaced with a dry kiln and a dryer crusher will be installed. Secondly, coal drying will use waste heat from the dry kiln, replacing natural gas usage.

The operations for cement production after the project is implemented are displayed in Figure 5. The dry process does not include the mixing of water with the raw material. Rather the raw materials must have a low moisture content. As there is no water, the evaporation of water from slurry is not required. Therefore this measure implemented by the project significantly reduces the level of energy consumption compared to a wet kiln, and therefore reduces the CO_2 emissions from fuel combustion.

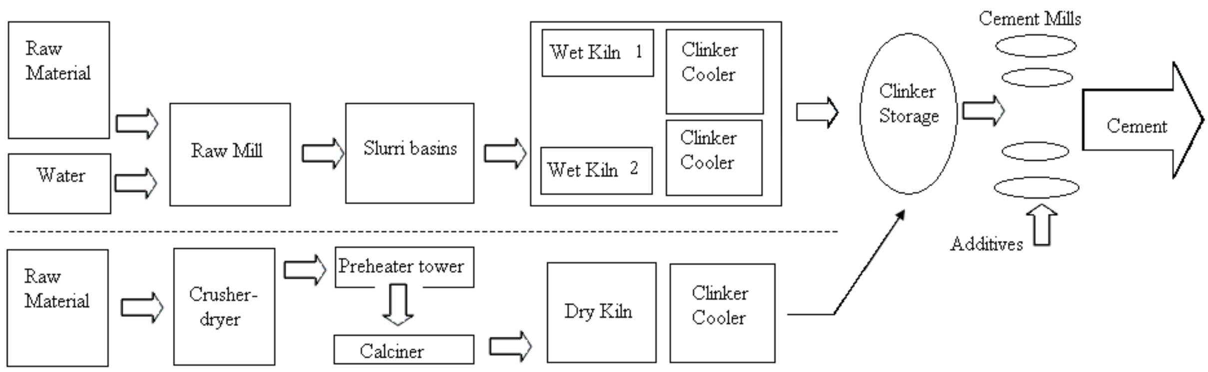

Figure 5: Cement production at IF cement following the implementation of project activities

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[10] Capacity provided by IF Cement from manufacturers specifications

[11] Clinker to cement ratios calculated using production data provided by IF Cement. Calculations available in supporting spreadsheet #1.

In the dry process the raw materials (limestone and marl) are crushed and mixed in the crusher-dryer. Moisture in the materials is removed with the recycled exhaust gases from the dry kiln which reduces fuel consumption. The ground up raw material is homogenized and mixed, and then transported to the raw mill silo. This mixture then moves from the raw mill silo to the pre-heater/calciner to be heated by the exhaust gases from the kiln which further reduce fuel consumption. Using the exhaust gas to heat the mixture is a measure to reduce CO_2 usage that will be implemented by the project. The temperature in the calciner must remain at about 950ºC to ensure that the calcination reaction takes place. The material that reaches the kiln is 95-97% calcined. Clinker is then produced from the sintering process and moved to the cooler and further to clinker storage. The clinker taken from the storage is then milled together with additives to form the cement.

The process change, both in the elimination of water and the recycling of exhaust gases would allow a reduction in energy consumption of the dry kiln to approximately 3.10 GJ per tonne of clinker[12]. The average fuel consumption of the wet rotary kilns is approximately 6.82 GJ per tonne of clinker[12]. This considerable decrease in fuel consumption by the kiln system leads to a significant reduction of CO_2 emissions from fuel use alone.

The production capacity of the new kiln will be approximately 782,000 tonnes of clinker per year[13]. It is expected that the dry kiln will work 340 days a year with a 5% allowance for emergency stops and maintenance. Therefore, the yearly capacity of the new dry installation will be approximately 750,000 tonnes of clinker. Together with the two remaining wet kilns, producing some 250,000 tonnes of clinker, the total capacity of IF Cement after the project implementation will be approximately 950 000 tonnes of clinker.

It is planned to use coal as the primary fuel for the foreseeable future, however should security of supply of coal become an issue, natural gas or other suitable fuels will be used.

[12] Calculated from energy consumption and clinker production data provided by IF Cement. Calculations are available in supporting spreadsheet #1.

[13] Capacity provided by IF Cement from manufacturers specifications


Figure 6: New cyclone pre-calciner


Figure 7: New horizontal rotary dry kiln

Fuels in the cement sector
In the former Soviet Union natural gas has been subsidized, allowing cement factories to continue using natural gas, whereas in Western Europe, coal has been the main source of fuel due to the higher cost of natural gas. With recent developments in the natural gas sector in Ukraine, coal has also become a more attractive fuel in terms of price and availability. Several alternative fuels are also used to supplement coal including: tires, sawdust, woodchips, peat and waste oil. For this particular project the quantity of fuels is affected by the project but the mix of fuels is assumed to be constant, since it is determined by price and availability. The fuel mix from the year 2008 is used as the assumed mix of fuels and this is compared to the average fuel consumed, in Gigajoules, from the 3-year average of 2005 – 2007.

Actions for maintenance

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 IF Cement. In the case where maintenance procedures cannot be done internally, an external company is contracted to do the maintenance work. At present, the contractor firms “Cemmash” and “Stanislavmash” provide the maintenance work at the plant.

The plant provides the external contractor with design documentation, estimates and technical; documentation, necessary materials and spare parts. The plant is obliged to provide a contractor with compressed air from the plant network, oxygen, water, electric power, hoisting machines during preparatory and maintenance work. In case the contractor is using his own energy resources the plant pays for them according to contractor estimates and prices.

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

Measures taken for training

The project involves the installation and operation of a dry kiln and all the equipment necessary to operate it which is newer technology to Ukraine. Therefore IF Cement will put in place an extensive training programme so that the staff will be familiar and able to operate this different process. Furthermore new operating personnel as well as a new processing line and shift foremen will be required to operate the new technology.

The training program is developed and delivered by FLSmidth of Denmark, the engineering firm involved in the project documents (mechanical and electrical) preparation as well as supply and transportation of the equipment and replacement parts. The program included on-the-job training which was held on a similar processing line designed by FLSmidth at the cement plant in the city of Chelm, Poland (Cementownia Chelm S.A.). The trainees were provided with the manual and those who completed the program also passed the internal factory exam before starting to work on the new dry processing line.

Risks of the project and Mitigation actions

The risks of the project are summarized in the following table.

Risks	Mitigation
1. Financial Risk	
There are risks that the global financial downturn will affect the cement industry, making it more difficult for IF Cement to pay back loans that were obtained to finance this project. Also, if additional loans are required to finance this project, they may be more difficult to obtain because of difficult lending conditions.	IF Cement has obtained a long-term loan from EBRD and Ukrexim Bank and has solid long-term contracts for delivery of cement. IF Cement is not overextending itself in this project. Also, IF Cement expects to significantly reduce its coal and natural gas consumption with this project and will use the savings to repay the loans.
2. Technological Risk	
The conventional cement production in Ukraine and surrounding countries is wet cement production. There is little experience or knowledge about dry cement technology.	FLSmidth of Denmark will train and assist IF Cement to eliminate the technological risk. They have a strong background in dry cement production.
3. Market Risk	
The cement produced at IF Cement is for use primarily in Ukraine. The production of cement is directly related to the market demand. Economic recession or new alternatives which might decrease the demand for cement will also lead to a decrease in production levels.	Market projections were done to estimate whether or not the market could possibly reduce the demand for cement.
4. JI Approval Risk	
There is a risk that this project will not be approved by the Ukrainian government or the JI panel.	The Carbon Manager of the Multi-lateral Carbon Credit Fund is preparing the project documentation according to the most recent JI rules and procedures and will assist and advise IF Cement through the determination and project registration process. The extensive experience of the Carbon Manager is expected to mitigate the risks of non-approval.

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 CO_2 emissions during the cement production are mainly generated from: 1) the chemical reaction during the calcination process during clinker production; 2) the combustion of fossil fuel; and 3) the use of electricity. The project will not affect the chemical process but only impact the fuel combustion component and potentially the electricity consumption values. Emission reductions from this project are considered on the basis of reducing CO_2 emissions and do not take other GHG emissions, such as N_2O and CH_4, into account. This provides a conservative estimate of reductions.

The wet technology for cement production requires mixing of marl, limestone and water to form slurry, where water contributes about 40% of the weight[14]. This mixture is then passed through a rotary kiln. Under high temperature (up to 1450°C), the limestone is calcined and forms clinker. The process requires significant amounts of energy to evaporate the water contained in the slurry. When the dry technology for cement production is applied, the mixing of marl and limestone is done without adding water, which creates the opportunity to save significant amounts of fossil fuel.

In addition, the project will use waste heat that is recovered from the dry kiln to dry coal before it is crushed and used to fuel the clinker production process. Previously coal was dried using natural gas. This natural gas is now no longer needed, leading to an additional emission reduction.

Our calculations have shown that the project reduces CO_2 emissions from fuel consumption by over 50% or 0.32 tonnes CO_2 per tonne of clinker. When 450 000 tonnes of production per year is switched from wet to dry clinker production technology this leads to an average CO_2 savings of approximately 168,000 tonnes per year[9].

In addition to the wet-to-dry switch the project will result in a capacity expansion of approximately 300 000 tonnes of clinker capacity per year; all produced with the dry cement process. In order to reliably estimate the emission reductions from this increase in capacity we need to rely on a sectoral or sector-wide baseline for the Ukrainian cement industry. Anticipated emissions reductions from incremental cement production have been quantified by a recognized source as shown within the Volyn Cement PDD. The Volyn Cement method for calculating emissions from incremental production has been provided within Annex B of the JI PDD[15]. Using this method for calculating the emissions for incremental production, the savings due to increased efficiency of the IF Cement dry cement production can be measured in comparison to the sector wide production efficiency in Ukraine. These saving have been included within the reduction calculation for this project.

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[14] UKEEP Energy Assessment at JSC Ivano-Frankivskcement, Ukraine, report prepared for EBRD and BMF by denkstatt IC Consulenten, page 15

[15] Volyn-Cement Project Design Document, PDD version 1.5, January 30, 2008, http://ji.unfccc.int/UserManagement/FileStorage/UWCFRFLURJEJMZ0SELJI9F7ECR33CU accessed on April 1, 2009

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

Length of the crediting period:	10 years

Year	Estimate of annual of emission reductions, tons of CO_2-equivalent
2008	61,587
2009	172,956
2010	178,980
2011	181,927
2012	181,927
2013	181,927
2014	181,927
2015	181,927
2016	181,927
2017	181,927
Total estimated amount of emission reductions over the crediting period, (tonnes of CO_2-equivalent)	1,687,012
Annual average emission reductions over the crediting period,(tonnes of CO_2-equivalent)	168,701

A.5. Project approval by the Parties involved:

Management of Ivano-Frankivsk Cement have approved the project to convert kiln 3 to a dry kiln technology. Financing and all necessary regulatory approvals were obtained and the decommissioning of the old kiln 3 and replacement with the new dry kiln occurred between March and May, 2008. Commissioning of the dry kiln occurred in June, 2008. The UkrExim Bank is a major lender the project along with the European Bank for Reconstruction and Development (EBRD). Through the Multi-lateral Carbon Credit Fund (MCCF), established by EBRD, documents necessary for the sale of the Emission Reduction Units under the Joint Implementation Program, Track 1, have been prepared. A letter of endorsement has been obtained from Ukrainian authorities to proceed with the emission reduction component of the project.

The Project Idea Note (PIN) for the project has been reviewed by the National Environmental Investment Agency Ukraine in 2008. The Project had received the Letter of Endorsement № 668/23/7 dated 08.09.2008.

After finishing of project determination procedure, the PDD and Determination Report will be submitted to National Agency of Environmental Investments of Ukraine for receiving the Host Country Letter of Approval.

SECTION B. Baseline

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

There is no approved CDM methodology that can be directly applied to the proposed project. However approved CDM Methodologies, such as ACM0003 v07.2 and ACM0005 v04, have been consulted in detail for general principals and guidance with regards to cement projects. These methods are used as guidance, rather than full adoption, due to slight differences in project activity. Further guidance has been taken from two similar JI projects that have already been determined by an Independent Entity: the Podilsky Cement project[16] and the Volyn Cement project[17]. The Podilsky Cement PDD outlines a change in cement process from a wet technology to a dry process. Volyn Cement has also switched cement production from a wet process to semi-dry, as well as implementing changes in the raw material composition. The Podilsky Project Design Document (PDD) has passed the JISC review process, while the Volyn Cement PDD has passed stakeholder review, therefore using this guidance while developing the project design document for IF Cement is feasible.

If the proposed project is not implemented, JSC Ivano-Frankivsk Cement would continue to operate the wet cement process with the existing three rotary wet kilns. As long as the company provides proper maintenance, all three wet kilns are able to operate for a rather long period, at least up to 2020[18]. Scenarios analyzed as part of the UKEEP report have estimated that the existing production process could continue for up to 15 years[19].

Identification Of Alternative Baseline Scenarios

Article 6 of the Kyoto Protocol establishes that "Emission reductions need to be additional to what would occur in the absence of the project." Appendix B of JI Guidelines (Annex to Decision 9, CMP1, 2005 in Montreal) states that the "baseline is the scenario that reasonably represents what would occur in the absence of the project." There is no approved CDM methodology that can be directly applied to the proposed project. Therefore, according to Annex 1 of the JISC Guidance on Criteria for Baseline Setting and Monitoring "additionality can be proved by demonstrating that the baseline is conservative and that the project is not included in the baseline." This is shown by following steps one to four of the current "Tool for the Demonstration and Assessment of Additionality, Version 05.2"

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

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

Alternative 1: Replacement of existing wet kiln with new dry kiln

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[16] Switch from wet to dry process at Podilsky Cement, Ukraine, version 2.1, February 2, 2007, http://ji.unfccc.int/UserManagement/FileStorage/62HINFHR08HYV4Y0O6C0074UVY11VL, accessed April 1, 2009

[17] Volyn-Cement Project Design Document, PDD version 1.5, January 30, 2008, http://ji.unfccc.int/UserManagement/FileStorage/UWCFRFLURJEJMZ0SELJI9F7ECR33CU accessed on April 1, 2009

[18] . UKEEP Energy Assessment at JSC Ivano-Frankivskcement, Ukraine, report prepared for EBRD and BMF by denkstatt IC Consulenten, page 7

[19] UKEEP Energy Assessment at JSC Ivano-Frankivskcement, Ukraine, report prepared for EBRD and BMF by denkstatt IC Consulenten, pages 6, 7

The baseline selected combines:

1. Historical emissions for the current wet production process up to and including to the capacity of the three wet kilns and
2. A sector-wide baseline for all incremental production that the new dry kiln may provide.

The baseline of historical emissions is calculated using average energy consumption (in Gigajoules) for the years 2005 to 2007 weighted by the fuel mix of the project year. The fuel mix of the project year is used because the project activity is assumed to not influence the fuel mix, since the fuel mix is mainly influenced by fuel price and availability. The project activity is assumed to influence the energy necessary to produce clinker; therefore this is the main variable that is tracked.

The baseline of historical emissions is used for all production up to the previous production capacity of the IF Cement facility, namely 450 000 tonnes clinker/year. The assumption being that this production capacity would have been produced by the previous wet production process

The baseline activity also includes a quantity of natural gas that is used to dry coal for use as a fuel in the clinker production process. The project eliminates the need for this natural gas by replacing it with waste heat recovered from the new dry kiln.

For all clinker production beyond the 450 000 tonnes clinker/year the baseline identified would be derived from a sector-wide baseline of the energy intensity of clinker production in the Ukraine. This sector-wide baseline is derived from the Volyn Cement PDD[20]. The assumption is that if this incremental production is not produced at the IF Cement facility, it will be produced by other facilities in the Ukraine.

This baseline is accepted since it will produce the same quantity of clinker as the project activity, is allowed by current regulations and accounts for the capacity expansion that will result from the installation of the dry kiln in the project activity.

Alternative 2: Construction of a new plant with dry kiln technology at the existing functioning quarry.

This baseline is rejected because it suffers from the same financial barriers as the project and is subject to several technological barriers, including:

- Lack of a water supply and sewerage systems
- Lack of a reliable energy supply system
- Lack of storage rooms
- Lack of adequate transportation networks (motor roads, railway communication/service)

[20] Volyn-Cement Project Design Document, PDD version 1.5, January 30, 2008, http://ji.unfccc.int/UserManagement/FileStorage/UWCFRFLURJEJMZ0SELJI9F7ECR33CU accessed on April 1, 2009

- Far distance (20km) for labour force to commute labour (most people employees/workers live in Ivano-Frankivsk).

Alternative 3: Reconstruction of kilns 1 and 2 and replacement with dry kiln technology.

This baseline is rejected because it suffers from the same financial barriers as the project and is subject to a major technological barrier in that the site is too cramped to be considered for new construction. Kilns №1 and №2, sludge preparation facility, grinding facility, storages for raw materials, clinker and additives are all located on this site. Therefore, prolonged equipment shutdown would be required for the new kiln installation. A major portion of the clinker production would need to be shutdown to execute this alternative scenario.

Alternative 4: Replacement of kiln 3 with a dry kiln of smaller capacity.

It is technically possible to install a new dry kiln of only 500,000 tonnes/yr of clinker capacity such that this kiln would replace only the existing capacity of the three wet kilns. This baseline is rejected because it suffers from the same financial barriers as the project but does not have the added advantages of increased sales of cement, leading to added revenue, and decreased energy intensity for clinker production, leading to added cost savings. This scenario also faces the same technological, training and resistance to change barriers as the project.

It is therefore concluded that the status quo of continued operation of the wet kiln technology for up to 15 more years is the most realistic baseline for the clinker that would be produced from existing capacity. For any incremental production, it is assumed that this clinker would have been produced with the same emissions intensity as the sector-wide baseline established and calculated for other similar projects in Ukraine (e.g. Volyn Cement and Podilsky Cement)[21].

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:

Cement sector in Ukraine is 100% privatized and there is no particular state programme regarding the development of cement production. The Energy Strategy of Ukraine until 2030 sets improvement of energy efficiency and decreasing energy intensity in the heavy industry as one of the long-term priorities for the state. At the same time the Energy Strategy until 2030 does not impose any obligations regarding energy intensity improvements, neither it introduces any financial incentives for the companies who reduce their energy consumption. The proposed JI project is in line with the host country's energy strategy.

Additionality

Alternatives to the project have been considered in section B.1 and barriers to these alternatives have been assessed. This assessment of alternatives to the project has demonstrated there are no feasible alternatives to the JI project implementation except to continue to use the wet

[21] Details of this calculation can be found in Annex 2 of Volyn-Cement Project Design Document, PDD version 1.5, January 30, 2008, http://ji.unfccc.int/UserManagement/FileStorage/UWCFRFLURJEJMZ0SELJI9F7ECR33CU accessed on April 1, 2009

technology for the clinker production. The remainder of this additionality assessment will focus on the financial analysis of the project.

Currently there is no national regulation or other incentive on the national level that would require a change of technology at cement plants. The wet cement process continues to be the prevailing practice in Ukraine. There are serious technical and financial barriers to this project[22]. The project is very capital-intensive, and the resulting IRR of 9.8% is relatively low compared to the currently available interest rates for project finance in Ukraine, which are 30% or above for loans in the National currency and 20-25% for loans in foreign currency[23]. Similar projects switching from wet to dry clinker production technology in Ukraine are proposed as JI projects[24]. The very first JI project to receive final JISC approval actually was a very similar project at another Ukrainian cement factory (Podilsky cement). This project was made feasible largely due to the carbon credit revenue, as highlighted in the additionality justification for this project.[25].

Note that this project is being financed under the UKEEP facility (see denkstatt report[26]) which features certain elements of JI assessment. In particular it offers to the project companies an Energy Audit that helps them explore the potential for greenhouse gas reductions and the opportunities for a carbon transaction. In IF Cement's case the Energy Audit identified a significant carbon credit potential. The analysis below highlights the IRR values as detailed by the financial specialists of IF Cement. These values are similar to the analysis of 8 investment scenarios presented in the UKEEP report. Here it is clear that the revenue from carbon credits significantly affects the feasibility of the project. The assumptions that were used in this analysis include a representative carbon credit price (i.e. €10.50/ERU).

Step 2: Investment analysis

Sub-step 2a: Determine appropriate analysis method

The Investment analysis of the IF Cement project has been implemented in compliance with the "Tool for the demonstration and assessment of additionality" (version 05.2) and "Guidance on the Assessment of Investment Analysis (version 02)".

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[22] UKEEP Energy Assessment at JSC Ivano-Frankivskcement, Ukraine, report prepared for EBRD and BMF by denkstatt IC Consulenten, page 19 - 21

[23]The possibilities for financing at the national level are limited at the moment. The typical interest rate of commercial banks in Ukraine is about 30% for the period of up to three years. The examples are the largest banks of Ukraine: Raiffaisen Bank Aval (www.aval.ua), Privat Bank (www.privatbank.com.ua), Pravex bank (www.pravex.com.ua). The limited availability of the financing is a substantial barrier in implementation of proposed project.

[24] Consult Podilsky or Volyn Cement PDDs

[25] Switch from wet to dry process at Podilsky Cement, Ukraine, page 10, version 2.1, February 2, 2007, http://ji.unfccc.int/UserManagement/FileStorage/62HINFHR08HYV4Y0O6C0074UVY11VL, accessed April 1, 2009

[26] UKEEP Energy Assessment at JSC Ivano-Frankivskcement, Ukraine, report prepared for EBRD and BMF by denkstatt IC Consulenten

Project IRR benchmark analysis was determined as relevant for the presented project. Project IRR was determined to be 9.8% for the project without the sale of ERUs and 12.9% with the sale of ERUs[27].

The key assumptions are the following:

1. The analysis is based on the relevant information available at the time of the investment decision, i.e. January of 2008. The analysis is implemented in the Ukraine's national currency. The exchange rate applied: 1 Euro = 7.78 UAH.

2. The assessment period is not limited to the proposed crediting period of the JI activity 2008-2012 but extended to 10 years reflecting the substantial period of expected operation of the investment project activity.

3. Annual project effect is estimated as an operating profit differential, i.e. an increase of operating profit in the project year in comparison with actual operating profit in the base year (2007) calculated in comparable prices.

4. To estimate economic effect of the dry technological complex, operating profit includes only profit from cement produced and not from other value –added products manufactured at the plant. In average, 65% of cement produced by IF Cement is sold and 35% is used as a raw material at the plant to manufacture various value-added products such construction blocks, plates and pipes. Therefore, operating profit from cement includes profit from the sale of cement to external parties and the use of cement at the plant ("internal sale").

5. Calculations are made on the basis of fixed comparable prices of 2008.

6. Operating profit includes depreciation relating to the project activity as it is required for the purpose of the project IRR calculating.

7. Residual value of the dry technological complex is added to operating profit differential in the last year of the assessment period.

8. The cost of financing expenditures (i.e. loan interest payment) is not included in the calculation of the project IRR.

9. Clinker production projections are based on full technical capacity of the dry kiln. [28]

10. IRR adjustment for inflation is based on the generally accepted approach[29]. Inflation rate assumed in the nominal IRR calculations is 15%, i.e. the inflation in the Ukraine for the period of July 2008 - June 2009[30].

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[27] Financial Analysis provided by IF Cement, refer to supporting documentation #2

[28] The source data and project IRR calculations are presented in the supporting spreadsheet #2

11. Carbon emission reductions are as presented in this PDD. The purchase price is assumed to be 10.5 € per tonne[31].

The investment analysis demonstrates that the IRR would be 9.8% without the ERU sales and 12.9 % with the ERU sales. The IRR for the IF Cement project does not meet the investment benchmark and therefore would be considered financially additional[27].

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

With the economic downturn commercial lending rates in Ukraine have risen significantly and reached 30-35% for loans in the national currency in the first quarter of 2009[32]. Chairman of the Board of Raiffaisen Bank Aval Vladimir Lavrentchuk refers to the current rate of 30% as problematic to companies[33].

The IRR benchmark can be calculated as the sum of without risk investment rate plus risk factor adjustment. During June 2009 the yield on medium-term and long-term bonds denominated in Ukrainian hryvnyas with maturity of two and three years was between 22.5% and 22.67%.[34] Therefore the required rate of return not including project specific risks can be estimated as 22.59%. Due to the lack of the data for the similar projects in the country, the risk factor adjustment may be identified only on the basis of expert opinion. Following the conservative approach towards risk estimation proposed by the official Methodological Recommendations on Evaluation of Investment Projects Efficiency of June 21, 1999 N BK adopted in Russia[35], the risk factor can be estimated as 8%. Thus based on conservative risk estimate, and without risk factor, the IRR benchmark amounts to 30.59% (22.59% + 8%).

The calculated nominal (adjusted for inflation) project IRR without sale of Emission Reduction Units is 26.3%, i.e. below the benchmark. Sale of Emission Reduction Units makes the project more financially feasible with the increased nominal IRR of 29.8% which is close to the benchmark. Therefore, based on the investment analysis the project is additional.

The IRR estimates would not make this project feasible without the sale of carbon credits and without a significantly long payback period.

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

<u>Sensitivity Analysis</u>

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[29] "Discounted Cash Flow Analysis Methodology and Discount Rates" by Lawrence Devon Smith – online resource: http://www.cim.org/mes/pdf/VALDAYLarrySmith.pdf

[30] Web site of the National Bank of Ukraine: http//bank.gov.ua

[31] The purchase price is assumed in accordance with the Emission Reduction Purchase Agreement between the company and the Carbon Manager

[32] Online resource, http://finance.bigmir.net/useful_articles/credits/83611
[33] Online resource, http://www.ricardo.com.ua/invest/news_invest/69321

[34] Web site of the National Bank of Ukraine: http://bank.gov.ua?Fin_ryn/OVDP/OVDP_mis.xls

[35] There is no similar officially adopted methodology in the Ukraine.

Sensitivity analysis was implemented for variations of inputs: cement price +10%, coal price (main technological fuel) -10%, raw materials price -10%, electricity price -10% and natural gas price -10%.[36] The IRRs remain below benchmark in each scenario and therefore the revenue from the sale of Emission Reduction Units remains an important factor in the overall feasibility of the project.

<u>Step 3: Conduct barrier analysis</u>**:**

Sub-step 3a: Identify barriers that would prevent the implementation of the proposed project activity:

A project of the scale of the IF Cement project faces many financial and non-financial barriers. These can be overcome by consideration of environmental benefits such as increases in energy efficiency, reductions of greenhouse gas (GHG) emissions as well as emissions of other harmful substances. To achieve this, IF Cement has actively participated in the UKEEP[37] program resulting in the production of a feasibility study which evaluated the financial and non-financial barriers for the project. Results of this key study have been used to present the following analysis of these barriers in this PDD.

1. Investment Barrier

The project requires an investment of more than 60 million EURO[38] resulting in the installation of a clinker production technology that is used in less than 10% of Ukraine cement plants. Even when cost savings from reduced fuel consumption are considered, the Internal Rate of Return (IRR) of the project is only slightly more than 9.8% (before taxes)[38]. This results in payback time of the project going beyond 10 year period, a fairly long time frame for commercial lenders in a tough economic climate in Ukraine. With the sale of Emission Reduction Units (ERU), the IRR increases to a bit more than 12.9% with a payback of close to 9 years[38]. This makes the project more viable and therefore contributes to the project's successful execution.

2. Technological, prevailing practice and market barriers

The first major shift in Portland cement production was in the late nineteenth century when low capacity shaft kilns were replaced with rotary kilns. This was followed by the switch from the wet process to the dry process in western economies throughout the 1960s, which was driven by the increase in efficiency of fuel usage. The next important development was the pre-calciner technology which used a separate piece of equipment, a vertical tower, for the calcinations (and pre-heating) of raw materials. This improved the quality and made it easier to recover the kiln exhaust heat and use much shorter rotary kilns.

<u>Technological Barrier</u>: The high moisture content of raw material deposits available in the former Soviet Union countries are one reason that the wet process is still predominant, unlike in

[36] Please refer to supporting financial documentation #2

[37] Ukraine Energy Efficiency Program

[38] Please refer to supporting spreadsheet #2

the western European countries. The cyclone pre-calciner would be required to significantly dry the materials before the clinker production process and this technology was not available at the time of construction of the Ukrainian plants.

Market Barrier: Another reason for this predominance was the subsidized fuel prices. In Ukraine, apart from two cement plants using the dry process, built in the 1970s, and two JI projects, no other producers have experience of construction and operation of technology other than wet production. With the low fuel prices there was no need to adopt more energy efficient technology such as the cyclone pre-calciner and dry kiln.

Prevailing practice: In addition, there are few operating examples of dry cement production in Ukraine as the wet process is common practice. There are low awareness levels and minimal technical expertise for dry production in the cement sector. The lack of examples or knowledge about the dry process creates a barrier to the proposed JI project activity. IF Cement employees must undergo training on the entire process and be capable of dealing with operating problems. The training needs to overcome resistance to moving away from the older, more familiar technology as well as transferring knowledge and competence to the personnel so that the new technology operates successfully.

Sub-step 3b: Show that the identified barriers would not prevent the implementation of at least one of the alternatives (except the proposed project activity)

The alternative to the project which involves continued operation of the wet kilns and incremental production produced by other cement facilities in the Ukraine is not prevented by the above barriers. The investment barrier is overcome since there is no up-front investment required, because no upgrades or retrofits are performed. The technological barriers are overcome since existing technology continues to be used. The prevailing practice barrier is overcome since staff will not need to change their job functions or operate new machinery. The market barrier is overcome since fuel prices are still inexpensive enough to continue using the wet production process and continue to make a profit.

Step 4: Common Practice Analysis

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

The wet clinker production process is the most similar activity to the project activity. This is the situation prior to the project implementation at the IF Cement facility. If the project activity was not undertaken, it is likely the wet production process would be the alternative used.

The UKEEP project has identified that approximately 90% of the cement industry in Ukraine still uses the wet production process[39]. This demonstrates that the dry production process is not the common practice in Ukraine. This also means that there are likely not many technicians or engineers that are familiar with the dry technologies. There is also likely resistance to change, even in the face of rising energy prices and reduced cement prices, since the wet technology is familiar and predictable.

[39] SIDA, UKEEP, IC Consulenten, *Largest UKEEP Project is under Construction*, 1-page project description.

Sub-step 4b: Discuss any similar Options that are occurring:

Different configurations of the current project have also been considered in the baseline selection process. These include: construction of a new plant at the quarry, decommissioning of kilns 1 and 2 and replacement with a dry kiln and construction of a kiln of smaller capacity. As described in the baseline section (B.1.1), each of these has significant barriers and would not be considered common practice either.

There are no similar activities in the Ukraine that have not been registered or are considering registration as a JI project. Examples of other similar projects that are registered or are seeking registration can be found in the Podilsky PDD and the Volyn Cement PDD, previously referenced.

Step 5: Conclusion

The project is additional. The baseline scenario is a combination of continued wet production of clinker and a sector-wide baseline that includes both wet and dry production processes.

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

The project boundary must include all sources of emissions that are affected or controlled by the project. The main aspects affected by the project are the following:

- Changes in the quantity of fuel combusted
- Electricity usage at the project site

To determine which sources are to be included within the project boundary, the following approach was taken

- All sources which are not affected by the project have been excluded
- All sources which are affected by the project have been included

The following are tables and diagrams indicating the cement process at IF Cement. As process changes affect the daily operation of the IF Cement plant, two tables have been provided to outline sources before, during and after baseline activities and project implementation (Table 1 and Table 2). These tables identify all emission sources that could be reasonably attributable to the baseline and project, using a streamlined life-cycle assessment approach. Emissions sources, sinks or reservoirs are presented in this manner to be completely transparent about the activities that would be expected to generate emissions, however, not all these identified sources are included in the final project boundary. Finally, rational for the inclusion or exclusion of these identified sources have been provided (Table 3). Figures are provided after the table for a visual representation of the baseline emission sources (Figure 8) and the project emission sources (Figure 9). Definitions of the terms Source, Sink, Reservoirs that are Controlled, Related or Affected are provided in the footnotes on the next pages. These terms have different meanings from the terms Included or Excluded, which refer to which emission sources are inside or outside the project boundary.

Table 1: Baseline Emission Sources

Source, Sink or Reservoir (SSR)	Description	Controlled, Related or Affected[40]
Upstream SSRs during Baseline Operation (Offsite)		
Emissions for Production/Processing of Fuel Mix	These emissions are a result of production, processing and transportation of the fuels used at the Cement Plant including; coal, sawdust, tires, oil, peat and natural gas	Related
Electricity use for raw material extraction and processing	Emissions resulting from the extraction and processing of the cement feedstock including limestone, marl and iron ore residue. Extraction is the direct mining of natural resources and processing is any process of cleaning, crushing or alteration to the raw materials before arriving at the Cement site.	Related
Onsite SSRs during Baseline Operation		
Emissions from electricity and fuel use for coal preparation and drying	In the baseline coals is dried using natural gas and transported using conveyor systems.	Controlled
Electricity Use for Water Pumping	Grid based emissions resulting from electricity consumption to power the water pumping stations.	Related
Electricity for slurry process and homogenization	Grid based emissions resulting from electricity consumption to power the slurry milling and homogenization.	Related
Electricity use for Wet-Kiln #1 Operation	Grid based emissions resulting from electricity consumption to power the	Related

[40] Definitions are extracted from the ISO 14064-2 standard:

Greenhouse gas source: physical unit or process that releases a GHG into the atmosphere

Greenhouse gas sink: physical unit or process that removes a GHG from the atmosphere

greenhouse gas reservoir: physical unit or component of the biosphere, geosphere or hydrosphere with the capability to store or accumulate a GHG removed from the atmosphere by a **greenhouse gas sink** or a GHG captured from a **greenhouse gas source**

Controlled greenhouse gas source, sink or reservoir: GHG source, sink or reservoir whose operation is under the direction and influence of the greenhouse gas project proponent through financial, policy, management or other instruments

Related greenhouse gas source, sink or reservoir: GHG source, sink or reservoir that has material or energy flows into, out of, or within the project

Affected greenhouse gas source, sink or reservoir: GHG source, sink or reservoir influenced by a project activity, through changes in market demand or supply for associated products or services, or through physical displacement

Source, Sink or Reservoir (SSR)	Description	Controlled, Related or Affected[40]
	wet kiln #1.	
Emissions from Combustion of Fuel for Kiln #1	Combustion emissions from the burning of fuel for the wet kiln #1	Controlled
Emissions from Calcining of Limestone and Marl in Kiln #1	Process emissions resulting from the calcining of limestone within the kiln #1. Emissions result from the chemical reaction of $CaCO_3$ + heat → CaO + $\mathbf{CO_2}$	Controlled
Electricity use for Wet Kiln #2 Operation	Grid based emissions resulting from electricity consumption to power the second wet kiln.	Related
Emissions from Combustion of Heating Fuel Kiln 2	Combustion emissions from the burning of fuel mix to fire the second wet kiln	Controlled
Emissions from Calcining of Limestone and Marl in Kiln #2	Process emissions resulting from the calcining of limestone within the kiln #2. Emissions result from the chemical reaction of $CaCO_3$ + heat → CaO + $\mathbf{CO_2}$	Controlled
Electricity use for Wet Kiln #3 Operation	Grid based emissions resulting from electricity consumption to power the third wet kiln.	Related
Emissions from Combustion of Fuel for Kiln #3	Combustion emissions from the burning of fuel for the wet kiln #3	Controlled
Emissions from Calcining of Limestone and Marl in Kiln 3	Process emissions resulting from the calcining of limestone within the third kiln. Emissions result from the chemical reaction of $CaCO_3$ + heat → CaO + $\mathbf{CO_2}$	Controlled
Electricity use for clinker storage and milling	Grid based emissions resulting from electricity consumption to power the clinker milling and conveyer system to store to the cement storage	Related
Downstream SSRs during Baseline Operation		
Emissions from Transportation of final product	Transportation emission result from the combustion of fossil fuels to transport the cement to its various destinations	Related
Other		
Site Decommissioning	Any emissions generated by the eventual decommissioning of the cement facility at the end of its useful	Related

Source, Sink or Reservoir (SSR)	Description	Controlled, Related or Affected[40]
	life	

Table 2: Project Emission Sources

Sources, Sinks or Reservoirs (SSR)	Description	Controlled, Related or Affected
Upstream SSRs during Project Operation		
Emissions for Production/Processing of Fuel Mix	These emissions are a result of production, processing and transportation of the fuels used at the Cement Plant including; coal, sawdust, tires, oil, peat and natural gas	Related
Electricity use for raw material extraction and processing	Emissions resulting from the extraction and processing of the cement feedstock including limestone, marl and iron ore residue. Extraction is the direct mining of natural resources in quarries and processing is any process of cleaning, crushing or alteration to the raw materials before arriving at the Cement site.	Related
Onsite SSRs during Project Operation		
Emissions from electricity and fuel use for coal preparation and drying	In the project coal is dried using waste heat from the dry kiln and milled in the coal mill	Controlled
Electricity Use for Water Pumping	Grid based emissions resulting from electricity consumption to power the water pumping stations.	Related
Electricity for slurry process and homogenization	Grid based emissions resulting from electricity consumption to power the raw mill.	Related
Electricity use for Wet Kiln #1 Operation	Grid based emissions resulting from electricity consumption to power the wet kiln #1.	Related
Emissions from Combustion Fuel for Kiln #1	Combustion emissions from the burning of fuel for the wet kiln #1	Controlled
Emissions from Calcining of Limestone and Marl in Kiln #1	Process emissions resulting from the calcining of limestone within the kilns. Emissions result from the chemical reaction of $CaCO_3 + heat \rightarrow CaO + \mathbf{CO_2}$	Controlled

Sources, Sinks or Reservoirs (SSR)	Description	Controlled, Related or Affected
Electricity use for Wet Kiln #2 Operation	Grid based emissions resulting from electricity consumption to power the wet kiln #2.	Related
Emissions from Combustion of Fuel for Kiln #2	Combustion emissions from the burning of fuel for the wet kiln #2	Controlled
Emissions from Calcining of Limestone and Marl in Kiln #2	Process emissions resulting from the calcining of limestone within the kiln #2. Emissions result from the chemical reaction of $CaCO_3$ + heat → CaO + $\mathbf{CO_2}$	Controlled
Electricity use for Dry Kiln #3 Operation	Grid based emissions resulting from electricity consumption of dry kiln #3.	Related
Emissions from Combustion of Fuel for Dry Kiln #3	Combustion emissions from the burning of fuel at Dry Kiln #3	Controlled
Emissions from Calcining of Limestone and Marl in Dry Kiln #3	Process emissions resulting from the calcining of limestone within the dry kiln #3. Emissions result from the chemical reaction of $CaCO_3$ + heat → CaO + $\mathbf{CO_2}$	Controlled
Electricity use for clinker storage and milling	Grid based emissions resulting from electricity consumption for clinker milling and transportation to cement storage.	Related
Upstream SSRs Before Project Operation		
Electricity and Fuel use for extraction, processing and transportation of raw materials for manufacture of dry kiln	Emissions resulting from the extraction, transportation and processing of raw materials (steel, iron and other metals). This SSR includes all emissions from direct mining of metals, transportation of mined product, processing of mined materials into raw metals, transportation of processed metal to manufacturing site	Related
Electricity and Fuel use for manufacture of dry kiln	Emissions resulting from processing the raw materials for construction of the dry kiln at the manufacture location from raw materials	Related
Fuel use for transportation of dry kiln to IF Cement site	Fuel use to transport the constructed dry kiln to the IF Cement site	Related
Electricity and Fuel use for installation and commissioning of dry kiln	Electricity and fuel use needed to assemble and test and commission the new dry kiln.	Related
Downstream SSRs during Project Operation		

Sources, Sinks or Reservoirs (SSR)	Description	Controlled, Related or Affected
Emissions from Trans. of final product	Transportation emission result from the combustion of fossil fuels to transport the cement to its various destinations	Related
Other		
Site Decommissioning	Any emissions generated by the eventual decommissioning of the cement facility at the end of its useful life	Related

As discussed earlier, the emission sources identified at the cement plant are either included or excluded based on if the sources are affected by the project activity. Justification for inclusion and exclusion of identified emission sources is as follows:

Table 3: Comparison of Project and Baseline Emission Sources

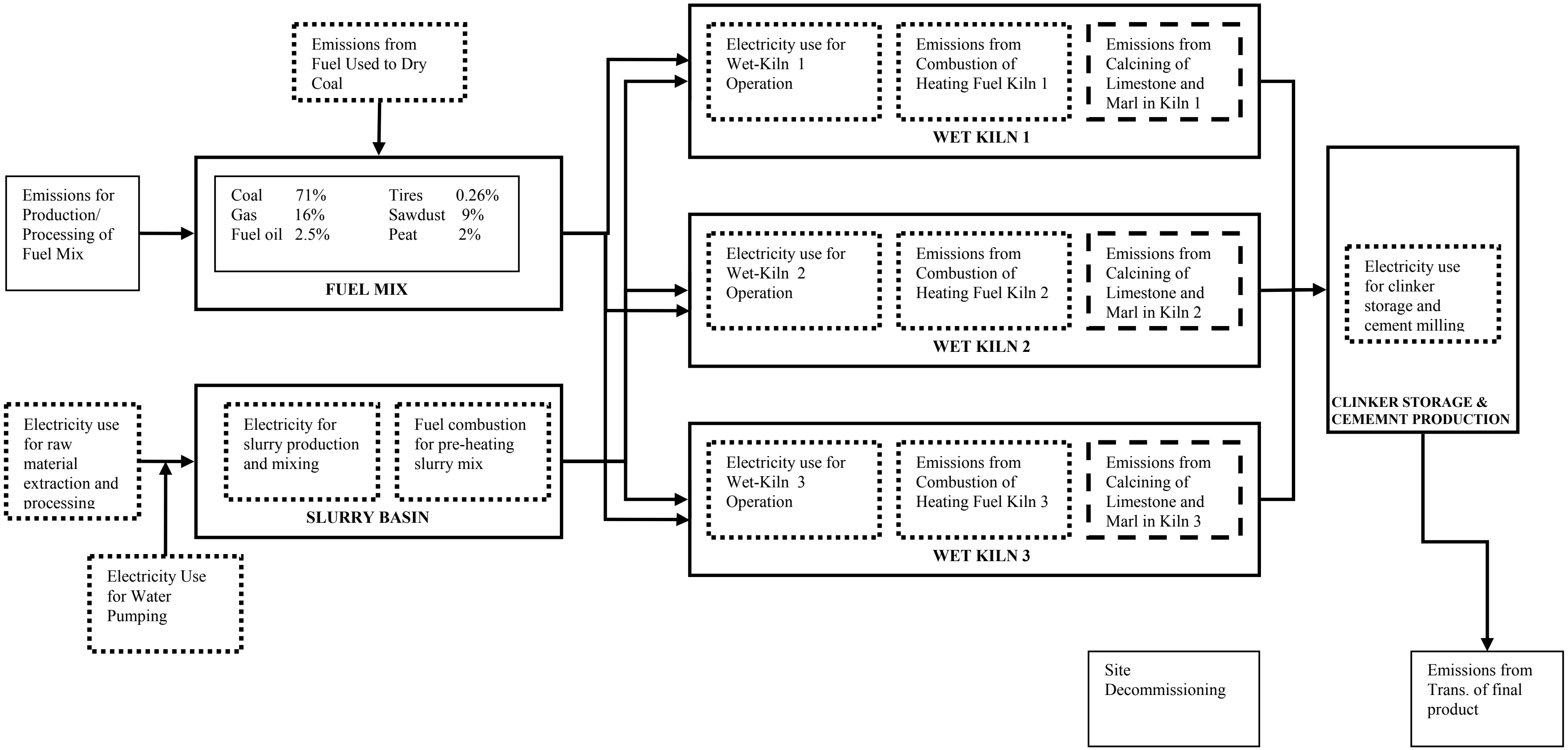
Sources, Sinks or Reservoirs (SSR)	Include / Exclude	Justification
Upstream SSRs during Baseline and Project Operation		
Emissions for Production/Processing of Fuel Mix	Exclude	Excluded as it is outside the project boundary. This is in line with general principals and guidelines for selecting project scope, as seen within CDM Approved Cement Manufacturing Methodologies (specifically ACM0003 v07.2 and ACM0005 v4).
Electricity use for raw material extraction and processing	Include	Because of increased production, electricity use for extraction and processing will change between the project and baseline.
Onsite SSRs during Baseline and Project Operation		
Electricity and fuel for coal preparation and drying in the baseline	Include	Because natural gas is eliminated for drying of coal in project scenario, an emission reduction should be achieved.
Electricity and fuel use for coal preparation and drying in the project	Include	
Electricity Use for Water Pumping in the Baseline	Include	Electricity use should decrease in the project because less water is needed
Electricity Use for Water Pumping in the Project		
Electricity for slurry process and mixing in the Baseline	Include	Electricity use should decrease in the project because there is less slurry to process
Electricity for slurry process and mixing in the Project. Electricity for preparation, homogenization and milling		

Sources, Sinks or Reservoirs (SSR)	Include / Exclude	Justification
of raw materials for dry kiln #3 in the project.		
Electricity use for Wet Kiln 1 in the Baseline	Include	Kiln 1 is included in the calculations because it will be phased out as part of the project but is still present in the first years of the project.
Electricity use for Wet Kiln 1 in the Project		
Emissions from Combustion of Fuel for Kiln 1 in the Baseline	Include	This is the main change between the project and the baseline. The quantity of fuel consumed per tonne of clinker produced will change significantly the wet kilns will be used less as the dry kiln comes online.
Emissions from Combustion of Fuel for Kiln 1 in the Project		
Emissions from Calcining of Limestone and Marl in Kiln 1 in the baseline	Exclude	They will remain the same between baseline and project
Emissions from Calcining of Limestone and Marl in Kiln 1 in the project case		
Electricity use for Wet Kiln 2 Operation in the baseline scenario in the baseline	Include	Kiln 2 is included in the calculations because it will be phased out as part of the project but is still present in the first years of the project.
Electricity use for Wet Kiln 2 Operation in the baseline scenario in the project scenario		
Emissions from Combustion of Fuel for Kiln 2 in the baseline scenario	Include	This is the main change between the project and the baseline. The quantity of fuel consumed per tonne of clinker produced will change significantly the wet kilns will be used less as the dry kiln comes online
Emissions from Combustion of Fuel for Kiln 2 in the project case		
Emissions from Calcining of Limestone and Marl in Kiln 2 in the baseline	Exclude	They will remain the same between baseline and project
Emissions from Calcining of Limestone and Marl in Kiln 2 in the project case		
Electricity use for Dry Kiln #3 Operation in project case	Include	This will change because a dryer/crusher must be installed for the dry kiln
Emissions from Combustion of Fuel for Wet Kiln #3 in the baseline scenario	Include	This will change between the project and the baseline because wet kiln #3 will be

Sources, Sinks or Reservoirs (SSR)	Include / Exclude	Justification
in the caseEmissions from Combustion of Fuel for Dry Kiln #3in the project case		decommissioned.
Emissions from Calcining of Limestone and Marl in Kiln 3 in the baseline scenario	Include	Only included for capacity expansion calculation. Assumed to be the same between the project and baseline otherwise.
in the caseEmissions from Calcining of Limestone and Marl in Dry Kiln #3 in the project case		
Electricity use for clinker storage and cement milling in the Baseline	Include	Because of the change in production levels, the electricity usage for clinker storage and cement milling will change.
Electricity use for clinker storage and cement milling in the Project		
Downstream SSRs during Project Operation		
Emissions from Transportation of final product in the Baseline	Exclude	Excluded as it is outside the project boundary. This is in line with general principals and guidelines for selecting project scope, as seen within CDM Approved Cement Manufacturing Methodologies (specifically ACM0003 v07.2 and ACM0005 v4)
Emissions from Transportation of final product in the Project		
Upstream SSRs Before Project Operation		
Electricity and Fuel use for extraction, processing and transportation of raw materials for manufacture of dry kiln	Exclude	Excluded as it is outside the project boundary. This is in line with general principals and guidelines for selecting project scope, as seen within CDM Approved Cement Manufacturing Methodologies (specifically ACM0003 v07.2 and ACM0005 v4)
Electricity and Fuel use for manufacture of dry kiln	Exclude	Excluded as it is outside the project boundary. This is in line with general principals and guidelines for selecting project scope, as seen within CDM Approved Cement Manufacturing Methodologies (specifically ACM0003 v07.2 and ACM0005 v4)
Fuel use for transportation of dry kiln to IF Cement site	Exclude	Excluded as it is outside the project boundary. This is in line with general principals and guidelines for selecting project scope, as seen within CDM Approved Cement Manufacturing Methodologies (specifically ACM0003 v07.2 and ACM0005 v4)
Electricity and Fuel use for installation and commissioning of dry kiln	Exclude	Excluded as it is outside the project boundary. This is in line with general principals and guidelines for selecting project scope, as seen within CDM Approved Cement Manufacturing Methodologies (specifically ACM0003 v07.2 and ACM0005 v4)
Other		
Site Decommissioning	Exclude	Will remain the same between the project and the

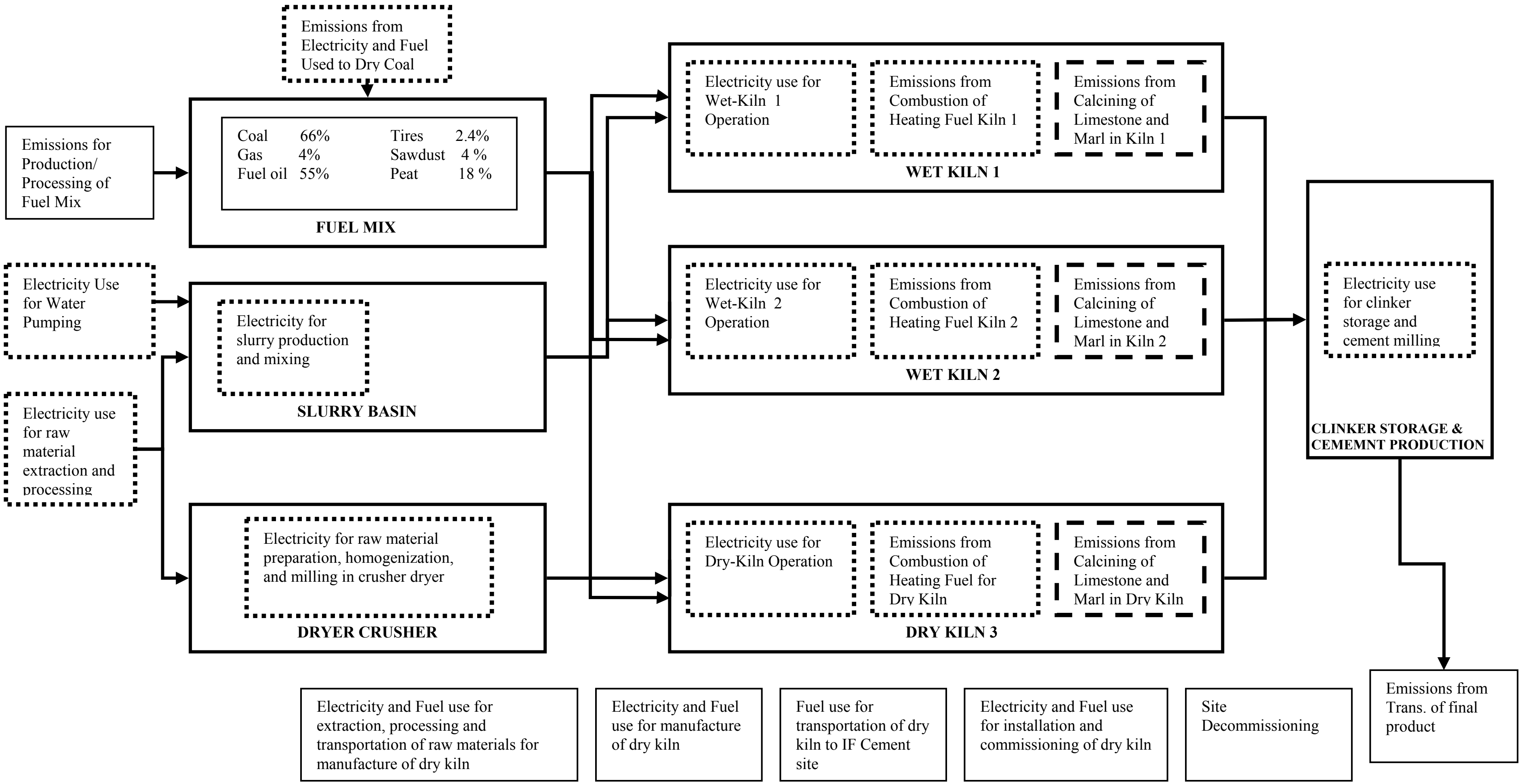
Sources, Sinks or Reservoirs (SSR)	Include / Exclude	Justification
Site Decommissioning	Exclude	baseline

In Figure 8 and Figure 9 the DOTTED boxes are those emission sources that are included in the project boundary. DASHED boxes are included for the calculation of the emissions intensity of the sector-wide baseline.



Fuel quantities reported are from UKEEP report, previously referenced, pg 34

Figure 8: Emission Source Diagram for Baseline



Fuel quantities reported are from UKEEP report, previously referenced, pg34

Figure 9: Emission Source Diagram for Project

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

This baseline is set by the PDD developer, GreenStream Network, on behalf of IF Cement 05/05/2009. More information can be found within Annex 1.

SECTION C. Duration of the project / crediting period

C.1. Starting date of the project:

July 01, 2008

C.2. Expected operational lifetime of the project:

Given proper maintenance the current equipment can be operated for at least another ten years or 120 months.

C.3. Length of the crediting period:

2008-2012 (5 years or 60 months) and 2013 to 2017 (5 years or 60 months)

SECTION D. Monitoring plan

D.1. Description of monitoring plan chosen:

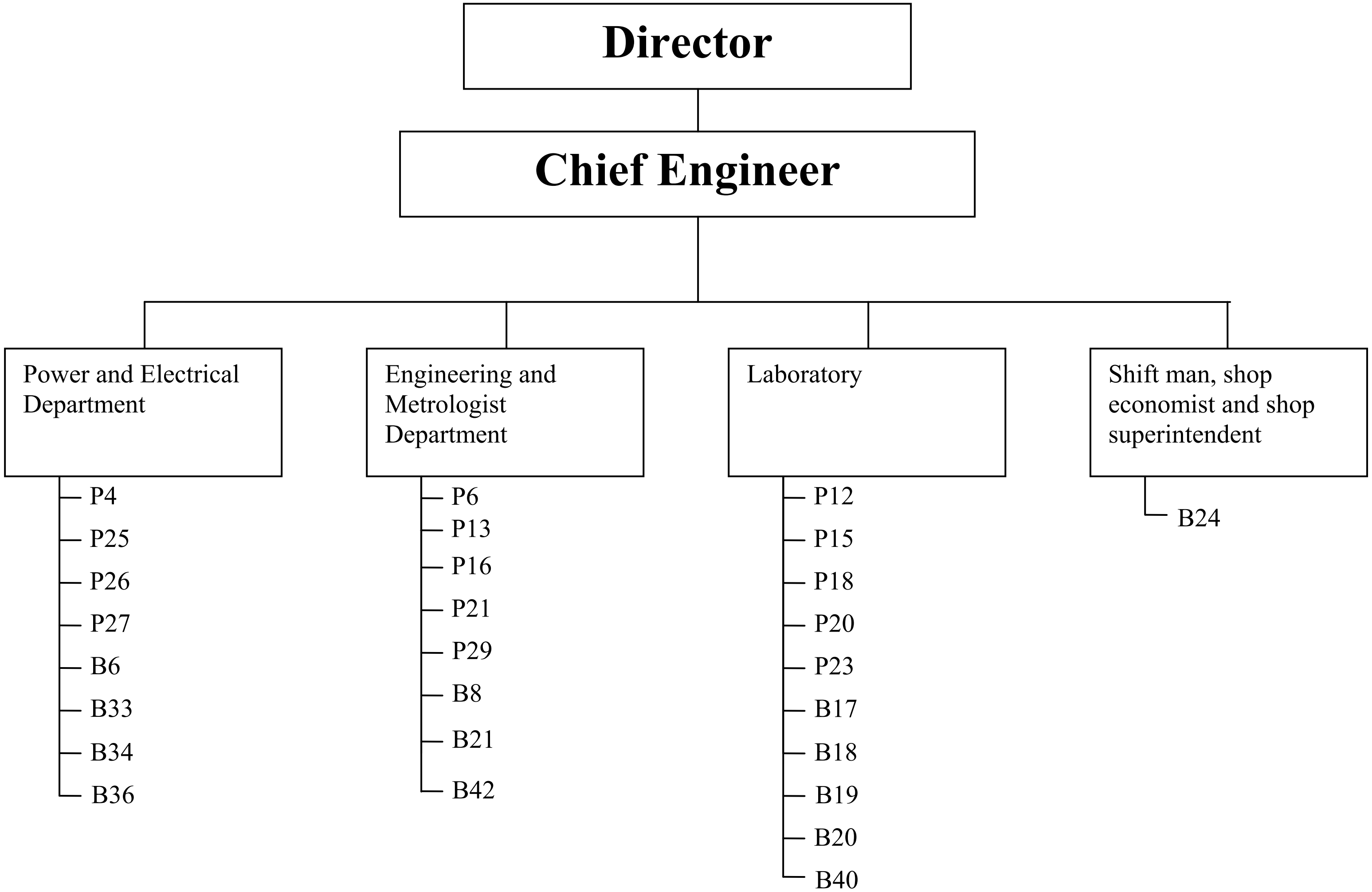
As described in section B.3 the project activities affect the combustion of kiln fuel, coal drying emissions and electricity consumption. For the development of the baseline scenario, and the project case, only those sources identified within Table 3 are included within the project and have been included within the monitoring plan.

A detailed records management system has been established to record and document all required data. The records management system includes paper records maintained by staff of the laboratory and production staff as well as electronic records maintained by the departments. These records are available as part of the determination or verification process, as they outline all consumption values for the project site.

Main Assumptions

- Calcination emissions do not change between the baseline and the project; as baseline and project raw materials mix remains constant;
- The cement to clinker ratio is determined by orders received from IF Cement customers and is not considered to not change between the project and the baseline
- There is no legal requirement to implement any of the project activities;
- The fuel mix for the kiln firing is unaffected by the implementation of the project;

Data collection and manipulation for the monitoring plan are the responsibility of 4 departments within IF Cement. The following organizational chart provides details on which parameters and emission sources are the responsibility of which department.


Director
Chief Engineer
Power and Electrical Department
P4
P25
P26
P27
B6
B33
B34
B36
Engineering and Metrologist Department
P6
P13
P16
P21
P29
B8
B21
B42
Laboratory
P12
P15
P18
P20
P23
B17
B18
B19
B20
B40
Shift man, shop economist and shop superintendent
B24

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

Table 4: Data to be collected for the Project

D.1.1.1. Data to be collected in order to monitor emissions from the project, and how these data will be archived:								
ID number (Please use numbers to ease cross-referencing to D.2.)	*Data variable*	*Source of data*	*Data unit*	*Measured (m), calculated (c), estimated (e)*	*Recording frequency*	*Proportion of data to be monitored*	*How will the data be archived? (electronic / paper)*	*Comment*
P1	PE_y	*Calculated as part of the JI project*	tCO_2	*C*	*Annually*	*100%*	*Electronic*	
P2	$PE_{coal,y}$	*Calculated as part of the JI project*	tCO_2	*C*	*Annually*	*100%*	*Electronic*	
P3	$PE_{prod,y}$	*Calculated as part of the JI project*	tCO_2	*C*	*Annually*	*100%*	*Electronic*	
P4	$EL_{coal,y}$	*IF Cement power department*	*MWh/tonne coal*	*M*	*Annually*	*100%*	*Paper and Electronic*	
P5	$EF_{el,y}$	*TÜV SÜD*[41]	tCO_2/MWh	*C*	*Annually*	*100%*	*Electronic*	
P6	FC_{coal}	*Consumption fuel meters*	*GJ/tonne coal*	*M*	*Annually*	*100%*	*Paper and Electronic*	

[41] TÜV SÜD Industrie Service GmbH Report, Ukraine - Assessment of new calculation of CEF <http://ji.unfccc.int/UserManagement/FileStorage/46JW2KL36KM0GEMI0PHDTQF6DVI514>

P7	***$EF_{fuel,y}$***	*IPCC*[42]	*tCO_2/GJ*	*C*	*Annually*	*100%*	*Electronic*	
P8	***$PE_{calcin,y}$***	*Calculated as part of the JI project*	*tCO_2*	*C*	*Annually*	*100%*	*Electronic*	
P9	***$PE_{kiln,y}$***	*Calculated as part of the JI project*	*tCO_2*	*C*	*Annually*	*100%*	*Electronic*	
P10	***$PE_{el,y}$***	*Calculated as part of the JI project*	*tCO_2*	*C*	*Annually*	*100%*	*Electronic*	
P11	***OutCaOy***	*IF Cement Laboratory and Chemistry Department*	*tonnes*	*M*	*Annually*	*100%*	*Paper and Electronic*	
P12	***CaO content of the clinker***	*IF Cement Laboratory and Chemistry Department*	*%*	*M*	*Annually*	*100%*	*Paper and Electronic*	
P13	***CLNKy***	*IF Cement monthly data records*	*tonnes*	*M*	*Annually*	*100%*	*Paper and Electronic*	
P14	***InCaOy***	*tIF Cement Laboratory and Chemistry Department*	*tonnes*	*M*	*Annually*	*100%*	*Paper and Electronic*	
P15	***CaO content of the***	*IF Cement*	*%*	*M*	*Annually*	*100%*	*Paper and*	

[42] IPCC defaults are from: Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories, Vol. III (Reference Manual), p. 1.13

	raw material	*Laboratory and Chemistry Department*					*Electronic*	
P16	***RM**$_{dry}$*	*IF Cement Engineer and Metrologist*	*tonnes*	*M*	*Annually*	*100%*	*Paper and Electronic*	
P17	***OutMgOy***	*IF Cement Laboratory and Chemistry Department*	*tonnes*	*M*	*Annually*	*100%*	*Paper and Electronic*	
P18	***MgO content of the clinker***	*IF Cement Laboratory and Chemistry Department*	*%*	*M*	*Annually*	*100%*	*Paper and Electronic*	
P19	***InMgOy***	*IF Cement Laboratory and Chemistry Department*	*tonnes*	*M*	*Annually*	*100%*	*Paper and Electronic*	
P20	***MgO content of the raw material***	*IF Cement Laboratory and Chemistry Department*	*%*	*M*	*Annually*	*100%*	*Paper and Electronic*	
P21	***FC**$_{fuel\_i}$*	*IF Cement Engineer and Metrologist*	*tonnes or m^3*	*M*	*Annually*	*100%*	*Paper and Electronic*	

P22	EF_{fuel_i}	*IPCC*[43]	tCO_2 */GJ*	*M*	*Annually*	*100%*	*Paper and Electronic*	
P23	NCV_{fuel_i}	*IF Cement Laboratory and Chemistry Department*	*Kcal / tonne or* m^3	*M*	*Annually*	*100%*	*Paper and Electronic*	
P24	**Conv_1**	*IPCC*	*KJ/kcal*	*M*	*Annually*	*100%*	*Electronic*	*Conversion factor: kcal→kJ*
P25	EL_{grind}	*IF Cement Power Department*	*MWh*	*M*	*Annually*	*100%*	*Paper and Electronic*	
P26	EL_{RM}	*IF Cement Power Department*	*MWh*	*M*	*Annually*	*100%*	*Paper and Electronic*	
P27	EL_{kiln}	*IF Cement Power Department*	*MWh*	*M*	*Annually*	*100%*	*Paper and Electronic*	
P28	$EF_{el,y}$	TÜV SÜD[44]	tCO_2/MWh	*M*	*Annually*	*100%*	*Electronic*	
P29	**Coalprod**	*IF Cement engineer and metrologist*	*tonne*	*M*	*Monthly*	*100%*	*Paper and Electronic*	

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

[43] IPCC defaults are from: Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories, Vol. III (Reference Manual), p. 1.13

[44] TÜV SÜD Industrie Service GmbH Report, Ukraine - Assessment of new calculation of CEF <http://ji.unfccc.int/UserManagement/FileStorage/46JW2KL36KM0GEMI0PHDTQF6DVI514>

equivalent):

Emissions from the project year are a combination of two distinct sets of calculations representing all aspects of the project location affected by the implementation of the project. The two components affected by the project are (1) the emissions from fuel combustion for coal processing and (2) fuel combustions for the production of clinker. These two project aspects each contribute to the overall emission reductions, and have been calculated separately for transparency.

$$PE_y = PE_{coal,y} + PE_{prod,y}$$

Where

PE_y is the project emissions in year y (tCO_2)
$PE_{coal,y}$ is the project emissions from the coal drying and crushing in year y (tCO_2)
PE_{prod} is the project emissions from dry cement production and any remaining wet production in year y (tCO_2)

1.0
2.0 Coal Preparation

Emissions resulting from drying and crushing coal will be reduced within the project year, as waste heat from the new dry kiln will be used to substitute the use of natural gas for drying purposes. Coal is dried for all three kilns at IF Cement. These fuel savings are calculated from the coal drying process onsite. Electricity data is also required to ensure no change in electricity consumption occurs while implementing this aspect of the project. Data regarding electricity consumption during the project case will show any changes in consumption based on electricity consumed for the new coal processing techniques. Quantification of emissions for fuel use has been adapted from the approved CDM methodology ACM0003 version 07.2. Quantification of emissions for electricity has been adapted from the approved CDM methodology ACM0005 version 04.

$$PE_{coal,y} = \{ [EL_{coal,y} \times EF_{el,y}] + [FC_{coal} \times EF_{fuel,y} \times (NCV_{fuel\_i} \times Conv\_1)] \} Coalprod$$

Where

$PE_{coal,y}$	is the project emissions from coal mill in year y (tCO_2)
$EL_{coal,y}$	is the electricity due to coal drying and handling (kWh/ tonne coal)
$EF_{el,y}$	is the emission factor of Ukraine electricity grid in year y (tCO_2/MWh)
FC_{coal}	is the fuel consumption for drying of the coal mill in year y (m^3 /tonne coal)
$EF_{fuel,y}$	is the emission factor for the fuel (tCO_2/GJ)
NCV_{fuel_i}	Net calorific value of fuel (kcal/tonne or m^3)
Conv_1	Conversion from kcal to kJ (constant) (kJ/kcal)
Coalprod	Volume of Coal Processed within the project year (tonnes coal)

2.0 Dry Cement Production

The switch from wet to dry cement production is the primary means of reducing energy demand during the project. Here the emissions resulting from the production of cement after the implementation of the dry kiln are quantified. Emissions are a result of electricity usage kiln fuel consumption and calcination emissions of the raw materials. These three main categories are further broken down to illustrate all sources of emissions resulting from the production of cement using the dry technology. Furthermore, each source of emissions has been separated by existing capacity and the capacity expansion; for transparency when comparing to baseline emissions.

Existing capacity was obtained from the following calculation, and capacity expansion production is the remaining production after existing capacity has been accounted for. The Quantification technique between existing capacity and capacity expansion are defined as per the Volyn Cement PDD[45] methodology for incremental production, annex 2.

$$CLNK_{exist,y} = CLNK_{actual,y} \quad \text{with maximum of } CLNK_{existcap}$$

[45] Volyn-Cement Project Design Document, PDD version 1.5, January 30, 2008, http://ji.unfccc.int/UserManagement/FileStorage/UWCFRFLURJEJMZ0SELJI9F7ECR33CU accessed on April 1, 2009. p.67

where:

$CLNK_{exist,y}$ Clinker production in the baseline scenario on the existing kilns in year y (tonnes clinker)
$CLNK_{actual,y}$ Clinker production in the project scenario in year, y (tonnes clinker)
$CLNK_{existcap}$ Clinker production *capacity* of the existing wet kilns (tonnes)

Overall the emissions resulting from project emissions are as follows:

$$PE_{prod,y} = PE_{calcin,y} + PE_{kiln,y} + PE_{el,y}$$

Where

$PE_{prod,y}$ Project emissions from the production of cement using the dry process and any remaining wet process in year y (tCO_2)
$PE_{calciny}$ Project emissions due to calcination in year y from both existing capacity and capacity expansion production (tCO_2)
$PE_{kiln,y}$ Project emissions from combustion of kiln fuels in year y from both existing capacity and capacity expansion production (tCO_2)
$PE_{el,y}$ Project emissions from the consumption of electricity for cement production from both from both existing capacity and capacity expansion production (tCO_2)

Since calcination emissions are a result of a particular raw material mix and this mix is not influenced by the project activity, it is assumed that calcination emissions do not change between the baseline and the project. This assumption means the raw material mix from the project being the same as the raw material mix in the baseline. For this reason, $PE_{calcin,y}$ will not be considered in the calculations of emission reductions from the historical baseline, up to and including clinker existing capacity ($CLNK_{existcap}$) of the wet kilns.

2.1 Calcination

Calcination emissions result from the calcining of limestone and dolomite within the firing kilns. Emissions result from the chemical reaction of

$CaCO_3$ + heat → CaO + CO_2**.** Calcination emissions are only included in the capacity expansion calculations since it is assumed that the mix of raw materials will not change between the project and the baseline and therefore, the calcination emissions will not change for the existing capacity calculation. They are included in the capacity expansion calculations since the Volyn Cement PDD includes these and it is necessary to include them in this calculation to ensure a fair comparison. Quantification of calcination emissions has been taken from approved CDM methodology ACM0005 version 04.

$$PE_{calcin,y} = \{ 0.785*(OutCaOy - InCaOy) + 1.092*(OutMgOy - InMgOy) \}_{capacity\ expansion}$$

where:

$PE_{calcin,y}$	Emissions from the calcinations of limestone (tCO_2)
0.785	Stoichiometric emission factor for CaO (tCO_2/t CaO)
1.092	Stoichiometric emission factor for MgO (tCO_2/t MgO)
InCaO,y	CaO content (%) of the raw material * RM_{dry} (tonnes)
OutCaO,y	CaO content (%) of the clinker * $CLNK_y$ (tonnes)
InMgO,y	MgO content (%) of the raw material * RM_{dry} (tonnes)
OutMgO,y	MgO content (%) of the clinker * $CLNK_y$ (tonnes)
$CLNK_y$	Quantity of clinker produced within year y (tonnes)
RM_{dry}	Raw material consumption for dry kiln in year y (tonnes)

2.2 Kiln Fuel

The fuel used within the kilns is comprised of a number of different fuel types; the summation of all energy, in GJ, provided by the kiln fuels will be quantified as the combustion emissions of the three kilns; including the new dry kiln. Fuel mix providing the heat energy will be taken as the fuel mix from the project year, as fluctuations in fuel mix are not affected by the project activity. The fuel mix is primarily influenced by price and availability considerations. Overall fuel usage is seen to decrease over the crediting period, on a per tonne of clinker basis, as the increased dry kiln production phases out the production in the remaining wet kilns. Quantification of emissions for kiln fuel has been adapted from the approved CDM methodology ACM0003 version 07.2.

$$PE_{kiln,y} = \{ \sum_i FC_{fuel\_i} \times EF_{fuel\_i} \times [NCV_{fuel\_i} \times Conv\_1] \}_{existing\ capacity} + \{ \sum_i FC_{fuel\_i} \times EF_{fuel\_i} \times [NCV_{fuel\_i} \times Conv\_1] \}_{capacity\ expansion}$$

Where:

$PE_{kiln,y}$ Project emissions from combustion of kiln fuels in year y (tCO_2)
FC_{fuel_i} Fuel consumption of fuel type *i* (tonnes or m^3)
EF_{fuel_i} Emission factor for fuel type *i* (tCO_2 / GJ)
NCV_{fuel_i} Net calorific value of fuel *i* (kcal/tonne or m^3)
Conv_1 Conversion from kcal to kJ (constant) (kJ/kcal)

2.3 Electricity Consumption

Indirect emissions caused by the consumption of electricity must be accounted for within the production of cement. Electricity is utilized within the cement manufacturing process to power fans, conveyers and grinders and other such electric devices throughout the cement process. Electricity consumption will be affected by the project activity as the process of raw mill preparation and kiln consumption differs between the wet and dry cement process. Electricity consumption has been broken down into three main components for quantification. Quantification of emissions for electricity consumption has been adapted from the approved CDM methodology ACM0005 version 04.

$$PE_{el,y} = \{ [EL_{RM} + EL_{kiln} + EL_{grind}]_{existing\ capacity} + [EL_{RM} + EL_{kiln} + EL_{grind}]_{cap.\ expansion} \} \times EF_{el,y}$$

$PE_{el,y}$ Project emissions from the consumption of electricity for cement production (tCO_2)
EL_{RM} Electricity for the raw materials preparation and transport to the site (MWh)
EL_{kiln} Electricity for the kiln (MWh)
EL_{grind} Electricity consumption for clinker milling (MWh)
$EF_{el,y}$ Carbon emission factor of Ukraine electricity grid (tCO_2/MWh)

Table 5: Data to be collected for the Baseline

D.1.1.3. Relevant data necessary for determining the baseline of anthropogenic emissions of greenhouse gases by sources within the project boundary, and how such data will be collected and archived:								
ID number (Please use numbers to ease cross-referencing to D.2.)	*Data variable*	*Source of data*	*Data unit*	*Measured (m), calculated (c), estimated (e)*	*Recording frequency*	*Proportion of data to be monitored*	*How will the data be archived? (electronic/ paper)*	*Comment*
B1	$\mathbf{BE}_{y}$	*Calculated as part of the JI Project*	tCO_2	*C*	*Annually*	*100%*	*Electronic*	
B2	$\mathbf{BE}_{coal,y}$	*Calculated as part of the JI Project*	tCO_2	*C*	*Annually*	*100%*	*Electronic*	
B3	$\mathbf{BE}_{existing\ capacity,\ y}$	*Calculated as part of the JI Project*	tCO_2	*C*	*Annually*	*100%*	*Electronic*	
B4	$\mathbf{BE}_{capacity\ expansion,y}$	*Calculated as part of the JI Project*	tCO_2	*C*	*Annually*	*100%*	*Electronic*	
B5	$\mathbf{BE}_{BC,y}$	*Calculated as part of the JI Project*	tCO_2	*C*	*Annually*	*100%*	*Electronic*	
B6	$\mathbf{EL}_{coal}$	*IF Cement Power engineering specialist*	*MWh*	*M*	*Annually*	*100%*	*Paper and Electronic*	

B7	***$EF_{el,y}$***	*TÜV SÜD*[46]	tCO_2/MWh	*C*	Annually	100%	Electronic	
B8	***FC_{coal}***	*IF Cement fuel meters*	*GJ*	*M*	*Annually*	*100%*	*Paper and Electronic*	
B9	***$EF_{fuel,y}$***	*IPCC*[47]	*tCO_2/GJ*	*M/C*	*Annually*	*100%*	*Electronic*	
B10	***$CLNK_{exist,y}$***	*Calculated by IF Cement*	*tonnes*	*C*	*Annually*	*100%*	*Electronic*	*Refer to table 7 for more detail*
B11	***$CLNK_{actual,y}$***	*IF Cement monthly data records*	*tonnes*	*M*	*Annually*	*100%*	*Paper and Electronic*	
B12	***$CLNK_{existcap}$***	*IF Cement manufacturing specifications*	*tonnes*	*M*	*Annually*	*100%*	*Paper and Electronic*	
B13	***$BE_{calcin,y}$***	*Calculated as part of the JI Project*	*tCO_2*	*C*	*Annually*	*100%*	*Electronic*	
B14	***$BE_{kiln,y}$***	*Calculated as part of the JI Project*	*tCO_2*	*C*	*Annually*	*100%*	*Electronic*	
B15	***$BE_{el,y}$***	*Calculated as part of the JI Project*	*tCO_2*	*C*	*Annually*	*100%*	*Electronic*	
B16	***OutCaOy***	*IF Cement Laboratory and Chemistry Department*	*tonnes*	*C*	*Annually*	*100%*	*Electronic*	

[46] TÜV SÜD Industrie Service GmbH Report, Ukraine - Assessment of new calculation of CEF <http://ji.unfccc.int/UserManagement/FileStorage/46JW2KL36KM0GEMI0PHDTQF6DVI514>

[47] IPCC defaults are from: Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories, Vol. III (Reference Manual), p. 1.13

B17	***CaO content of the raw material***	*IF Cement Laboratory and Chemistry Department*	*%*	*M*	*Continually*	*100%*	*Paper and Electronic*	
B18	***CaO content of the clinker***	*IF Cement Laboratory and Chemistry Department*	*%*	*M*	*Continually*	*100%*	*Paper and Electronic*	
B19	***MgO content of the raw material***	*IF Cement Laboratory and Chemistry Department*	*%*	*M*	*Continually*	*100%*	*Paper and Electronic*	
B20	***MgO content of the clinker***	*IF Cement Laboratory and Chemistry Department*	*%*	*M*	*Continually*	*100%*	*Paper and Electronic*	
B21	***RM***	*IF Cement engineer and metrologist*	*tonnes*	*C*	*Annually*	*100%*	*Electronic*	
B22	$RM_{wet,y}$	*IF Cement engineer and metrologist*	*tonnes*	*M*	*Continually*	*100%*	*Paper and Electronic*	
B23	$CLNK_{wet,y}$	*IF Cement monthly data records*	*tonnes*	*M*	*Continually*	*100%*	*Paper and Electronic*	
B24	***InCaOy***	*IF Cement Laboratory and Chemistry Department*	*tonnes*	*C*	*Annually*	*100%*	*Electronic*	

B25	***OutMgOy***	*IF Cement Laboratory and Chemistry Department*	*tonnes*	*C*	*Annually*	*100%*	*Electronic*	
B26	***InMgOy***	*IF Cement Laboratory and Chemistry Department*	t*tonnes*	*C*	*Annually*	*100%*	*Electronic*	
B27	*BKE*	*Calculated as part of the JI Project*	*GJ/tonne clinker*	*C*	*Annually*	*100%*	*Paper*	
B28	EF_{fuel_i}	*IPCC*[48]	tCO_2/GJ	*M/C*	*Annually*	*100%*	*Electronic*	
B29	$BE_{el\_grind,y}$	*Calculated as part of the JI Project*	tCO_2	*C*	*Annually*	*100%*	*Electronic*	
B30	$BE_{el\_RM,y}$	*Calculated as part of the JI Project*	tCO_2	*C*	*Annually*	*100%*	*Electronic*	
B31	$BE_{el\_kiln,y}$	*Calculated as part of the JI Project*	tCO_2	*C*	*Annually*	*100%*	*Electronic*	
B32	EL_{Kiln}	*IF Cement Power Department*	*MWh/tonne clinker*	*M*	*Annually*	*100%*	*Paper and Electronic*	
B33	EL_{grind}	*IF Cement Power Department*	*MWh/tonne clinker*	*M*	*Annually*	*100%*	*Paper and Electronic*	

[48] IPCC defaults are from: Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories, Vol. III (Reference Manual), p. 1.13

B34	EL_{RM}	*IF Cement Power Department*	*MWh/tonne clinker*	*M*	*Annually*	*100%*	*Paper and Electronic*	
B35	$CEM_{,y}$	*IF Cement monthly data records*	tCO_2	*M*	*Annually*	*100%*	*Paper and Electronic*	*Existing capacity*
B36	$BEF_{incr,y}$	*Volyn Cement PDD*	tCO_2*/tonne of cement*	*ME*	*Annually*	*100%*	*Paper and Electronic*	
B37	$CLNK_{incr}$	*Calculated as part of the JI Project*	*Tonnes*	*C*	*Annually*	*100%*	*Electronic*	
B38	***NCV_fuel_i***	*IF Cement Laboratory and Chemistry Department*	*Kcal/*m^3 *or tonne*	*M*	*Continually*	*100%*	*Paper and Electronic*	
B39	***Conv_1***	*IPCC*	*KJ/kcal*	*M*	*Annually*	*100%*	*Electronic*	*Conversion factor: kcal→kJ*
B40	***Coalprod***	*IF Cement monthly data records from laboratory*	*tonne*	*M*	*Monthly*	*100%*	*Paper and Electronic*	
B41	$CEM_{capacity\ expansion}$	*Calculated as part of the JI Project*	*tonne*	*C*	*Annually*	*100%*	*Electronic*	*Capacity Expansion*
B42	$BEF_{rev,y}$	*Volyn Cement PDD*	tCO_2*/tonne of cement*	*C*	*Annually*	*100%*	*Electronic*	

B43	***$CLNKFAC_y$***	*Calculated as part of the Plant Operation*	*%*	*C*	*Annually*	*100%*	*Electronic*	*IF Cement Value of Clinker content in Cement*
B44	***CLNKFACincr***	*Volyn Cement PDD*	*%*	*M*	*Annually*	*100%*	*Paper and Electronic*	

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

Emissions from the baseline year are a combination of two distinct sets of calculations representing all aspects of emissions occurring in absence of the project activity. These two sources are (1) the emissions from coal drying and processing and (2) the production of clinker using wet technology. Due to a capacity expansion that results from the addition of the dry kiln, the baseline emissions have been calculated to account for incremental production volumes as a result of the project. Overall the incremental production has been accounted for as a ‘capacity expansion’ from the baseline’s maximum capacity; as defined below. The methodological approach to account for incremental cement production has been taken from Annex 2 of the Volyn cement PDD[15].

Overall the emissions from coal drying and wet cement production makeup the baseline emissions. These baseline aspects, including incremental production, each contribute to the overall emissions of the everyday operations and have been calculated separately for transparency.

$$BE_y = BE_{coal,y} + [\, BE_{existing\ capacity,\ y} + BE_{capacity\ expansion,y} \,]$$

Where

BE_y is the baseline emissions in year y (tCO_2)
$BE_{coal,y}$ is the baseline emissions from the coal mill in year y (tCO_2)
$BE_{existing\ capacity,y}$ is the baseline emissions from wet cement production in year y (tCO_2)

$BE_{capacity\ expansion,y}$ is the baseline emissions from incremental production (tCO_2),

1.0 Coal Drying and Preparation

Heat for the drying of coal during the baseline is supplied by natural gas consumption within the coal mill. This use of fuel for heat production is required to dry coal. These emissions are calculated from the coal drying process onsite. Data regarding electricity consumption during the project case will show any changes in consumption based on electricity consumed for new coal processing techniques. Quantification of emissions for electricity consumption has been adapted from the approved CDM methodology ACM0005 version 04. Quantification for fuel use has been adapted from the approved CDM methodology ACM0003 version 07.2.

$$BE_{coal,y} = \{ [EL_{coal} \times EF_{el,y}] + [FC_{coal} \times EF_{fuel,y} \times (NCV_{fuel\_y} \times Conv\_1)] \} * Coalprod$$

Where

$BE_{coal,y}$ is the baseline emissions from coal mill in year y (tCO_2)
EL_{coal} is the electricity for coal preparation and handling (MWh/tonne coal)
$EF_{el,y}$ is the carbon emission factor of Ukraine electricity grid (tCO_2/MWh)
FC_{coal} is the natural gas consumption of coal dryer in year y (m^3/tonne coal)
$EF_{fuel,y}$ is the carbon emission factor (tCO_2/GJ)
NCV_{fuel_y} Net calorific value of fuel (kcal/tonne or m^3)
Conv_1 Conversion from kcal to kJ (constant) (kJ/kcal)
Coalprod Quantity of coal processed in project year (tonne coal)

2.0 Wet Cement Production

The switch from wet to dry cement production is the primary means of reducing energy demand during the project. Here the emissions resulting from the production of cement using the baseline wet technology are quantified. Emissions are a result of electricity usage, kiln fuel consumption and calcination emissions of the raw materials. These three main categories are further broken down to illustrate all sources of emissions resulting from the production of cement using the wet technology.

To account for incremental clinker production volumes the first step is to identify the maximum volumes of production of the current wet kilns (i.e. variable ***with maximum of*** $CLNK_{existcap}$). Once this value is known it is subtracted from the total production to determine the amount of clinker that must be quantified against a sector-wide baseline rather than a project-specific baseline. The remainder of production emissions for the baseline case are taken into account using the incremental production values outlined within the same method. These emission quantities for the sector-wide baseline have been calculated using the method developed in Annex 2 of the Volyn Cement PDD[49].

$$CLNK_{exist,y} = CLNK_{actual,y} \quad \textit{with maximum of } CLNK_{existcap}$$

where:

$CLNK_{exist,y}$	Clinker production in the baseline scenario on the existing kilns in year y (tonnes clinker)
$CLNK_{actual,y}$	Clinker production in the project scenario in year, y (tonnes clinker)
$CLNK_{existcap}$	Clinker production *capacity* of the existing wet kilns (tonnes)

$$BE_{existing\ capacity,\ y} = BE_{calcin,y} + BE_{kiln,y} + BE_{el,y}$$

[49] Volyn-Cement Project Design Document, PDD version 1.5, January 30, 2008, http://ji.unfccc.int/UserManagement/FileStorage/UWCFRFLURJEJMZ0SELJI9F7ECR33CU accessed on April 1, 2009. p.67

Where :

$BE_{existing\ capacity\ ,\ y}$	Baseline emissions from the production of cement using the wet process (tCO_2)
$BE_{calciny}$	Baseline emissions due to calcinations in year y, for existing capacity (tCO_2)
$BE_{kiln,y}$	Baseline emissions from combustion of kiln fuels in year y, for existing capacity (tCO_2)
$BE_{el,y}$	Baseline emissions from the consumption of electricity for cement production, for existing capacity (tCO_2)

2.1 Calcination

Calcination emissions result from the calcining of limestone and marl within the firing kilns. Emissions result from the chemical reaction of $CaCO_3$ + heat → $CaO + CO_2$**.** The quantity of emissions calculated here is only applicable to the clinker which is considered to be incremental production beyond what the previous three wet kilns could have produced. These emissions must be compared against a sector-wide baseline since the assumption would be that this incremental cement production could have been produced by average of existing cement production facilities in Ukraine or by best available technology if a new cement plant were built in Ukraine. The methodology for calculating the emissions from this assumed sector-wide baseline is presented in Annex 2 of the Volyn Cement PDD[50]. Quantification of calcination emissions has been taken from approved CDM methodology ACM0005 version 04.

$$BE_{calcin,y} = \{ 0.785*(OutCaOy - InCaOy) + 1.092*(OutMgOy - InMgOy)\}_{capacity\ expansion}$$

where:

$BE_{calcin,y}$	Emissions from the calcinations of limestone (tCO_2)
0.785	Stoichiometric emission factor for CaO (tCO_2/t CaO)
1.092	Stoichiometric emission factor for MgO (tCO_2/t MgO)

[50] Volyn-Cement Project Design Document, PDD version 1.5, January 30, 2008, http://ji.unfccc.int/UserManagement/FileStorage/UWCFRFLURJEJMZ0SELJI9F7ECR33CU accessed on April 1, 2009

InCaO,y CaO content (%) of the raw material * **RM** (tonnes); see below for definition of RM
OutCaO,y CaO content (%) of the clinker * ***CLNK$_{exist,y}$***(tonnes)
InMgO,y MgO content (%) of the raw material * **RM** (tonnes); see below for definition of RM
OutMgO,y MgO content (%) of the clinker * ***CLNK$_{exist,y}$*** (tonnes)
$CLNK_{exist,y}$ Clinker production in the baseline scenario on the existing kilns in year y (tonnes)
RM Raw material consumption for kilns in year y (tonnes)

2.2 Kiln Fuel

Emissions from the consumption of kiln fuel are a result of two main factors; (1) wet kiln fuel efficiency (GJ used/tonne clinker) and (2) The carbon intensity of the fuel mix used. First, the existing efficiency of the wet kilns were determined as the average efficiency from over the previous three years of consumption data (2005 to 2007) prior to the project implementation; as required by approved methods. The fuel mix providing the heat energy will be determined as the fuel mix from the project year; as fluctuations in fuel are a result of price and availability and are not influenced by the project activity. As stated within the assumptions; fuel mix is independent of kiln technology for this project. Quantification of emissions for kiln fuel has been adapted from the approved CDM methodology ACM0003 version 07.2. Emissions from the consumption of fuel are as follows:

$$\boldsymbol{BE_{kiln,y}} = \sum_i BKE \times EF_{fuel\_i} \times \mathrm{CLNK}_{\mathrm{exist,y}}$$

Where:

$BE_{kiln,y}$ Baseline emissions from combustion of kiln fuels in year y (tCO_2)
BKE The average baseline kiln efficiency for 3 years prior to the project (2005-2007) for the existing kiln (GJ/tonne clinker)
EF_{fuel_i} Emission factor for fuel mix (tCO_2 / GJ) (based on identified fuel mix from project year)
$CLNK_{exist,y}$ Clinker production in the baseline scenario on the existing kilns in year y (tonnes clinker)

2.3 Electricity Consumption

Indirect emissions caused by the consumption of electricity must be accounted for within the production of cement. Electricity is utilized within the cement manufacturing process to power fans, conveyers and grinders, slurry mixing and other such electric devices throughout the cement process. Electricity consumption will be affected by the project activity as the process of raw material handling and preparation differs between the wet and dry cement process. Quantification of emissions for electricity consumption has been adapted from the approved CDM methodology ACM0005 version 04.

$$BE_{el,y} = BE_{el\_RM,y} + BE_{el\_kiln,y} + BE_{el\_grind,y}$$

where:

$BE_{el,y}$	Baseline emissions from the consumption of electricity for cement production, averaged intensity over three reporting years (tCO_2)
$BE_{el\_RM,y}$	Indirect emissions from electricity consumption for the raw material processing (tCO_2)
$BE_{el\_kiln,y}$	Indirect emissions from electricity consumption for wet kiln operation (tCO_2)
$BE_{el\_grind,y}$	Indirect emissions from the consumption of electricity for grinding of cement (tCO_2); as defined below

where

$$BE_{el\_RM,y} = EL_{RM} \times RM_{,y} \times EF_{el,y}$$

where:

$BE_{el\_RM,y}$	Indirect emissions from electricity consumption for the raw material processing (tCO_2)
EL_{RM}	Average electricity consumption for the consumption of electricity from the raw material process during the three year prior to the project (MWh/tonne RM)

RM_y	Raw material production in the baseline scenario on the existing kilns in year y (tonnes clinker)
$EF_{el,,y}$	Carbon emission factor of Ukraine electricity grid (tCO_2/MWh)

$$BE_{el\_kiln,\,y} = EL_{Kiln} \times CLNK_{exist,y} \times EF_{el,y}$$

where:

$BE_{el\_kiln,\,y}$	Indirect emissions from electricity consumption for the wet kiln operation (tCO_2)
EL_{kiln}	Average electricity consumption for the consumption of electricity from the wet kiln operation during the three year prior to the project (MWh/tonne clinker)
$CLNK_{exist,y}$	Clinker production in the baseline scenario on the existing kilns in year y (tonnes clinker)
$EF_{el,\,y}$	Carbon emission factor of Ukraine electricity grid (tCO_2/MWh)

$$BE_{el\_grind,y} = EL_{grind} \times CEM \times EF_{el,y}$$

where:

$BE_{el\_grind,y}$	Indirect emissions from the consumption of electricity for grinding of cement (tCO_2)
EL_{grind}	Specific electricity consumption of the grinding mills as an average from three years of historical data (MWh/tonne clinker)
$EF_{el,,y}$	Carbon emission factor of Ukraine electricity grid (tCO_2/MWh)
CEM	Quantity of Cement produced in year (tonnes)

2.4 Capacity Expansion

Production capacity in the project extends beyond what the technical capacity of the wet kiln operation can produce. To account for emissions from this incremental production, the Volyn Cement method has been used to identify the most likely emissions resulting from the production of additional capacity of cement in absence of the project activity. The following calculation methods have been adapted from the Volyn Cement PDD[51].

$$BE_{incr,y} = CEM_{capacity\ expansion} * BEF_{rev,y}$$

where:

$BE_{incr,y}$	Baseline emissions of incremental cement production in year y (tCO_2)
$CEM_{capacity\ expansion}$	Quantity of cement produced above that of the existing capacity prior to the project implementation (tCO_2) ; as defined below
$BEF_{rev,y}$	Baseline emission factor for incremental cement production in year y (tCO_2/tonne cement) adjusted from volyn cement method, see Annex 2 of the VolynCement PDD for details

Cement production for the incremental component of the baseline emissions is relative to the clinker production capacity at the plant.

$$CEM_{capacity\ expansion,} = CLNK_{inc} * (1+ (1- CLNKFAC_y))$$

where:

$CEM_{capacity\ expansion}$	Quantity of cement produced above that of the existing capacity prior to the project implementation (tonne cement)
$CLNKFAC_y$	Clinker factor; average quantity of clinker in finished cement (%)
$CLNK_{inc}$	Incremental cement production in the baseline scenario (tonnes); and as defined below

where

$$CLNK_{incr} = CLNK_{actual,y} – CLNK_{existcap}$$

51

Volyn-Cement Project Design Document, PDD version 1.5, January 30, 2008, http://ji.unfccc.int/UserManagement/FileStorage/UWCFRFLURJEJMZ0SELJI9F7ECR33CU accessed on April 1, 2009. pg. 43-44, 67.

where

$CLNK_{incr}$	Incremental cement production in the baseline scenario (tonnes)
$CLNK_{actual,y}$	Clinker production in the project scenario in year, y (tonnes clinker)
$CLNK_{existcap}$	Clinker production *capacity* of the existing kilns (tonnes)

The Volyn Cement method has been adjusted to include and reflect the actual IF Cement clinker content in cement. Simply put, the method prescribed in the Volyn Cement PDD has a much lower clinker to cement ratio, and this value has been changed to account for the actual clinker content required by IF Cement consumers. Further details are provided within Annex 3.

$$BEF_{rev,y} = BEF_{incr,y} * (CLNKFAC_y / CLNKFAC_{incr})$$

where

$BEF_{rev,y}$	Baseline emission factor for incremental cement production in year y (tCO_2/tonne cement) adjusted from Volyn Cement method, see Annex 2 of the Volyn Cement PDD for details
$CLNKFAC_{,y}$	Clinker factor; average quantity of clinker in (IF Cement produced) finished cement (%)
$CLNKFAC_{,incr}$	Clinker factor; average quantity of clinker in (Volyn method) finished cement (%)
$BEF_{incr,y}$	Baseline emission factor for incremental cement production in year y (tCO_2/tonne cement), see Annex 2 of the VolynCement PDD for details

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

Table 6: Final Emission Reduction Calculations

D.1.2.1. Data to be collected in order to monitor emission reductions from the project, and how these data will be archived:								
ID number *(Please use numbers to ease cross-referencing to D.2.)*	Data variable	Source of data	Data unit	Measured (m), calculated (c), estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment
P1	PE_y		*tonnes* CO_2e	*C*	*Annually*		*electronically*	
B1	BE_y		*tonnes* CO_2e	*C*	*Annually*		*Electronically*	

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

$$ER_y = BE_y - PE_y$$

Where:

ER_y = Emission reductions from the switch from wet to dry production and the use of waste heat for coal drying, CO_2 only
BE_y = Total baseline emissions from previous wet production process, CO_2 only
PE_y = Total project emissions from new dry production process, any remaining wet production and any equipment necessary to implement new coal drying using waste heat recovery, CO_2 only.

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

No leakage has been identified within the project.

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

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

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

No leakage was identified within the project

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

Since there is no leakage identified for this project, the final equation remains:

$ER_y = BE_y - PE_y$

Where:

ER_y = Emission reductions from the switch from wet to dry production and the use of waste heat for coal drying, CO_2 only

BE_y = Total baseline emissions from previous wet production process, CO_2 only
PE_y = Total project emissions from new dry production process, any remaining wet production and any equipment necessary to implement new coal drying using waste heat recovery, CO_2 only.

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:

JSC "Pivdendinprocement" (Kharkiv) has developed the project design "Reconstruction of cement production by means of switching to dry method with implementation of new energy saving technologies". The project has been implemented according to State Construction Norms:

- DBN A.2.2-3-2004 "Composition, handling procedures, approval and submitting of project documentation for construction"
- DBN A.2.2-1-2003 "Composition and content of documents evaluating the environmental effect applied in the process of design and construction of production facilities, buildings and premises".

The basis for this project development is:

- Decision of Yamnytska village council №15 from 14.02.2007;
- Terms of reference for the development of project design;
- Architectural and planning assignment №09/5 from 12.02.2007;
- Technical conditions №1298 from 13.11.2006 of Central Administration of Ministry of Emergency Situations of Ukraine in Ivano-Frankivsk region;
- Conclusion №146 from 03.05.2006 of Ivano-Frankivsk Regional Health Office;
- Conclusion №2423/П from 18.04.2006 of State Expertise of Regional Administration of Land Resources;
- Technical conditions for power supply №44/07-103-1082 from 19.02.2007 issued by JSC "Prykarpattyaoblenergo".

On 10 July 2007 the project design passed through comprehensive state expertise at State enterprise "Ivano-Frankivsk regional service of Ukrainian State investment expertise" and the conclusion was issued. On the base of positive expert conclusions the project design "Reconstruction of cement production by means of switching to dry method with implementation of new energy saving technologies" can be recommended for issuing of license on construction and installation works.

The following construction norms have been used during the construction process:
The instructions on organization of construction contained in a chapter of the project design "Reconstruction of cement production by means of switching to dry method with implementation of new energy saving technologies" developed by JSC "Pivdendinprocement".

- DBN A.3.1-5-96 «Organization of building process».
- Public health regulations III -4-80* "Construction safety"
- Rules of determination of construction costs (DBN D.1.1-1-2000)
- DBN V.2.8-2-95. Technologies, outfit, inventories and tools applied in construction. Equipment and power tool. The types of testing. Procedure.
- DBN V.2.8-3-95. Technologies, outfit, inventories and tools applied in construction. Technical operation of construction machinery.
- DBN V.2.8-4-96. Technologies, outfit, inventories and tools applied in construction. The system of maintenance and repair of machinery
- DBN V.2.8-5-96. Technologies, outfit, inventories and tools applied in construction. Technical parameters of methods of mechanization, which are the subject for control during the process of certification testing.

State Standard of Ukraine DSTU V.2.6- 7-95 (GOST 8829-94). Structure of buildings and installations. Products made of construction concrete and reinforced concrete. The methods of testing by loading. The rules of estimation of substantiality, toughness and crack resistance.

- DBN V.1.1-3-97 Engineering protection of territories, buildings and constructions against land slides and rock slides. The main regulations.
- DBN V.1.1-7-2002. Protection against fire. Fire safety of construction objects.
- Etc.

For cement production JSC "Ivano-Frankivsk Cement" uses following standards:

1. State Standards of Ukraine (DSTU) B V.2.7-46-96 Cements for general construction purposes. (Technical conditions)
2. DSTU B V.2.7-112-2002 Cements. (General technical conditions)
3. TU U B V.2.7-00030937.12-98 Portland cement clinker (tradable). (Technical conditions)

4. GOST 5382-91 Cements and cementitious materials. (Methods of chemical analysis)
5. DSTU B V.2.7-88-99 Oil-well portland cement. (Technical conditions)
6. TU U 26.5-00030937-014-2001 Portland cement for production of asbestos cement products.
7. DSTU B V.2.7-85-99 Sulfate resistant cement. (Technical conditions)
8. EN 196-1:2005Methods of testing cement- Part 1:Determination of strength
9. EN 196-2:1994Methods of testing cement- Part 2: Chemical analysis of cement.
10. EN 196-3:2005Methods of testing cement- Part 3: Determination of setting time and soundness.
11. EN 196-4:1994Methods of testing cement- Part 4: Quantitative determination of constituents.
12. EN 196-6:1994Methods of testing cement- Part 6: Determination of fineness.
13. EN 196-7:1994Methods of testing cement- Part 7: Methods of taking and preparation samples of cement.
14. EN 196-10:2004E Methods of testing cement- Part10: Determination of water-soluble chromium (VI) content of cement.
15. EN 196-21:1994 Methods of testing cement- Part21: Determination of chloride, carbon dioxide and alkali content of cement
16. EN 451-1:2003 Methods of testing fly ash-Part1: Determination of free calcium oxide content.
17. Process procedure. Complex of documents of technological process of cement production. TR00292988-1.1.08.

D.2. Quality control (QC) and quality assurance (QA) procedures undertaken for data monitored:

Table 7: QA/QC Procedures for Data Collection

Data (Indicate table and ID number)		Uncertainty level of data (accuracy) (%)	Measurement Accuracy Level (High, Medium, Low)	Explain QA/QC procedures planned for these data, or why such procedures are not necessary.
P4 $EL_{coal.y}$	**Electricity for coal drying and processing (MWH)**	±1.0	High	ACKOE on the basis of electronic multifunctional meters Landis+Gyr of type ZMD410CT, calibrated once every 6 years
		±2.0	High	Micropocessor-based management devices of REF 542plus type, calibrated once every 3 years. Shop power engineering specialist and technician are responsible for data recording on paper and electronically. Records are kept for 3 years.
P6 FC_{coal}	**Fuel consumption in the (G/J) coal dryer**	±1.0 ±0.25 ±0.5 ±0.2	High High High High	Coal drying is provided by exhaust gases from kiln №3; the gases are not monitored. When the kiln is shut down, natural gas is used for coal drying. Short-term gas usage is monitored by: - Gas meter "Delta" 2050/G65 1.3-100 m^3/year. Made by "Arsenal" plant, Kyiv; Calibrated once every 2 years by representative of the State Ivano-Frankivsk scientific and practical centre for standartization, metrology and certification. -Absolute pressure sensor MIDA-DA-13P-Ex 0-1,0 MPa. Calibrated once every year by representative of the State Ivano-Frankivsk scientific and practical centre for standartization, metrology and certification. -Thermoelement TCMU-0289 -50…+50. . Calibrated once every 2 years by representative of the State Ivano-Frankivsk scientific and practical centre for standartization, metrology and certification. -Gas Volume Measuring Device (gauge) UNIVERSA-02. Calibrated once every 2 years by representative of the State Ivano-Frankivsk scientific and practical centre for standartization, metrology and certification. Engineer-metrologist is responsible for data recording on paper and electronically.
P7 $EF_{fuel,y}$	**Emission factor for each type of fuel (Kg CO2/TJ)**			Coal-96000 Natural gas-56100 Oil wastes-77400 Sawdust -112000 Wood chipboards-112000 Peat-106000 Tires-85000

P12 CaO	**Content in clinker**	±0.12	High	Thermo, Model: ARL 9900XP Serial №:178 Made in Switzerland by Thermo Electron SA Head of the laboratory and engineer-chemist are responsible for data recording on paper and electronically. Calibrated once every two weeks by engineer-analyst.
P13 CLNKy	**Annual clinker production volumes (tonnes)**	±2.0 ±0.5	High High	Annual clinker production volumes are summed up on the basis of monthly and shift clinker production data. Monthly and shift data recorded electronically and on paper. Electronic version is kept for one month while paper records are kept for a period of three years. Production volumes are calculated with the usage of conversion factors: - for kiln №3 conversion factor is 1,655, i.e. 1,655 tonnes of raw meal is used to produce one tonne of clinker; - for the wet kilns conversion factor varies from 0,650 to 0,621 depending on the sludge moisture (1м^3 of sludge is required to produce 0,65 - 0,621 tonnes of clinker). As for the kiln №3, data is provided by a weigher of raw material meal which goes into the kiln; the data is summed up automatically; clinker production volumes are calculated on the basis of the conversion factor. Kiln calibration was implemented at the start-adjusting phase and is repeated every three months by comparison of data obtained from raw material meal weigher and those obtained by weighing on motor-car balance those TVA 60-15(4)-$К_{Ф}$-10(КС3). Meter range: 0-60 tonnes. Made by “Technovesy”. Calibrated once every six months by representative of the State Ivano-Frankivsk scientific and practical centre for standartization, metrology and certification; corrections are made if necessary. Verification of data on clinker produced and consumed for cement production is conducted under the monthly inventory (stock taking) by comparison of actual data and survey measurement of residual clinker at the storehouses. Technologist and Head of the workshop are responsible for the calibration. In addition, clinker balance is installed for the kiln №3 to measure clinker production volume. Conveyer scales MULTIBEL with nominal output of 150 tonnes/hour. Calibrated once every three months by engineer-metrologist; data is recorded on paper and electronically.
P15 CaO	**Content in raw**	±0.32	High	Thermo, Model: ARL 9900XP Serial №:178 Made in Switzerland by Thermo Electron

	material meal			SA Data recorded on paper and electronically. Head of the laboratory and engineer-chemist are responsible for data recording. Calibrated by engineer-analyst once every two weeks. _
P16 RM	**Raw materials consumption at the dry kiln (tonnes)**	±4.0 ±4.0 ±2.0 ±4.0	Medium Meduim High Medium	Weigher DOSIMAT with nominal output of 125 tonnes/hour. Made in PFISTER GmbH. Calibrated by engineer-metrologist once every three months. Weigher DOSIMAT with nominal output of 160 tonnes/hour. Made in PFISTER GmbH. Calibrated by engineer-metrologist once every three months. Weigher DOSAX with nominal output of 10 tonnes/hour. Made in PFISTER GmbH. Calibrated by engineer-metrologist once every three months. Weigher DOSIMAT with nominal output of 10 tonnes/hour. Made in PFISTER GmbH. Calibrated by engineer-metrologist once every three months. FLS LOW system Made in FLSmidth Calibrated by engineer-metrologist once every three months; data is recorded on paper and electronically.
P18 MgO	**Content in clinker**	±0.2	High	Thermo, Model: ARL 9900XP Serial №:178 Made in Switzerland by Thermo Electron SA Data recorded on paper and electronically. Head of the laboratory and engineer-chemist are responsible for data recording. Calibrated once every 2 weeks by engineer -analyst.
P20 MgO	**Content in raw materials**	±0.19	High	Thermo, Model: ARL 9900XP Serial №:178 Made in Switzerland by Thermo Electron SA Data recorded on paper and electronically. Head of the laboratory and engineer-chemist are responsible for data recording. Calibrated once every 2 weeks by engineer -analyst.
P21 FC_{fuel_i}	**Fuel consumption of type i (tones or m^3)** **- coal, tonnes**	±1.0	High	Coal dust weighers for the kiln №1 Multicor K40, Serial № V953103 B15 29-2007 with nominal output of 7 tonnes/hour. Made in SHENCK PROCESS GmbH Calibrated by engineer-meterologist once every 3 months. Data recorded on paper and electronically; data kept for one month.
		±1.0	High	Coal dust weighers for the kiln №3 Multicor K40, Serial № V035031 B15 03-2007 with nominal output of 7 tonnes/hour. Made in SHENCK PROCESS GmbH Calibrated by engineer-meterologist once every 3 months. Data recorded on paper and electronically; data kept for one month.
		±1.0	High	Coal dust weighers for decarbonifier, the kiln №3 Multicor K40, Serial № V035031

				B15 29-2007 with nominal output of 7 tonnes/hour. Made in SHENCK PROCESS GmbH. Calibrated by engineer-metrologist once every 3 months. Data recorded on paper and electronically; data kept for one month.
		±1.0	High	Coal dust weighers for the kiln №2 Multicor K50, Serial № V043049 B15 29-2008 with nominal output of 5 tonnes/hour. Made in SHENCK PROCESS GmbH Calibrated by engineer-metrologist once every 3 months. Data recorded on paper and electronically; data kept for one month.
	- gas, m^3	±1.0	High	Gas meter LGK-150 32-1000 m^3/hour, registry № 10245. Calibrated by engineer-metrologist once every 3 months. Data recorded on paper and electronically.
		±2.0	High	Flowmeter Endress Hauser t-mass 0-5000 m^3/hour. Calibrated by engineer-metrologist once every 2 years. Data recorded on paper and electronically.
	Alternative fuel, tonnes	0.4t-10t ±20Kg 10t-40t ±40 Kg More than 40 tonnes ±60 Kg	High High High	Motor-car balance TBA 60-15(4)-K_f-10(KC3) registry №059. Measurement range 0-60 tonnes. Made by "Technovesy". Calibrated once every 6 months. Verified once a year by representative of the State Ivano-Frankivsk scientific and practical centre for standartization, metrology and certification. Data recorded on paper.
P23 NCV_{fuel_i}	**Low heat value of fuel i (GJ/t or GJ/m^3) - coal, peat, wood chipboards, sawdust**	±0.3	High	PRECYZLA-BIT , Model: RL-12Mn №066 Head of the laboratory and engineer-chemist are responsible for data recording; data recorded on paper and electronically. Calibrated by engineer-chemist once every 6 months. Verified once a year by representative of the State Ivano-Frankivsk scientific and practical centre for standartization, metrology and certification.
	- gas	±1.0	High	Chromatograph «Cristall 2000M». Verified once a year by representative of the State Ivano-Frankivsk scientific and practical centre for standartization, metrology and certification. Data recorded on paper; gas supplier issues gas quality certificate by fax once a week.
P25 EL_{grind}	**Electricity consumption for clinker crushing**	±1.0	High	ACKOE on the basis of electronic multifunctional meters Landis+Gyr , type of ZMD410CT. Verified once every 6 years.
		±2.0	High	Micropocessor-based management devices, type of REF 542plus. Verified once every 3

	(MWh)			years. Power engineering specialist and technician are responsible for data recording on paper and electronically; data kept up to 3 years.
P26 EL_{RM}	**Electricity for raw materials preparation and Transportation to production facility from quarry (MWh)**	±1.0	High	ACKOE on the basis of electronic multifunctional meters Landis+Gyr , type of ZMD410CT. Verified once every 6 years. Power engineering specialist and technician are responsible for data recording on paper and electronically; data kept up to 3 years.
P27 EL_{KILN}	**Electricity for kiln (MWh)**	±1.0	High	ACKOE on the basis of electronic multifunctional meters Landis+Gyr , type of ZMD410CT. Verified once every 6 years.
		±2.0	High	Micropocessor-based management devices, type of REF 542plus. Verified once every 3 years. Power engineering specialist and technician are responsible for data recording on paper and electronically; data kept up to 3 years.
P28 $EF_{el,y}$	**Carbon emission coefficient to Ukraine's integrated power system (Kg CO_2/kWh)**			0,893
P29 Coalprod	**Coal consumption volume**	±1.0	High	Coal dust weighers for the kiln №1 Multicor K40, Serial № V953103 B15 29-2007 with nominal output of 7 tonnes/hour. Made in SHENCK PROCESS GmbH Calibrated by engineer-metrologist once every 3 months. Data recorded on paper and electronically.
		±1.0	High	Coal dust weighers for the kiln №3 Multicor K40, K40 Serial № V035031 B15 03-2007 with nominal output of 7 t/hour. Made in SHENCK PROCESS GmbH. Calibrated by engineer-metrologist once every 3 months. Data recorded on paper and electronically.
		±1.0	High	Coal dust weighers for decarbonifier, the kiln №3 Multicor K40, Serial № V035031 B15 29-2007 nominal capacity 7 t/hour. Made in SHENCK PROCESS GmbH. Calibrated by engineer-metrologist once every 3 months. Data recorded on paper and

				electronically.
		±1.0	High	Coal dust weighers for the kiln №2 Multicor K40, K50 Serial № V043049 B15 29-2008 nominal capacity 5 t/hour. Made in SHENCK PROCESS GmbH. Calibrated by engineer-metrologist once every 3 months. Data recorded on paper and electronically.
		±0.5	High	Conveyer balance for lump coal MULTIBELT with nominal capacity of 150 tonnes/year. Made in SHENCK PROCESS GmbH Calibrated by engineer-metrologist once every 3 months. Data recorded on paper and electronically.
B6 EL_{coal}	**Electricity consumption for coal drying and preparation (MWh)**	±1.0	High	ACKOEon the basis of electronic multifunctional meters Landis+Gyr , type of ZMD410CT. Verified once every 6 years.
		±2.0	High	Micropocessor-based management devices, type of REF 542plus. Verified once every 3 years. Power engineering specialist and technician are responsible for data recording on paper and electronically; data kept up to 3 years.
B8 FC_{coal}	**Fuel consumption by coal drying in a year y (GJ)**	±1.0 ±0.25 ±0.5 ±0.2	High High High High	Heat-generator "KRON" is used for coal drying. Gas consumptions is monitored by the following devices: -Gas meter "Delta" 2050/G65 1.3-100 m^3/year. Made by "Arsenal", Kyiv. Verified once every 2 years by the State Ivano-Frankivsk scientific and practical centre for standartization, metrology and certification. -Absolute pressure sensor MIDA-DA-13P-Ex 0-1,0 MPa. Verified once a year by representative of the State Ivano-Frankivsk scientific and practical centre for standartization, metrology and certification. - Thermoelement TCMU-0289 -50…+50. Verified once every 2 years by representative of the State Ivano-Frankivsk scientific and practical centre for standartization, metrology and certification. -Gas volume measuring device UNIVERSAL-02. Verified once every 2 years by representative of the State Ivano-Frankivsk scientific and practical centre for standartization, metrology and certification. Data recorded on paper and electronically.

				Engineer-metrologist is responsible data recording.
B9 EF $_{fuel,y}$	**Carbon emission coefficient for each fuel ($Kg\ CO_2/TJ$)**		High	For coal -96000 For gas-56100 For oil wastes -77400 For sawdust -112000 For wood shipboards - 112000 For tires - 85000 For peat - 106000
B17 CaO	**Content in raw materials**	±0.32	High	Thermo, Model: ARL 9800XP Serial №:262 Made in Switzerland by Thermo Electron SA Data recorded on paper and electronically. Head of the laboratory and engineer-chemist are responsible for data recording. Calibrated by engineer-analyst once every 2 weeks.
B18 CaO	**Content in clinker**	±0.12	High	Thermo, Model: ARL 9800XP Serial №:262 Made in Switzerland by Thermo Electron SA Data recorded on paper and electronically. Head of the laboratory and engineer-chemist are responsible for data recording. Calibrated by engineer-analyst once every 2 weeks.
B19 MgO	**Content in raw materials**	±0.19	High	Thermo, Model: ARL 9800XP Serial №:262 Made in Switzerland by Thermo Electron SA Data recorded on paper and electronically. Head of the laboratory and engineer-chemist are responsible for data recording. Calibrated by engineer-analyst once every 2 weeks.
B20 MgO	**Content in clinker**	±0.2	High	Thermo, Model: ARL 9800XP Serial №:262 Made in Switzerland by Thermo Electron SA Data recorded on paper and electronically. Head of the laboratory and engineer-chemist are responsible for data recording. Calibrated by engineer-analyst once every 2 weeks.
B21 RM	**Raw materials consumption at the wet kiln**	 ±0.25 ±0.25	 High High	Slurry feeder : Kiln №1 V=0,422 $м^3$ Kiln №2 V=0,426 $м^3$

	(tonnes)			Calibrated once in 3 months by engineer-metrologist. Data saved in the electronic and paper form.
B23 $CLNK_{wet,y}$	**Clinker production volume per year, tonnes**	±2.0	High	For kilns №1,2,3 (wet technology) data are obtained from sludge feeders (sludge goes to the kilns) and are summed up automatically; based on a conversion coefficient, clinker production volume is calculated. Kilns calibrated each year by comparison of data obtained from sludge feeders for 24 hours and simultaneous weighing at truck scales TVA 60-15(4)-$К_f$-10(КС3). Measurement range 0-60 t . Made by "Technovesy". Calibrated once every 6 months. Verified once a year by representative of the State Ivano-Frankivsk scientific and practical centre for standartization, metrology and certification. Sludge feeders calibrated every 6 months by emptying sludge from fluid reservoirs to measuring reservoirs. Shiftman, shop economist and shop superintendent are responsible for clinker production volume stock-taking. Shop technologist and shop superintendent are in charge for calibrating measuring reservoirs and kilns. Verification of data on clinker produced and consumed for cement production is conducted under yearly inventory by comparison of actual data and survey measurement at the storehouses; data recorded on paper and electronically.
B27 BKE	**Average electricity consumption for three years previous wet kiln operation (MWh/t clinker)**		Medium	Electricity consumption and clinker production data are processed manually by months and prepared as tables; data kept on paper up to 3 years. Power engineering technician and economist of the workshop are responsible for data processing.
B36 BEL_{RM}	**Average electricity consumption for raw materials processing, MWh/t clinker)**		Medium	Electricity consumption and clinker production data are processed manually by months and prepared as tables; data kept on paper up to 3 years.
B40	**Low heat value**	±0.3	High	PRECYZLA-BIT , Model: RL-12Mn №066

NCV_{FUEL_i}	**of fuel i (GJ/t or m^3)** **-coal, peat**			Head of the laboratory and engineer-chemist are responsible for data recording; data recorded on paper and electronically. Calibrated by engineer-chemist once every 6 months. Verified once a year by representative of the State Ivano-Frankivsk scientific and practical centre for standartization, metrology and certification.
	-gas	±1.0	High	Chromatograph «Cristall 2000M». Verified once a year by representative of the State Ivano-Frankivsk scientific and practical centre for standartization, metrology and certification. Data recorded on paper; gas supplier issues gas quality certificate by fax once a week.
B42 **Coalprod**	**Coal consumption volume**	±1.0	High	Coal dust weighers for the kiln №2 Multicor Multicor K40 Serial № V953103 B15 29-2007 with nominal output of 7 t/hour. Made in SHENCK PROCESS GmbH Calibrated by engineer-metrologist once every 3 months. Data recorded on paper and electronically.
		±1.0	High	Coal dust weighers for the kiln №3 Multicor K40, K40 Serial № V035031 B15 03-2007 with nominal output of 7 t/hour. Made in SHENCK PROCESS GmbH. Calibrated by engineer-metrologist once every 3 months. Data recorded on paper and electronically.
		±1.0	High	Coal dust weighers for the kiln №1 Multicor K40 Serial № V035031 B15 29-2007 nominal capacity 7 t/hour. Made in SHENCK PROCESS GmbH. Calibrated by engineer-metrologist once every 3 months. Data recorded on paper and electronically.
		±0.5	High	Conveyer balance for lump coal MULTIBELT with nominal capacity of 150 tonnes/year. Made in SHENCK PROCESS GmbH Calibrated by engineer-metrologist once every 3 months. Data recorded on paper and electronically.
	Weighers for cement mills № 3-5	±0.5	High	Conveyer (band) weigher SCHENK FBW 1000 with nominal output of 40 t/hour Made in SHENCK PROCESS GmbH Calibrated by engineer-metrologist once every 3 months; data recorded on paper.
		±0.5	High	Conveyer (band) weigher SCHENK FBW 1000 with nominal output of 40 t/hour Made in SHENCK PROCESS GmbH Calibrated by engineer-metrologist once every 3 months; data recorded on paper.

		±0.5	High	Conveyer (band) weigher SCHENK FBW 1000 with nominal output of 15 t/hour Made in SHENCK PROCESS GmbH Calibrated by engineer-metrologist once every 3 months; data recorded on paper.
		±0.5	High	Conveyer (band) weigher SCHENK FBW 1000 with nominal output of 40 t/hour Made in SHENCK PROCESS GmbH Calibrated by engineer-metrologist once every 3 months; data recorded on paper.
		±0.5	High	Conveyer (band) weigher SCHENK FBW 1000 with nominal output of 40 t/hour Made in SHENCK PROCESS GmbH Calibrated by engineer-metrologist once every 3 months; data recorded on paper.
		±0.5	High	Conveyer (band) weigher SCHENK FBW 1000 with nominal output of 15 t/hour Made in SHENCK PROCESS GmbH Calibrated by engineer-metrologist once every 3 months; data recorded on paper.
		±0.5	High	Conveyer (band) weigher SCHENK FBW 1000 with nominal output of 40 t/hour Made in SHENCK PROCESS GmbH Calibrated by engineer-metrologist once every 3 months; data recorded on paper.
		±0.5	High	Conveyer (band) weigher SCHENK FBW 1000 with nominal output of 40 t/hour Made in SHENCK PROCESS GmbH Calibrated by engineer-metrologist once every 3 months; data recorded on paper.
	Weighers for raw materials mill	±0.5	High	Conveyer (band) weigher SCHENK FBW 1000 with nominal output of 7 t/hour Made in SHENCK PROCESS GmbH Calibrated by engineer-metrologist once every 3 months; data recorded on paper.
		±0.5	High	Conveyer (band) weigher SCHENK FBW 1000 with nominal output of 7 t/hour Made in SHENCK PROCESS GmbH Calibrated by engineer-metrologist once every 3 months; data recorded on paper.
		±0.5	High	Conveyer (band) weigher SCHENK FBW 1000 with nominal output of 7 t/hour Made in SHENCK PROCESS GmbH Calibrated by engineer-metrologist once every 3 months; data recorded on paper.
	Track scales	0.7t-10t ±50 kg 10t-30t ±100 kg more than 30t ±150 Kg	Medium-High High High	Scales VPP PC-100 №0203. Measurement range 0-100 t. Made by “Armavir” plant. Calibrated once every 3 months. Verified once a year by representative of the State Ivano-Frankivsk scientific and practical centre for standartization, metrology and certification. Data recorded on paper.

	Track scales	0.8t-50t ±50 kg 50t-100t ±100 kg more than 100t ±150 Kg	Medium-High High High	Scales VPP PC-150 №0204. Measurement range 0-150 t. Made by “Armavir” plant. Calibrated once every 3 months. Verified once a year by representative of the State Ivano-Frankivsk scientific and practical centre for standartization, metrology and certification. Data recorded on paper.
	Track scales	1 t-50t ±50 kg 50t-100t ±100 kg more than 100t ±150 Kg	Medium-High High High	Scales TVV-150 №0207. Measurement range 0-150 t. Made by “Technovesy”. Calibrated once every 3 months. Verified once a year by representative of the State Ivano-Frankivsk scientific and practical centre for standartization, metrology and certification. Data recorded on paper.
	Truck scales	0.4t-10t ±20 kg 10t-40t ±40 kg more than40t ±60 kg	Medium-High High High	Truck scales TBA 60-15(4)-$К_f$-10(КС3) Registry №059 Measurement range 0-60 t . Made by “Technovesy”. Calibrated once every 6 months. Verified once a year by representative of the State Ivano-Frankivsk scientific and practical centre for standartization, metrology and certification. Data recorded on paper and electronically.
	Truck scales	0.4t-10t ±20 kg 10t-40t ±40 kg more than40t ±60 kg	Medium-High High High	Truck scales TBA 60-15(4)-$К_f$-10(КС3) registry №059 Measurement range 0-60 t . Made by “Technovesy”. Calibrated once every 6 months. Verified once a year by representative of the State Ivano-Frankivsk scientific and practical centre for standartization, metrology and certification. Data recorded on paper and electronically.
	Truck scales	0.4t-10t ±20 kg 10t-40t ±40 kg more than40t ±60 kg	Medium-High High High	Truck scales TBA 60-15(4)-$К_f$-10(КС3) registry №059 Measurement range 0-60 t . Made by “Technovesy”. Calibrated once every 6 months. Verified once a year by representative of the State Ivano-Frankivsk scientific and practical centre for standartization, metrology and certification. Data recorded on paper and electronically.

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

IF Cement will use the traditional operational and management plans that have been developed and implemented by the company over the previous years to ensure high quality cement production, safe equipment operation and high performance of the facility. The standard operating procedures are available from the company and are used to train staff and ensure proper operation of equipment and facilities.

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

GreenStream Network along with the Project Participants from IF Cement. Please see Annex 1 for further details.

SECTION E. Estimation of greenhouse gas emission reductions

E.1. Estimated project emissions:

Project Emissions[9]

Year	Estimate of Annual Emissions (tonnes of CO_2e)
2008	265,408
2009	430,774
2010	490,116
2011	519,152
2012	519,152
2013	519,152
2014	519,152
2015	519,152
2016	519,152
2017	519,152
2008-2017	4,820,362

E.2. Estimated leakage:

No leakage was identified in the project.

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

Year	Estimate of Annual Emissions (tonnes of CO_2e)
2008	265,408
2009	430,774
2010	490,116
2011	519,152
2012	519,152
2013	519,152
2014	519,152
2015	519,152
2016	519,152
2017	519,152
2008-2017	4,820,362

E.4. Estimated baseline emissions:

Baseline Calculations[9]

Year	Estimate of Annual Emissions (tonnes of CO_2e)
2008	326,995
2009	603,730
2010	669,096
2011	701,080
2012	701,080
2013	701,080
2014	701,080
2015	701,080
2016	701,080
2017	701,080
2008-2017	6,507,381

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

The emission reductions generated by the proposed JI project are calculated as the difference between emissions in the baseline scenario and emissions in the project scenario. There was no leakage identified outside the project boundaries. The emission reductions are presented in Table E.5 below. The average annual emissions reduction is more than 168,000 t CO_2e over the 10 year crediting period.

Year	Estimate of Annual Emission Reductions (tonnes of CO_2e)
2008	61,587
2009	172,956
2010	178,980
2011	181,927
2012	181,927
2013	181,927
2014	181,927
2015	181,927
2016	181,927
2017	181,927
2008-2017	1,687,012

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

Table 8: Overview of project, baseline and emission reductions

Year	Estimated project emissions (tonnes of CO_2 eq.)	Estimated leakage (tonnes of CO_2 eq.)	Estimated baseline emissions (tonnes of CO_2 eq.)	Estimated emission reductions (tonnes of CO_2 eq.)
2008	265,408	0	326,995	61,587
2009	430,774	0	603,730	172,956
2010	490,116	0	669,096	178,980
2011	519,152	0	701,080	181,927
2012	519,152	0	701,080	181,927
2013	519,152	0	701,080	181,927
2014	519,152	0	701,080	181,927
2015	519,152	0	701,080	181,927
2016	519,152	0	701,080	181,927
2017	519,152	0	701,080	181,927
Total (tonnes of CO_2 eq.)	4,820,363	0	6,507,378	1,687,015

The provided emission reduction figures are estimates. Actual emission reductions depend mostly on the following variables:

1. Production volume of clinker and cement

Since the emission estimates in future years are dependent on predicted volumes of cement production, this variable will influence the actual emission reductions greatly.

2. Specific fuel consumption for clinker production and fuel saved for coal drying

Since the emission estimates depend on the amount of energy used to produce each tonne of clinker, this variable will influence the actual emission reductions greatly. Emission reductions will also be influenced by the amount of waste heat recovered to dry coal and whether or not natural gas drying of coal needs to be put back in service during dry kiln down times.

SECTION F. Environmental impacts

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

Cement production has a substantial impact on the local environment due to the combustion of fossil fuels as well as due to dust which is formed during the cement production cycle.

Controllable harmful substances emitted by various sources at the IF Cement include: nitrogen dioxide, sulfurous anhydride, carbon oxide as well as inorganic dust with SiO_2 content less than 20% and dust from the cement production. The plant's environment-relating activities are regulated by the Ukraine's Ministry of Environmental Protection. The Ministry approved Normative Permissible Levels of Emissions (Order #309 of June 27, 2006) and issued Permit # 262713 which established special normative permissible levels for the IF Cement for the period from May 28 2009 to January 28, 2014. Control over the emissions is conducted by the plant's laboratory which is certified to maintain sanitary-ecological norms. The laboratory conducts tests and keeps test records in accordance with the laboratory's passport and prescribed schedule.

Switching to a dry process will allow the company to significantly decrease fuel consumption, which in turn reduces emissions of harmful substances. The new dry technology will meet the existing Best Available Technology (BAT) benchmarks and will also decrease dust emissions compared to the existing emissions level.

As a result of the project implementation, specific (per one tonne of clinker) emissions from the new kiln #3 for the second half of 2008 decreased: dust – by 2.8 times, CO – 2 times, NO_x – 3 times and SO_2 - by 1.8 times as compared with the average emissions in 2005-2007. Improved environmental performance of three kilns in 2008 is demonstrated by the following emission reductions: dust - by 58%, CO – by 31%, NO_x – by 49%, SO_2 – by 44%[52].

In compliance with the national sanitary classification of production facilities the IF Cement pertains to the first group of facilities which requires the establishment of 1000 meters sanitary buffer zone. The shortest distance between the plant and the state frontier between the Ukraine and Rumania is 200 kilometers. The surface-derived observations relating to nitrogen dioxide, sulfurous anhydride, carbon oxide and dust provide evidence that maximum concentration levels of these harmful substances do not exceed the normative levels throughout the dissipation area. An aggregate maximum concentration of the substances at the border of the sanitary buffer zone is twice less than the maximum permissible level. Therefore, the plant does not have negative transboundary pollution impacts on the territories of foreign countries.

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

[52] Information provided IF Cements Laboratory, please refer to supporting documentation #3.

of an environmental impact assessment undertaken in accordance with the procedures as required by the host Party:

The Terms of Reference for the EIA production was prepared by the design institute Yuzhgiprocement" (February 16, 2007). The EIA document entitled "Reconstruction of Cement Production at the IF Cement with Introduction of Dry Method and New Energy-Saving Technologies" was prepared by the firm-subcontractor "BIO-PLUS", Ukraine, in February-May of 2007.

The EIA was reviewed and approved by the State Environmental Protection Agency in the Ivano-Frankivsk Oblast, (Decision of Expert Commission # 66, June 27, 2007) and the Ivano-Frankivsk Oblast Sanitary-Epidemiological Office, Ukraine's Ministry of Health (Decision of Expert Commission # 2008, May 16, 2007).

SECTION G. Stakeholders' comments

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

In compliance with the existing State Construction Standards relating to the EIA, IF Cement (Project Proponent) and "Yuzhgiprocement" (EIA Developer) prepared and published "The Notice of Intent" which outlined the anticipated project environmental impacts. The Notice was co-signed by State Environmental Protection Agency in the Ivano-Frankivsk Oblast, Ivano-Frankivsk Oblast Sanitary-Epidemiological Office, Ukraine's Ministry of Health and Yamnitsky Village Council (municipal authority).

IF Cement informed the public about the proposed reconstruction and anticipated environmental impacts through the municipal authority and mass media (Reference of May 10, 2007). The feedback from the public and results of the public hearings are summarized in the Minutes signed by the municipal authority, June 17, 2007.

Annex 1

CONTACT INFORMATION ON PROJECT PARTICIPANTS

Organisation:	Ivano-Frankivskcement
Street/P.O.Box:	v. Yamnytsya
Building:	
City:	Tysmenytsya district
State/Region:	Ivano-Frankivsk region
Postal code:	77422
Country:	Ukraine
Phone:	+38 0342 583764
Fax:	+38 0342 583748
E-mail:	tehcem@ifcem.if.ua
URL:	http://www.ifcem.if.ua/
Represented by:	Mykola Makoviychuk
Title:	Chief Engineer for Cementitious Material
Salutation:	Mr.
Last name:	Makoviychuk
Middle name:	
First name:	Mykola
Department:	Cement production
Phone (direct):	380 342 58 3522
Fax (direct):	+38 0342 584577
Mobile:	
Personal e-mail:	tehcem@ifcem.if.ua

Organisation:	UkrEximBank
Street/P.O.Box:	127, Gorkogo Str.
Building:	
City:	Kyiv
State/Region:	
Postal code:	03150
Country:	Ukraine
Phone:	+38 044 247 89 26
Fax:	+38 044 247 80 82
E-mail:	bank@eximb.com
URL:	http://www.eximb.com
Represented by:	Volodymyr G. Khrebet
Title:	Deputy Head of Division, Project Financing and International Financial Organizations Programs Department
Salutation:	Mr.
Last name:	Khrebet
Middle name:	G.
First name:	Volodymyr

Department:	Project Financing and International Financial Organizations Programs Department
Phone (direct):	+38 044 247 80 85
Fax (direct):	+38 044 247 80 82
Mobile:	
Personal e-mail:	vhrebet@hq.eximb.com

Organisation:	Stichting Carbon Finance
Street/P.O.Box:	c/- Fortis Intertrust (Netherlands) B.V., Prins Bernhardplein 200
Building:	
City:	Amsterdam
State/Region:	
Postal code:	1000 AZ
Country:	The Netherlands
Phone:	+31 20 521 4795
Fax:	+31 20 521 4836
E-mail:	Jaap.veerman@fortisintertrust.com
URL:	
Represented by:	Mr. Jaap C.M. Veerman
Title:	
Salutation:	Mr.
Last name:	Veerman
Middle name:	C.M.
First name:	Jaap
Department:	
Phone (direct):	+31 20 521 4795
Fax (direct):	+31 20 521 4836
Mobile:	
Personal e-mail:	Jaap.veerman@fortisintertrust.com

Annex 2

BASELINE INFORMATION

Baseline Information can be found within Section B.

The baseline is a hybrid or combined baseline where historical emissions are used as the baseline for fuel consumption up to and including the previous capacity of the wet kilns and a sector-wide baseline is used for the production capacity expansion. The historical baseline is set using the average consumption of fuels by the wet kilns for the years 2005, 2006 and 2007 multiplied by the fuel mix used during the project phase. The reason for using the fuel mix during the project phase is that the project activity only affects the total consumption of fuels and does not impact the fuel mix directly. The fuel mix of the project is still determined by fuel price and availability, as in the baseline. Therefore the historical baseline assumes that the fuel mix would not be affected by the project.

For the sector-wide baseline, the cement sector baseline developed for the Volyn Cement project is used. The Volyn Cement project is considered similar enough to the IF Cement project that the sector-wide baseline can be applied for the IF Cement project. The Volyn Cement sector-wide baseline has, however, been adapted to consider the cement to clinker ratio of the IF Cement project. This is because the cement to clinker ratio is not affected by the project and is specified or controlled by the customers of IF Cement rather than the company itself

Annex 3

MONITORING PLAN

Monitoring plan information can be found within Section D

Variable $BEF_{rev,y}$ in the emission reduction calculations represents a modification to the cement to clinker ratio in the sector-wide baseline produced for the Volyn Cement PDD. This modification of the cement to clinker ratio was necessary because IF Cement has not modified the cement to clinker ratio as part of the current project. The cement to clinker ratio is a function of the demands of IF Cement customers and particular IF Cement products.

If was found that the cement to clinker ratio in the sector-wide baseline was extremely optimistic and therefore needed to be adjusted for the current project. A simple ratio method was chosen to adjust the cement to clinker ratio to represent the ratio that was typical for IF Cement production for 2005 to 2008. This was thought to be the most representative figure for the current project.